USDA Natural Resources
Conservation Service

Ecological site R053CY018SD
Dense Clay

Last updated: 1/22/2024
Accessed: 05/03/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

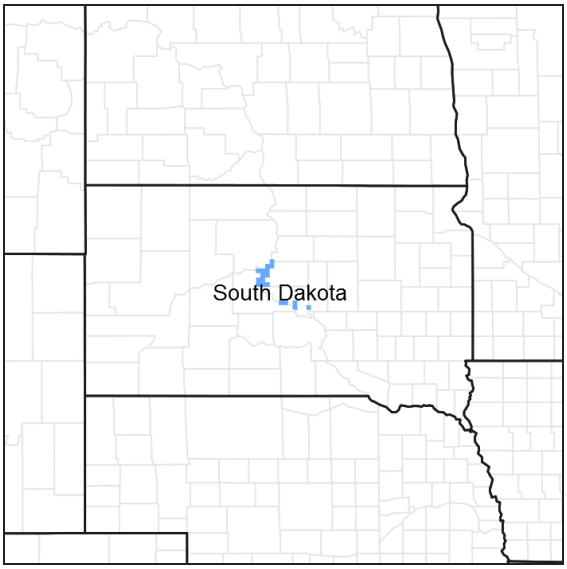


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 053C–Southern Dark Brown Glaciated Plains

The Southern Dark Brown Glaciated Plains (53C) is located within the Northern Great Plains Region. It is entirely in South Dakota encompassing about 3,990 square miles (Figure 1). The elevation ranges from 1,300 to 2,300 feet. The MLRA is level to gently rolling till plains including many areas of potholes. A terminal moraine occurs in the southern end of the MLRA. Moderately steep and steep slopes are adjacent to the major valleys. The headwaters of many creeks in central South Dakota occur in the high-lying MLRA. (USDA-NRCS 2006).

The dominant soil orders in this MLRA are Mollisols and Inceptisols. The soils in the area dominantly have a mesic soil temperature regime, an ustic soil moisture regime, and mixed or smectitic mineralogy. They generally are very deep, well drained or moderately well drained, and are loamy or clayey. This area supports natural prairie vegetation characterized by western wheatgrass (Pascopyrum smithii), big bluestem (Andropogon gerardii), needleandthread (Hesperostipa comata), and green needlegrass (Nassella viridula). Little bluestem (Schizachyrium scoparium), sideoats grama (Bouteloua curtipendula), and prairie sandreed (Calamovilfa longifolia) are important species on steeper sites. Western snowberry (Symphoricarpos occidentalis) and prairie rose (Rosa arkansana) are commonly dispersed throughout the area. (USDA-NRCS 2006).

Classification relationships

Major Land Resource Area (MLRA): Southern Dark Brown Glaciated Plains (53C) (USDA-NRCS 2006)

USFS Subregions: Northeastern Glaciated Plains Section (331E); Missouri Coteau Subsection (331Ea); Western Great Plains Section (331F); Missouri Breaks Subsection (331Fe); Western Glaciated Plains Section (332B); Southern Missouri Coteau Slope Subsection (332Bd, 332Be); North Central Great Plains Section (332D); Southern Missouri Coteau Slope Subsection (332Dd); Southern Missouri Coteau Subsection (332De) - (Cleland et al. 2007).

US EPA Level IV Ecoregion: Missouri Coteau (42a); Southern Missouri Coteau (42e); Southern Missouri Coteau Slope (42f) - (USEPA 2013)

Ecological site concept

The Dense Clay ecological site typically occurs on nearly level slopes in alluvial fan areas. Soils are moderately well drained and typically have greater than 55 percent clay in the soil surface and a clayey subsoil. The root restriction of the dense clay limits plant growth, production is lower, and species composition will tend towards shallow rooted and more tolerant of the high clay content of the soils. Slopes can range from 0 to 2 percent. Vegetation in the Reference State is dominated by cool season grasses including western wheatgrass and green needlegrass. Common forbs include biscuitroot, wild parsley, and heath aster. Non-native grasses such as Kentucky bluegrass and annual bromes may invade due to shifts in disturbance regime.

Associated sites

R053CY011SD	**Clayey** These sites occur on upland areas. The soils are well drained and have between 40 and 55 percent clay in the surface and subsoil. The central concept soil series is Raber, but other series are included.
R053CY013SD	**Claypan** These sites occur on uplands. Soils are moderately well drained and have a claypan (columnar structure) between 6 and 16 inches from the soil surface. The central concept soil series are Cavo, Degrey, and Farmsworth, but other series are included.
R053CY041SD	**Clayey Floodplain** These sites occur on floodplain areas. The soils are well drained to moderately well drained and have between 40 and 55 percent clay in the surface and subsoil. The central concept soil series are Lane and Wendte, but other series are included.

Similar sites

R053CY013SD	**Claypan** The Claypan site occurs in a slightly higher landscape position and has a claypan (columnar structure) between 6 and 16 inches of the soil surface. The vegetative community has more short warm-season grasses, higher diversity, and higher production.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site typically occurs on nearly level areas near drainageways.

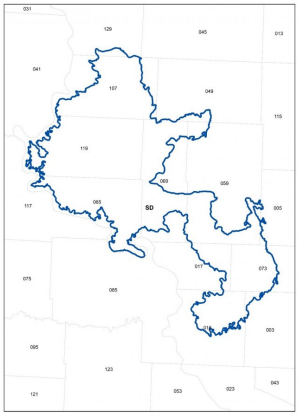


Figure 2. Distribution map

Table 2. Representative physiographic features

Landforms	(1) Flood plain
Flooding frequency	None
Ponding frequency	None
Elevation	396–701 m
Slope	1–6%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 53C 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 15 to 25 inches per year. The average annual temperature is about 45°F. January is the coldest month with average temperatures ranging from about 15°F (Stephan, South Dakota (SD)), to about 16°F (Onida 4 NW, SD). July is the warmest month with temperatures averaging from about 72°F (Stephan, SD), to about 74°F (Onida 4 NW, 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 12 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 11 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.

Table 3. Representative climatic features

Frost-free period (characteristic range)	107-127 days
Freeze-free period (characteristic range)	128-150 days
Precipitation total (characteristic range)	508-533 mm
Frost-free period (actual range)	104-129 days
Freeze-free period (actual range)	127-159 days

Precipitation total (actual range)	483-610 mm
Frost-free period (average)	117 days
Freeze-free period (average)	139 days
Precipitation total (average)	533 mm

Climate stations used

- (1) GETTYSBURG 13W [USC00393302], Gettysburg, SD
- (2) GETTYSBURG [USC00393294], Gettysburg, SD
- (3) HIGHMORE 23 N [USC00393838], Highmore, SD
- (4) ONIDA 4 NW [USC00396292], Onida, SD
- (5) PIERRE RGNL AP [USW00024025], Pierre, SD
- (6) HARROLD 12 SSW [USC00393608], Pierre, SD
- (7) STEPHAN 2 NW [USC00397992], Highmore, SD
- (8) WESSINGTON SPRINGS [USC00399070], Wessington Springs, SD

Influencing water features

No riparian areas or wetland features are directly associated with this site.

Soil features

The Dense Clay site typically occurs on nearly level slopes in alluvial fan areas. Soils are moderately well drained and typically has greater than 55 percent clay in the soil surface and a clayey subsoil. The central concept soil series is Bullcreek. The soils in this site formed in clayey alluvium. Slope is one to six percent. The clay surface layer is about five inches thick. The soils have a very slow infiltration rate except after dry periods when initial uptake may be rapid due to cracking of the surface. 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 typically not highly susceptible to wind and water erosion. Loss of vegetative cover can result in excessive erosion.

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

Table 4. Representative soil features

Surface texture	(1) Clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	0–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–16 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0–15
Soil reaction (1:1 water) (0-101.6cm)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The site which is located in the Southern Dark Brown Glaciated Plains Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Western Wheatgrass-Green Needlegrass Plant Community Phase. This community phase and the Reference State 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 considered. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

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. Western wheatgrass with its strong rhizomes and high drought tolerance is able to thrive in these soils. Western wheatgrass dominates the site and production is closely related to its vigor. 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.

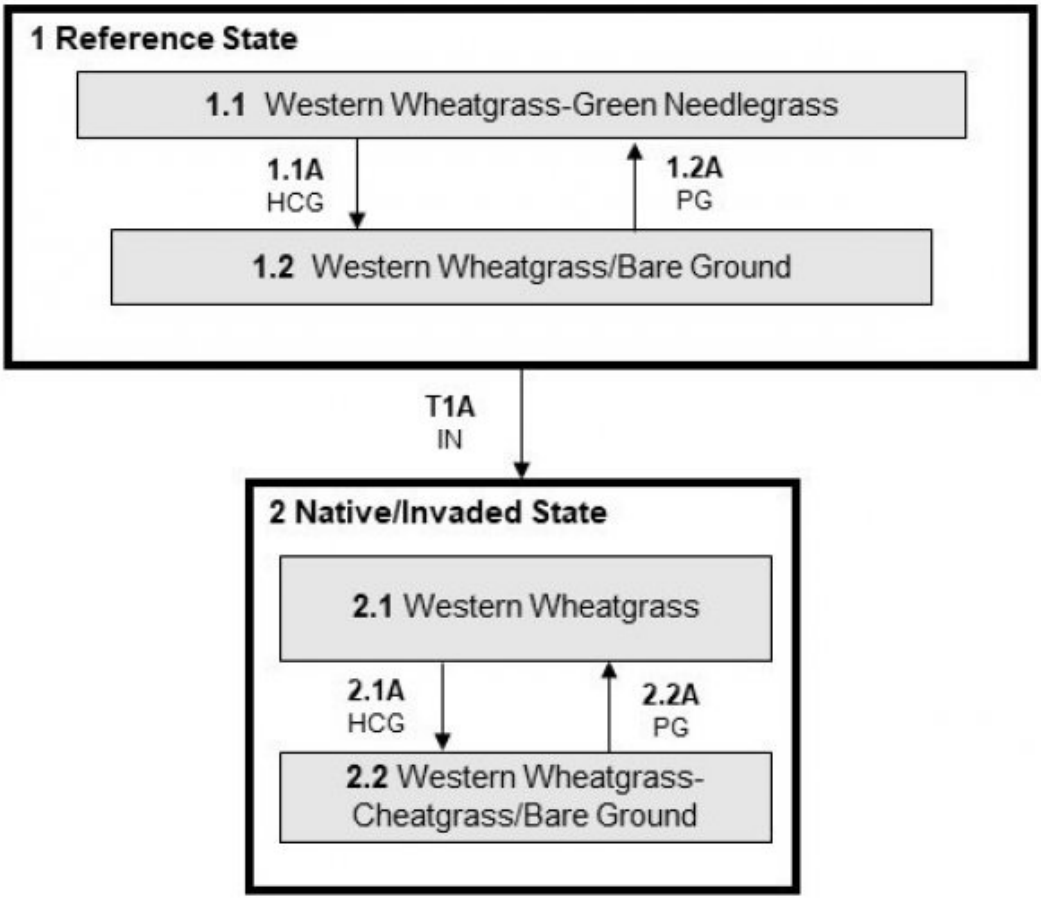
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states and community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition and community pathways between them. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

The vegetative pie charts may not add up to 100 percent due to internal rounding error.

State and transition model

Dense Clay – R053CY018SD



LEGEND
Dense Clay – R053CY018SD

HCG – Heavy continuous grazing
IN – Invasion
PG – Prescribed grazing

Figure 9. State-And-Transition model

Code	Process
T1A	Invasion
1.1A	Heavy continuous grazing
1.2A	Prescribed grazing with recovery periods
2.1A	Heavy continuous grazing
2.2A	Prescribed grazing with recovery periods

Figure 10. Matrix

State 1
Reference State

This state represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state was dominated by cool-season grasses. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. Cool-season species can decline and a corresponding increase in short, warm-season grasses would have occurred. Today, a similar state, the Native/Invaded State (State 2) can be found on areas that are properly managed with grazing and prescribed burning and sometimes on areas receiving occasional short periods of rest.

Community 1.1
Western Wheatgrass-Green Needlegrass

Interpretations are based primarily on the 1.1 Western Wheatgrass-Green Needlegrass Plant Community Phase. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. Cool-season grasses dominate the plant community. The major grasses included western wheatgrass and green needlegrass. Plant diversity is low, being dominated by western wheatgrass. Other grass or grass-like species occurring on this site may include buffalograss (*Bouteloua dactyloides*), blue grama (*Bouteloua gracilis*), and sedge (Carex). The dominant forbs include biscuitroot (*Lomatium foeniculaceum*), heath aster (Symphyotricum ericoides), and wild parsley (Musineon). Shrubs that can occur in this plant community are brittle cactus (*Opuntia fragilis*), saltbush (Atriplex), and plains pricklypear (*Opuntia polyacantha*). 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.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1233	1806	2359
Forb	95	151	224
Shrub/Vine	17	61	106
Total	**1345**	**2018**	**2689**

Figure 12. Plant community growth curve (percent production by month). SD5301, Southern Dark Brown Glaciated Plains, cool-season dominant.. 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

Community 1.2
Western Wheatgrass/ Bare Ground

This plant community evolved under heavy continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. The grass component is often completely dominated by western wheatgrass. Other perennial grasses are generally not found on this site or are greatly diminished. Drought and heavy spring use will lower basal density of green needlegrass and western wheatgrass creating opportunities for invasive species such as field pennycress (*Thlaspi arvense*), curlycup gumweed (*Grindelia squarrosa*), sweetclover (*Melilotus officinalis*), and annual forbs to occur. Brittle cactus and plains pricklypear are the commonly found shrubs. When compared to the 1.1 Western Wheatgrass-Green Needlegrass Plant Community Phase, 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 likelihood of cheatgrass (*Bromus tectorum*), Japanese bromegrass (Bromus japonicas), and Kentucky bluegrass (*Poa pratensis*) 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 somewhat resistant to change. Moving this plant community toward the 1.1 Western Wheatgrass-Green Needlegrass Plant Community Phase 1.1 can be accomplished through prescribed grazing. This plant community will have similar plant composition to 2.2 Western Wheatgrass-Cheatgrass/*Bare Ground* Plant Community Phase. The main difference is that this plant community phase does not have the presence of nonnative invasive species such as Cheatgrass, Japanese Bromegrass, or Kentucky bluegrass.

Figure 13. Plant community growth curve (percent production by month). SD5302, Southern Dark Brown Glaciated Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Pathway 1.1A
Community 1.1 to 1.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 1.2 Western Wheatgrass/*Bare Ground* Plant Community Phase.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 1.1 Western Wheatgrass-Green Needlegrass Plant Community Phase.

Conservation practices

Prescribed Grazing

State 2
Native/Invaded State

This state represents the more common range of variability that exists with the introduction of nonnative species. This state is dominated by cool-season grasses. It can be found on areas that are properly managed with prescribed grazing and sometimes on areas receiving occasional short periods of rest. Nonnative species such as cheatgrass, Japanese bromegrass, and Kentucky bluegrass can become dominant at times and influence the biotic and hydrologic ecological processes of the State. Taller cool-season species can decline and corresponding increase in

short-statured grass will occur.

Community 2.1
Western Wheatgrass

This plant community results from an encroachment of nonnative, invasive species such as cheatgrass, Japanese bromegrass, or bluegrass. This plant community phase is similar to the 1.1 Western Wheatgrass-Green Needlegrass Plant Community Phase. The main difference is that this plant community phase will have up to 10 percent of nonnative invasive species such as cheatgrass, Japanese bromegrass, or Kentucky Bluegrass.

Figure 14. Plant community growth curve (percent production by month). SD5302, Southern Dark Brown Glaciated Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 2.2
Western Wheatgrass/Annual Brome/Bare Ground

This plant community develops under droughty conditions, heavy spring grazing or long-term heavy continuous grazing. The potential vegetation is made up of about 80 percent grasses and grass-like plants, 10 percent forbs, and 10 percent shrubs. The grass component is often completely dominated by western wheatgrass. Other perennial grasses are generally not found on this site or are greatly diminished. Drought and heavy spring use will lower basal density of green needlegrass and western wheatgrass creating opportunities for invasive species such as field pennycress, curlycup gumweed, sweetclover, and annual forbs to occur. Brittle cactus and plains pricklypear are the commonly found shrubs. When compared to the 1.1 Western Wheatgrass-Green Needlegrass Plant Community Phase, the vigor, production, and basal density of the grasses have been reduced. Often the site will be bare ground with a few sprigs of western wheatgrass and a likelihood of cheatgrass, Japanese bromegrass and Kentucky bluegrass 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 somewhat resistant to change. Moving this plant community toward the 2.1 Western Wheatgrass Plant Community Phase can be accomplished through prescribed grazing.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	493	970	1435
Shrub/Vine	17	67	123
Forb	50	84	123
Total	**560**	**1121**	**1681**

Figure 16. Plant community growth curve (percent production by month). SD5301, Southern Dark Brown Glaciated Plains, cool-season dominant.. 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

Pathway 2.1A
Community 2.1 to 2.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community

to the 2.2 Western Wheatgrass-Cheatgrass/*Bare Ground* Plant Community Phase.

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 2.1 Western Wheatgrass Plant Community Phase.

Conservation practices

Prescribed Grazing

Transition T1A
State 1 to 2

Invasion of non-native plant species will likely lead this state over a threshold resulting in the Native/Invaded State (State 2).

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			706–1110	
	western wheatgrass	PASM	*Pascopyrum smithii*	706–1110	–
2	**Needlegrass**			303–706	
	green needlegrass	NAVI4	*Nassella viridula*	303–706	–
3	**Mid Warm-Season Grass**			40–202	
	sideoats grama	BOCU	*Bouteloua curtipendula*	40–202	–
4	**Short Warm-Season Grasses**			40–202	
	blue grama	BOGR2	*Bouteloua gracilis*	20–161	–
	buffalograss	BODA2	*Bouteloua dactyloides*	20–81	–
	saltgrass	DISP	*Distichlis spicata*	0–61	–
5	**Grass-likes**			20–101	
	needleleaf sedge	CADU6	*Carex duriuscula*	20–101	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–61	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–61	–
Forb					
6	**Forbs**			101–202	
	Forb, native	2FN	*Forb, native*	20–61	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–40	–
	textile onion	ALTE	*Allium textile*	20–40	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	20–40	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–40	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–40	–
	desertparsley	LOMAT	*Lomatium*	20–40	

	desertparsley	LOMAT	*Lomatium*	20–40	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	20–40	–
	spiny phlox	PHHO	*Phlox hoodii*	20–40	–
	goldenrod	SOLID	*Solidago*	0–40	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	20–40	–
	white heath aster	SYER	*Symphyotrichum ericoides*	20–40	–
	American vetch	VIAM	*Vicia americana*	0–20	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–20	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–20	–
	pussytoes	ANTEN	*Antennaria*	0–20	–
Shrub/Vine					
7	**Shrubs**			20–101	
	saltbush	ATRIP	*Atriplex*	0–61	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	20–61	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–40	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–40	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	–

Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			280–560	
	western wheatgrass	PASM	*Pascopyrum smithii*	280–560	–
2	**Needlegrass**			0–56	
	green needlegrass	NAVI4	*Nassella viridula*	0–56	–
3	**Mid Warm-Season Grasses**			0–56	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–56	–
4	**Short Warm-Season Grasses**			56–168	
	blue grama	BOGR2	*Bouteloua gracilis*	22–135	–
	buffalograss	BODA2	*Bouteloua dactyloides*	11–112	–
	saltgrass	DISP	*Distichlis spicata*	11–78	–
5	**Grass-likes**			11–112	
	needleleaf sedge	CADU6	*Carex duriuscula*	11–90	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–56	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–56	–
6	**Non-Native Grasses**			11–280	
	field brome	BRAR5	*Bromus arvensis*	11–280	–
	cheatgrass	BRTE	*Bromus tectorum*	11–280	–
	bluegrass	POA	*Poa*	0–90	–
Forb					
7	**Forbs**			56–112	
	sweetclover	MELIL	*Melilotus*	0–56	–
	Forb, introduced	2FI	*Forb, introduced*	0–45	–

	Forb, native	2FN	*Forb, native*	11–34	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–34	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–34	–
	common dandelion	TAOF	*Taraxacum officinale*	0–34	–
	field pennycress	THAR5	*Thlaspi arvense*	0–34	–
	yellow salsify	TRDU	*Tragopogon dubius*	0–34	–
	desertparsley	LOMAT	*Lomatium*	0–22	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	11–22	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–22	–
	spiny phlox	PHHO	*Phlox hoodii*	11–22	–
	goldenrod	SOLID	*Solidago*	0–11	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–11	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–11	–
	pussytoes	ANTEN	*Antennaria*	0–11	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–11	–
	textile onion	ALTE	*Allium textile*	0–11	–
Shrub/Vine					
8	**Shrubs**			22–112	
	plains pricklypear	OPPO	*Opuntia polyacantha*	11–45	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–34	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	11–34	–

Animal community

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.

Western Wheatgrass (1.1)
Average Annual Production (lbs./acre, air-dry): 1,800
Stocking Rate* (AUM/acre): 0.49

Western Wheatgrass/Annual Brome/*Bare Ground* (2.2)
Average Annual Production (lbs./acre, air-dry): 1,000
Stocking Rate* (AUM/acre): 0.27

*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.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration varies from very slow to slow and runoff potential for this site varies from high to very high depending on soil hydrologic group, slope and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, bluegrass, and/or smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

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

Other information

Ecological Site Correlation Issues and Questions:

• R053CY018SD Dense Clay (Bullcreek Series) typically is not used in MLRA 53C. The Bullcreek series is mainly used in MLRA 63A & 63B. The R053CY018SD Dense Clay ESD is only used in MLRA53C for a minor component.
• Reference and alternative states within the state and transition model are may not be fully documented and may require additional field sampling for refinement.

Inventory data references

There is no NRCS clipping data and other inventory currently available for this site. Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS, Shane Deranleau, Range Management Specialist, NRCS, Mitch Faulkner, Range Management Specialist, NRCS, and Bruce Kunze, Soil Scientist, NRCS.

Other references

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Coterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC. 92 pps.

Gilbert, M. C., Whited, P. M., Clairain Jr, E. J., & Smith, R. D. (2006). A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes. Washington DC.

Samson, F. B., & Knopf, F. L. (1996). Prairie Conservation Preserving North America's Most Endagered Ecosystem. Washington D.C.: Island Press.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed March 2018.
United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2003. National Range and Pasture Handbook, Revision 1. Grazing Lands Technology Institute. 214 pps.

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. 672pps.

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. 2018. The PLANTS Database (http://plants.usda.gov, 27 March 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

U.S. Environmental Protection Agency [EPA]. 2013. Level III and Level IV Ecoregions of the Continental United States. Corvallis, OR, U.S. EPA, National Health and Environmental Effects Research Laboratory, map scale 1:3,000,000. Available at http://www.epa.gov/eco-research/level-iii-and-iv-ecoregions- continental-united-states. (Accessed 1 March 2018).

Contributors

Stan Boltz

Approval

Suzanne Mayne-Kinney, 1/22/2024

Acknowledgments

Contact for Lead Authors: Natural Resources Conservation Service (USDA-NRCS), Redfield Soil Survey Office Redfield, SD; Lance Howe (Lance.Howe@usda.gov), Soil Survey Office Leader, USDA-NRCS, Redfield, SD; and Steve Winter (Steven.Winter@usda.gov), Soil Scientist, USDA-NRCS, Redfield, SD

Additional Information Acknowledgment: Jason Hermann (Jason.Hermann@usda.gov), Area Rangeland Management Specialist, USDA-NRCS, Redfield, SD.

This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. Quality Assurance was approved by David Kraft, NRCS Regional Ecologist as of 11/12/2020.

Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Stan Boltz, Mitch Faulkner, Shane Deranleau
Contact for lead author	Stan Boltz, stanley.boltz@sd.usda.gov, 605-352-1236
Date	03/15/2011
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

2. **Presence of water flow patterns:** None.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground typically 5 to 25 percent depending on recent precipitation. During below average precipitation periods, bare ground will increase.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None present.

7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability normally a 4 to 6 rating. Typically high root content and organic matter in the soil surface. Soil surface is very resistant to erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is typically granular, and mollic (higher organic matter) colors of A-horizon down to about 2 inches. If conditions are other than this, refer to map unit component descriptions for component on which the site occurs.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, deep-rooted native grass and grass-like species enhance infiltration and reduce runoff.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be present. At about 2 to 4 inches, clay content is very high and may appear to be a compaction layer, but platy structure will not be observed and this should not be confused with a compaction layer.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Wheatgrasses (mid, cool-season rhizomatous) >>

    Sub-dominant: Needlegrasses (mid and tall, cool-season bunchgrasses) >

    Other: Mid, warm-season grasses = short, warm-season grasses = forbs > grass-likes species = shrubs

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

14. **Average percent litter cover (%) and depth (in):** 55-85 percent plant litter cover, roughly 0.25 to 0.5 inches in depth. Litter cover is in contact with the soil surface.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,800 pounds/acre (air-dry basis)

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Refer to State and local Noxious Weed List.

17. **Perennial plant reproductive capability:** Perennial grasses have vigorous rhizomes and/or tillers.