USDA Natural Resources Conservation Service

Ecological site R053CY004SD
Wet Meadow

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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.

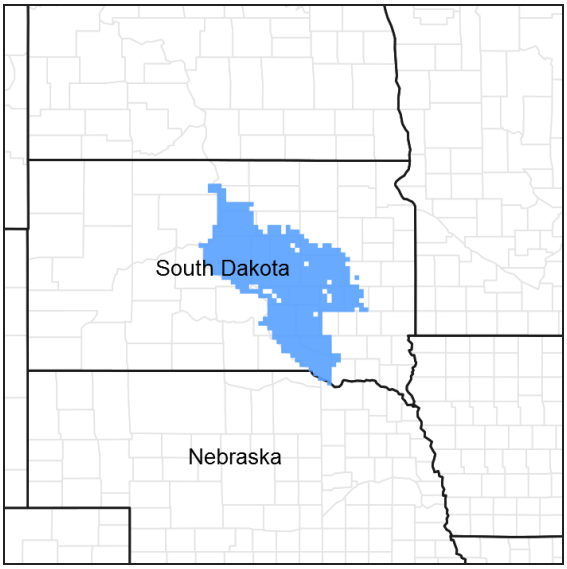


Figure 1. Mapped extent

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 is 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 Wet Meadow ecological site typically occurs in a basin or closed depression, and receives water directly from precipitation, surface overland flow, and groundwater discharge. Soils are poorly drained and formed in local alluvium. Permeability is very slow due to the clayey subsoil and the site will pond water 4 to 8 weeks in the spring of the year. Ponded water conditions and very slow permeability strongly influences the soil-water-plant relationship. Vegetation in the Reference State is codominated by grass-likes, warm-season, and cool-season grasses including woolly sedge, reedgrasses, and prairie cordgrass as well as switchgrass, fowl bluegrass, and a variety of other sedges and rushes. Key forbs include Rydberg's sunflower, Canada goldenrod, Indian hemp, and cinquefoil. Non-native species such as reed canarygrass, Kentucky bluegrass or quackgrass may invade due to change in disturbance regime.

Associated sites

R053CY037SD	**Deep Marsh** These sites occur in a basin or closed depression. Soils are very poorly drained, and the site will pond water year-round in most years. The central concept soil series is Macken.
R053CY020SD	**Loamy Overflow** These sites occur in upland swales. Soils are moderately well drained which have water flow into and over/through the site. The central concept soil series is Mobridge, Onita, and Prosper but other series are included.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Carex pellita* (2) *Spartina pectinata*

Physiographic features

This site occurs on shallow swales or depressions.

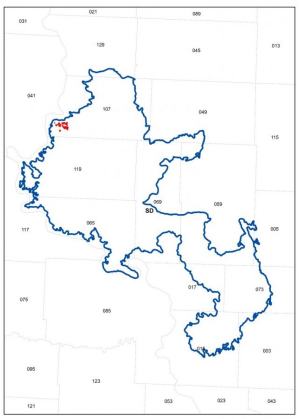


Figure 2. Distribution map

Table 2. Representative physiographic features

Landforms	(1) Pothole (2) Depression
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	Frequent
Elevation	1,300–2,300 ft
Slope	0–1%
Ponding depth	0–12 in
Water table depth	0–32 in
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)	20-21 in

Frost-free period (actual range)	104-129 days
Freeze-free period (actual range)	127-159 days
Precipitation total (actual range)	19-24 in
Frost-free period (average)	117 days
Freeze-free period (average)	139 days
Precipitation total (average)	21 in

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

Wetland description

Cowardin, et. al., 1979
System: Palustrine
Subsystem: N/A
Class: Emergent Wetland
Subclass: Persistent

Soil features

These are very deep, poorly drained, medium to fine textured soils. Saturated hydraulic conductivity is slow to very slow and available water capacity is high. Salinity and sodicity are typically none to slight. Water tables on this site range from near the surface to three feet below for several weeks during the growing season. The site normally receives additional water from surface runoff and/or underground seepage. This site occurs in potholes, depressions, and closed depressions. Slope ranges from zero to one percent. This site should show no evidence of rills, wind scoured areas, or pedestalled plants. The soil surface is stable and intact. Subsurface soil layers are nonrestrictive to water movement and root penetration. Ponded water conditions and slow permeability strongly influences the soil-water-plant relationship. The central concept soil series for this site is Tetonka.

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

Table 4. Representative soil features

Surface texture	(1) Silt loam
Family particle size	(1) Loamy
Drainage class	Poorly drained
Permeability class	Very slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	7–8 in

Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

State and Community Phases
The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

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/or 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 Prairie Cordgrass-Woolly Sedge-Northern Reedgrass 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.

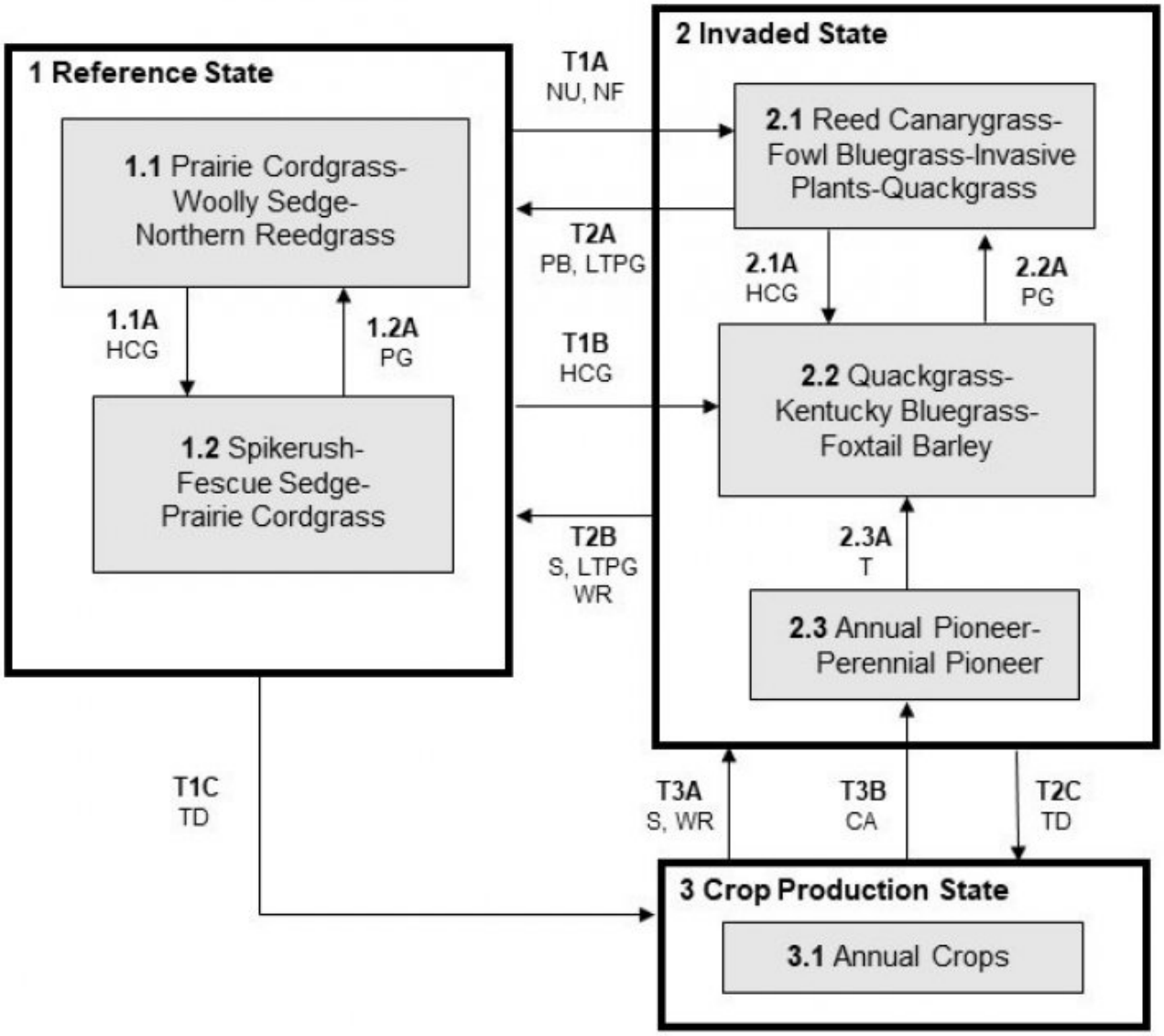
This ecological site (ES) has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have changed the disturbance regime of this site. Heavy continuous grazing without adequate recovery periods following each grazing occurrence causes this site to depart from the Reference State. Species such as fowl bluegrass (*Poa palustris*), spikerush (Eleocharis), and Baltic rush (Juncus balticus) will initially increase. Prairie cordgrass and northern reedgrass will decrease in frequency and production. Continued heavy grazing eventually causes quackgrass (*Elymus repens*), foxtail barley (*Hordeum jubatum*), Kentucky bluegrass (*Poa pratensis*), spikerush and unpalatable forbs such as curly dock (*Rumex crispus*) to increase and dominate.

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/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/or 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.

State and transition model

Wet Meadow – R053CY004SD



LEGEND
Wet Meadow – R053CY004SD

CA – Cropped and abandoned
HCG – Heavy continuous grazing
LTPG – Long-term prescribed grazing
NU – Non-use
NF – No fire
PB – Prescribed burning
PG – Prescribed grazing
S – Seeding
T – Time w/wo disturbances
TD – Tillage, Artificial drainage
WR – Wetland restoration

Figure 9. State-And-Transition model

Code	Process
T1A	Non-use, no fire
T1B	Heavy continuous grazing
T1C	Tillage, artificial drainage (surface and subsurface)
T2A	Long term prescribed grazing, prescribed burning
T2B	Long term prescribed grazing, seeding, wetland restoration
T2C	Tillage, artificial drainage (surface and subsurface)
T3A	Seeding, wetland restoration
T3B	Abandonment of cropping
1.1A	Heavy continuous grazing
1.2A	Prescribed grazing with recovery periods
2.1A	Heavy continuous grazing
2.2A	Prescribed grazing with recovery periods
2.3A	Time w/wo disturbances

Figure 10. Matrix

State 1
Reference State

The Wet Meadow site typically occurs in a basin or closed depression, and receives water directly from precipitation, surface overland flow, and groundwater discharge. Soils are poorly drained and formed in local alluvium. Permeability is very slow and the site will pond water 4 to 8 weeks in the spring of the year. Ponded water conditions and very slow permeability strongly influences the soil-water-plant relationship. The central concept soil series is Tetonka, but other series are included. This state represents the natural range of variability that dominates the dynamics of this ES. This state is typically codominated by cool- and warm-season grasses. Before European settlement, the primary disturbance mechanisms for this site in the reference condition included periodic fire, grazing by large herding ungulates, and fluctuations in the water table and ponding frequency and duration. Frequent surface fires (3 to 5 years) and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, the primary disturbance is from a lack of fire, concentrated livestock grazing, and weather fluctuations. Species that are desirable for livestock and wildlife can decline and a corresponding increase in less desirable species will occur.

Community 1.1
Prairie Cordgrass-Woolly Sedge-Northern Reedgrass

Interpretations are based primarily on the 1.1 Prairie Cordgrass-Woolly Sedge-Northern Reedgrass Plant Community Phase (this is also considered to be climax). This community evolved with grazing by large herbivores, occasional prairie fires, and relatively frequent ponding events and 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. The potential vegetation is about 50 percent grass-like species, 40 percent grasses, and 10 percent forbs by air-dry weight. Prairie cordgrass is the dominant tall warm-season grass occupying this plant community. Northern reedgrass is the dominant tall cool-season species. A variety of sedges and rushes occur throughout this community, as well as, switchgrass (*Panicum virgatum*) and fowl bluegrass. Key forbs include Rydberg's sunflower (*Helianthus nuttallii*), Canada goldenrod (Solidago canacensis), dogbane (Apocynum), and cinquefoil (Potentilla). This plant community phase is diverse, stable, and productive, and is well adapted to the Northern Great Plains. The high water table supplies much of the moisture for plant growth. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement offsite and natural plant mortality is very low. The diversity in plant species allows for the variability of both the fluctuations of water table and reoccurring ponding. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3305	4050	4690
Forb	195	450	810
Total	**3500**	**4500**	**5500**

Figure 12. Plant community growth curve (percent production by month). SD5306, Southern Dark Brown Glaciated Plains, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Community 1.2
Spikerush-Fescue Sedge-Prairie Cordgrass

This community develops with periods of heavy continuous grazing with lack of adequate recovery periods during the growing season following periods of below normal precipitation. Lack of litter and reduced plant heights result in higher soil temperatures and reduced water infiltration rates. Recognition of this plant community will enable the land user to implement key management decisions before a significant ecological threshold is crossed. Prairie cordgrass has been reduced in this plant community but still persists. Spikerush, fescue sedge (*Carex brevior*) (also called shortbeak sedge), and prairie cordgrass are the dominant species. Spikerush and Baltic rush, as well as, other grass-likes have increased. Northern reedgrass has been significantly reduced. Switchgrass may be removed at this stage. Reed canarygrass (*Phalaris arundinacea*) may begin to increase significantly. Forb species would include asters (Asteraceae), goldenrod (Solidago) and cinquefoil, as well as, a possible invasion of Canada thistle (*Cirsium arvense*). Plant production and frequency have been reduced. The water cycle, nutrient cycle, and energy flow are slightly reduced but continue to function adequately.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2345	3238	4090
Forb	155	262	410
Total	**2500**	**3500**	**4500**

Figure 14. Plant community growth curve (percent production by month). SD5306, Southern Dark Brown Glaciated Plains, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	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 Spikerush- Fescue Sedge-Prairie Cordgrass 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 Prairie Cordgrass-

Woolly Sedge-Northern Reedgrass Plant Community Phase. This pathway could also occur with a return to more normal precipitation levels and frequencies.

Conservation practices

Prescribed Grazing

State 2
Invaded State

This state is characterized by the dominance of invasive and/or nonnative species as a result of disturbance regimes outside the normal variability. Loss or reduction of native cool- and warm-season grasses and the forb component have negatively impacted energy flow and nutrient cycling. Infiltration is reduced and native plant mortality is increased. As the disturbance level increases, native plant density decreases even more, giving way to annual species and invasive perennial species, as well as, an increase in bare ground.

Community 2.1
Reed Canarygrass-Fowl Bluegrass-Invasive Plants-Quackgrass

This plant community phase develops with a long-term lack of grazing and/or fire. Eventually litter levels become high enough to reduce native grass vigor, diversity, and density. Years of accumulated litter will tend to make this community wetter. Sedge (Carex), Baltic rush, spikerush, and bulrush (Schoenoplectus) will increase. Hydrophytic forbs will also increase. Reed canarygrass often will increase to the point of dominance, while prairie cordgrass will diminish significantly. Other invasive plants such as creeping meadow foxtail (*Alopecurus arundinaceus*) may become prevalent if a seed source is present or nearby. Nutrient cycling will be greatly diminished and the energy flow will shift significantly and be reduced as well due to the increase in plant litter. Infiltration will be reduced somewhat compared to the Reference State. This plant community is somewhat resistant to change. The combination of both grazing and fire is most effective in moving this plant community towards the Reference State.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2435	3378	4305
Forb	65	122	195
Total	**2500**	**3500**	**4500**

Figure 16. Plant community growth curve (percent production by month). SD5306, Southern Dark Brown Glaciated Plains, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Community 2.2
Quackgrass-Kentucky Bluegrass-Foxtail Barley

This plant community phase occurs after prolonged heavy disturbance such as described above in the community pathway (i.e., heavy grazing pressure without adequate recovery). The prolonged nature of this disturbance will tend to increase soil temperatures and evaporation, causing this site to become drier than normal. This allows the increase/invasion of typically less hydrophytic vegetation such as quackgrass (*Elymus repens*) and Kentucky bluegrass (*Poa pratensis*). A significant amount of production and diversity has been lost when compared to the Reference State. Loss or reduction of native cool- and warm-season grasses, and the native forb component have negatively impacted energy flow and nutrient cycling. It will take an extended period of time to restore this plant community back to the Reference State with improved management. Renovation is typically not practical but may be the only means to significantly restore the ecological processes on this site.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1490	2250	2955
Forb	110	250	445
Total	**1600**	**2500**	**3400**

Figure 18. Plant community growth curve (percent production by month). SD5306, Southern Dark Brown Glaciated Plains, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Community 2.3
Annual Pioneer-Perennial Pioneer

This plant community develops under severe disturbance, typically abandonment after cropping. The dominant vegetation includes pioneer annual or perennial grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include inland saltgrass (*Distichlis spicata*), foxtail barley, barnyardgrass (Echinochloa), quackgrass, fowl bluegrass, Kentucky bluegrass, Baltic rush, and sedges. The dominant forbs include curlycup gumweed (*Grindelia squarrosa*), Canada thistle, and other early successional species. The community is susceptible to invasion of 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. Significant economic inputs, management, and time would be required to move this plant community toward a higher successional stage. Secondary succession is highly variable, depending upon availability and diversity of a viable reproductive source of higher successional species. This plant community may be renovated to improve the production capability but management changes would be needed to maintain the new plant community.

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 Quackgrass-Kentucky Bluegrass-Foxtail Barley 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 Reed Canarygrass-Fowl Bluegrass-Invasive Plants-Quackgrass Plant Community Phase. This pathway could also occur with a return to more normal precipitation levels and frequencies.

Pathway 2.3A
Community 2.3 to 2.2

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the Quackgrass-Kentucky Bluegrass-Foxtail Barley Plant Community Phase.

State 3
Crop Production State

This state is characterized by the production of annual crops using a variety of tillage and cropping systems along

with management practices. Cropping on this site is enabled during years with drier than normal precipitation or with artificial drainage (surface or subsurface).

Community 3.1
Annual Crops

This plant community developed with the use of a variety of tillage systems and cropping systems for the production of annual crops including corn, soybeans, wheat, and a variety of other crops.

Transition T1A & T1B
State 1 to 2

T1A: Non-use and/or no surface fire for extended periods of time (typically for 10 years or more) causing litter levels to become high enough to reduce native grass vigor, diversity will eventually cause a shift over a threshold leading to the 2.1 Reed Canarygrass-Fowl Bluegrass-Invasive Plants-Quackgrass Plant Community Phase within the Invaded State (State 2). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling. T1B: Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year) will eventually cause a shift over a threshold leading to the 2.2 Quackgrass-Kentucky Bluegrass-Foxtail Barley Plant Community Phase within the Invaded State (State 2). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Transition T1C
State 1 to 3

Tillage, artificial drainage (surface and subsurface) will cause a shift over a threshold leading to the 3.1 Annual Crops Plant Community Phase within the Crop Production State (State 3).

Restoration pathway T2A & T2B
State 2 to 1

T2A: Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) coupled with prescribed burning occurring at relatively frequent intervals (3 to 5 years) and a return to normal disturbance regime levels may lead this 2.1 Reed Canarygrass-Fowl Bluegrass-Invasive Plants-Quackgrass Plant Community Phase within the Invaded State (State 2) over a threshold to the Reference State (State 1). T2B: Seeding followed by long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) may lead this plant community phase over a threshold to the Reference State (State 1). Wetland restoration techniques may be necessary to restore biotic integrity and plant diversity and productivity.

Conservation practices

Prescribed Grazing
Wetland Restoration

Transition T2C
State 2 to 3

Tillage, artificial drainage (surface and subsurface) will cause a shift over a threshold leading to the 3.1 Annual Crops Plant Community Phase within the Crop Production State (State 3).

Restoration pathway T3A & T3B
State 3 to 2

Wetland restoration along with seeding of perennial species adapted to the site may lead this plant community

phase over a threshold to the Invaded State (State 2). Cropping followed by abandonment may lead this plant community phase over a threshold to the Invaded State (State 2) and more specifically to the 2.3 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass-likes**			1125–1800	
	woolly sedge	CAPE42	*Carex pellita*	90–675	–
	clustered field sedge	CAPR5	*Carex praegracilis*	90–450	–
	Sartwell's sedge	CASA8	*Carex sartwellii*	90–450	–
	shortbeak sedge	CABR10	*Carex brevior*	90–450	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	90–360	–
	green bulrush	SCAT2	*Scirpus atrovirens*	45–360	–
	spikerush	ELEOC	*Eleocharis*	90–225	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	45–90	–
	flatsedge	CYPER	*Cyperus*	0–90	–
2	**Tall Warm-Season Grasses**			900–1350	
	prairie cordgrass	SPPE	*Spartina pectinata*	675–1350	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	90–450	–
	switchgrass	PAVI2	*Panicum virgatum*	0–225	–
3	**Tall Cool-Season Grasses**			450–1125	
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	225–675	–
	slimstem reedgrass	CASTS5	*Calamagrostis stricta ssp. stricta*	90–450	–
	bluejoint	CACA4	*Calamagrostis canadensis*	90–450	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–225	–
4	**Cool-Season Bunchgrasses**			225–450	
	plains bluegrass	POAR3	*Poa arida*	45–360	–
	fowl bluegrass	POPA2	*Poa palustris*	90–360	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–90	–
5	**Wheatgrass**			45–225	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–225	–
	western wheatgrass	PASM	*Pascopyrum smithii*	45–225	–
6	**Other Native Grasses**			45–225	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–225	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–135	–
Forb					
7	**Forbs**			225–675	
	Forb, native	2FN	*Forb, native*	45–180	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	45–135	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	45–135	–
	cinquefoil	POTEN	*Potentilla*	45–90	–

	cinquefoil	POTEN	*Potentilla*	45–90	–
	mint	MENTH	*Mentha*	0–90	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–90	–
	western dock	RUAQ	*Rumex aquaticus*	45–90	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–90	–
	giant goldenrod	SOGI	*Solidago gigantea*	0–90	–
	goldenrod	SOLID	*Solidago*	45–90	–
	white panicle aster	SYLA6	*Symphyotrichum lanceolatum*	45–90	–
	Canadian anemone	ANCA8	*Anemone canadensis*	45–90	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–90	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	45–90	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–90	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–90	–
	blazing star	LIATR	*Liatris*	0–90	–
	wood lily	LIPH	*Lilium philadelphicum*	0–45	–
	Rydberg's sunflower	HENUR	*Helianthus nuttallii ssp. rydbergii*	0–45	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–45	–
	Virginia strawberry	FRVI	*Fragaria virginiana*	0–45	–
	blue-eyed grass	SISYR	*Sisyrinchium*	0–45	–
	Macoun's buttercup	RAMA2	*Ranunculus macounii*	0–45	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass-likes**			1225–1575	
	spikerush	ELEOC	*Eleocharis*	350–700	–
	shortbeak sedge	CABR10	*Carex brevior*	175–525	–
	green bulrush	SCAT2	*Scirpus atrovirens*	35–420	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	175–350	–
	flatsedge	CYPER	*Cyperus*	175–350	–
	clustered field sedge	CAPR5	*Carex praegracilis*	175–350	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	35–245	–
	Sartwell's sedge	CASA8	*Carex sartwellii*	35–175	–
	woolly sedge	CAPE42	*Carex pellita*	70–175	–
2	**Tall Warm-Season Grasses**			175–525	
	prairie cordgrass	SPPE	*Spartina pectinata*	175–525	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–175	–
	switchgrass	PAVI2	*Panicum virgatum*	0–70	–
3	**Tall Cool-Season Grasses**			70–525	
	reed canarygrass	PHAR3	*Phalaris arundinacea*	70–350	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	0–175	–
	slimstem reedgrass	CASTS5	*Calamagrostis stricta ssp. stricta*	0–70	–
	bluejoint	CACA4	*Calamagrostis canadensis*	0–70	–

4	**Cool-Season Bunchgrasses**			175–525	
	fowl bluegrass	POPA2	*Poa palustris*	175–350	–
	plains bluegrass	POAR3	*Poa arida*	0–280	–
	foxtail barley	HOJU	*Hordeum jubatum*	35–175	–
5	**Wheatgrass**			70–245	
	western wheatgrass	PASM	*Pascopyrum smithii*	70–245	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–105	–
6	**Other Native Grasses**			70–280	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–175	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	70–175	–
7	**Non-Native Grasses**			175–525	
	creeping meadow foxtail	ALAR	*Alopecurus arundinaceus*	0–350	–
	quackgrass	ELRE4	*Elymus repens*	0–350	–
	Kentucky bluegrass	POPR	*Poa pratensis*	70–350	–
Forb					
8	**Forbs**			175–350	
	giant goldenrod	SOGI	*Solidago gigantea*	0–105	–
	goldenrod	SOLID	*Solidago*	35–105	–
	white panicle aster	SYLA6	*Symphyotrichum lanceolatum*	35–105	–
	Forb, native	2FN	*Forb, native*	35–105	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–105	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	35–105	–
	cinquefoil	POTEN	*Potentilla*	35–105	–
	western dock	RUAQ	*Rumex aquaticus*	0–70	–
	mint	MENTH	*Mentha*	0–70	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–70	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	35–70	–
	Forb, introduced	2FI	*Forb, introduced*	0–70	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–70	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	35–70	–
	Canadian anemone	ANCA8	*Anemone canadensis*	0–35	–
	Rydberg's sunflower	HENUR	*Helianthus nuttallii ssp. rydbergii*	0–35	–
	blazing star	LIATR	*Liatris*	0–35	–
	wood lily	LIPH	*Lilium philadelphicum*	0–35	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–35	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–35	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–35	–
	blue-eyed grass	SISYR	*Sisyrinchium*	0–35	–
	Macoun's buttercup	RAMA2	*Ranunculus macounii*	0–35	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					

1	**Grass-likes**			700–1050	
	woolly sedge	CAPE42	*Carex pellita*	70–350	–
	clustered field sedge	CAPR5	*Carex praegracilis*	70–350	–
	Sartwell's sedge	CASA8	*Carex sartwellii*	70–350	–
	spikerush	ELEOC	*Eleocharis*	70–350	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	35–175	–
	green bulrush	SCAT2	*Scirpus atrovirens*	0–175	–
	flatsedge	CYPER	*Cyperus*	35–175	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	35–175	–
	shortbeak sedge	CABR10	*Carex brevior*	35–175	–
2	**Tall Warm-Season Grasses**			70–350	
	prairie cordgrass	SPPE	*Spartina pectinata*	70–350	–
3	**Tall Cool-Season Grasses**			700–1225	
	reed canarygrass	PHAR3	*Phalaris arundinacea*	700–1225	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	35–175	–
	slimstem reedgrass	CASTS5	*Calamagrostis stricta ssp. stricta*	0–35	–
	bluejoint	CACA4	*Calamagrostis canadensis*	0–35	–
4	**Cool-Season Bunchgrasses**			175–525	
	fowl bluegrass	POPA2	*Poa palustris*	70–525	–
	foxtail barley	HOJU	*Hordeum jubatum*	35–175	–
	plains bluegrass	POAR3	*Poa arida*	0–175	–
5	**Wheatgrass**			70–350	
	western wheatgrass	PASM	*Pascopyrum smithii*	70–350	–
6	**Other Native Grasses**			0–175	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–175	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–70	–
7	**Non-Native Grasses**			350–1225	
	quackgrass	ELRE4	*Elymus repens*	0–1050	–
	creeping meadow foxtail	ALAR	*Alopecurus arundinaceus*	0–875	–
	Kentucky bluegrass	POPR	*Poa pratensis*	70–525	–
Forb					
8	**Forbs**			70–175	
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–70	–
	giant goldenrod	SOGI	*Solidago gigantea*	0–70	–
	goldenrod	SOLID	*Solidago*	0–70	–
	Forb, introduced	2FI	*Forb, introduced*	0–70	–
	Forb, native	2FN	*Forb, native*	0–70	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–70	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–70	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–70	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–70	–
	cinquefoil	POTEN	*Potentilla*	0–70	–

	western dock	RUAQ	*Rumex aquaticus*	0–35	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–35	–
	white panicle aster	SYLA6	*Symphyotrichum lanceolatum*	0–35	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	0–35	–
	mint	MENTH	*Mentha*	0–35	–

Table 12. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass-likes**			625–875	
	spikerush	ELEOC	*Eleocharis*	125–625	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	250–500	–
	clustered field sedge	CAPR5	*Carex praegracilis*	50–250	–
	flatsedge	CYPER	*Cyperus*	50–250	–
	shortbeak sedge	CABR10	*Carex brevior*	25–200	–
	woolly sedge	CAPE42	*Carex pellita*	0–50	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–50	–
	Sartwell's sedge	CASA8	*Carex sartwellii*	25–50	–
	green bulrush	SCAT2	*Scirpus atrovirens*	0–50	–
2	**Tall Warm-Season Grasses**			0–125	
	prairie cordgrass	SPPE	*Spartina pectinata*	0–125	–
3	**Tall Cool-Season Grasses**			0–250	
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–250	–
4	**Cool-Season Bunchgrasses**			250–750	
	foxtail barley	HOJU	*Hordeum jubatum*	125–750	–
	fowl bluegrass	POPA2	*Poa palustris*	125–375	–
	plains bluegrass	POAR3	*Poa arida*	0–75	–
5	**Wheatgrass**			0–125	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–125	–
6	**Other Native Grasses**			25–250	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–175	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	25–125	–
7	**Non-Native Grasses**			375–1125	
	creeping meadow foxtail	ALAR	*Alopecurus arundinaceus*	0–875	–
	quackgrass	ELRE4	*Elymus repens*	125–875	–
	Kentucky bluegrass	POPR	*Poa pratensis*	125–750	–
Forb					
8	**Forbs**			125–375	
	Forb, introduced	2FI	*Forb, introduced*	25–200	–
	Forb, native	2FN	*Forb, native*	25–100	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	25–100	–
	goldenrod	SOLID	*Solidago*	25–100	–
	white panicle aster	SYLA6	*Symphyotrichum lanceolatum*	25–75	–

	New England aster	SYNO2	*Symphyotrichum novae-angliae*	25–75	–
	giant goldenrod	SOGI	*Solidago gigantea*	0–75	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–75	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	25–75	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–50	–
	cinquefoil	POTEN	*Potentilla*	0–50	–
	western dock	RUAQ	*Rumex aquaticus*	0–25	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–25	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–25	–

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.

Prairie Cordgrass/Sedge/Northern Reedgrass (1.1)
Average Annual Production (lbs./acre, air-dry): 4,500
Stocking Rate* (AUM/acre): 1.23

Fowl Bluegrass/Spikerush/Baltic Rush/Forbs (1.2)
Average Annual Production (lbs./acre, air-dry): 3,500
Stocking Rate* (AUM/acre): 0.96

Reed Canarygrass/Sedge/Invasive Plants/Prairie Cordgrass (2.1)
Average Annual Production (lbs./acre, air-dry): 3,500
Stocking Rate* (AUM/acre): 0.96

Quackgrass/Kentucky Bluegrass/Foxtail Barley/Invasive Plants (2.2)
Average Annual Production (lbs./acre, air-dry): 2,500
Stocking Rate* (AUM/acre): 0.69

Annual/Pioneer, Non-Native Perennial (2.3)
Average Annual Production (lbs./acre, air-dry): 1,800
Stocking Rate* (AUM/acre): 0.49

*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 C and D. Infiltration is very slow and runoff potential for this site is negligible. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower 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.

Other information

Ecological Site Correlation Issues and Questions:

• 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

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; and Bruce Kunze, Soil Scientist, NRCS.

Data Source Sample Period State County
SCS-Range-417 (0247046059) 10/20/1970 SD Hand
SCS-Range-417 (0147046059) 10/20/1972 SD Hand

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).

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Approval

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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.

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:** Barely observable or not present.

3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than 5 percent and pathces less than two inches in diameter.

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 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):** Structure is weak, thin, and platy, parting to granular, and mollic (higher organic matter) colors of A-horizon down to about 10 inches.

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.

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: Grass-like species > tall, warm-season grasses >

    Sub-dominant: Tall, cool-season grasses > forbs >

    Other: Mid, cool-season grasses > wheatgrasses

    Additional: Other native grasses occur in other functional groups.

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):** 85-90 percent plant litter cover, roughly 1 to 2 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):** 4,500 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; also reed canarygrass.

17. **Perennial plant reproductive capability:** Perennial grass and grass-like species have vigorous rhizomes and/or tillers.