USDA Natural Resources Conservation Service

Ecological site R053CY007SD
Saline Lowland

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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.

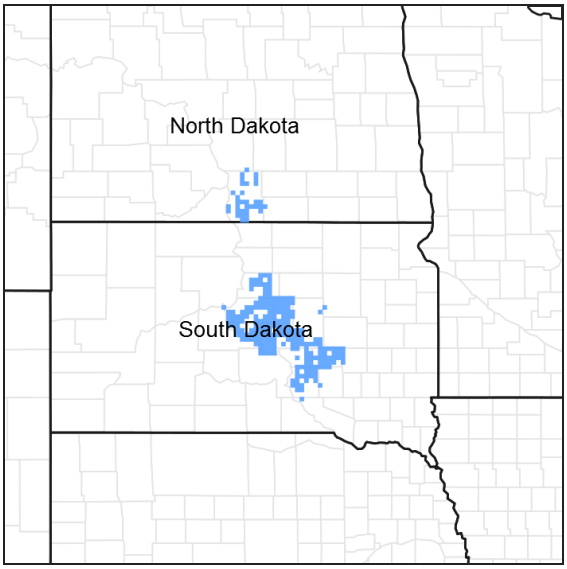


Figure 1. Mapped extent

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 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 Saline Lowland ecological site typically occurs in drainageways. Soils are poorly and very poorly drained which have a water table within 0 to 2 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. The soils will have visible salts within 16 inches of the soil surface. Dominant vegetation is adapted to high salinity and excessive wetness, which includes species such as Prairie Cordgrass, Alkali cordgrass, and Nuttal's alkaligrass. Salt tolerant forbs present may include alkali plantain, western dock, and Pursh seepweed. The site my become degraded due to change in disturbance regime, and vegetation may shift to community dominated by foxtail barley, inland saltgrass, and foxtail barley.

Associated sites

R053CY002SD	**Linear Meadow** These sites occur in drainageways. Soils are poorly and very poorly drained which have a water table within 0 to 2 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. Soils do not have visible salts within 16 inches of the soil surface. The central concept soil series are Clamo , but other series are included.
R053CY013SD	**Claypan** These sites occur in drainageways. Soils are somewhat poorly drained which have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. Soils have a claypan (columnar structure) between 6 and 16 inches from the soil surface. The central concept soil series is Farmsworth, but other series could be included.
R053CY015SD	**Thin Claypan** These sites can occur along the edges of drainageways on a slightly higher landscape. Soils are moderately well drained. Soils will have a claypan (columnar structure) within 6 inches and visible salts within 16 inches of the soil surface. The central concept soil series is Jerauld, but other series could be included.

Similar sites

R053CY019SD	**Closed Depression** These sites occur in slight depressions on nearly level slopes in the upland areas. Soils are poorly drained which have a water table within 0 to 2 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. Soils may have a claypan (columnar structure) within 6 inches of the soil surface or an abrupt texture change within 12 inches of the soil surface. The central concept soil series are Hoven, but other series are included. (more western wheatgrass, more dock and smartweed; higher production)
R053CY013SD	**Claypan** These sites occur in drainageways. Soils are somewhat poorly drained which have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. Soils have a claypan (columnar structure) within 16 inches, but greater than 6 inches of the soil surface. The central concept soil series is Farmsworth, but other series could be included.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	(1) *Spartina pectinata* (2) *Spartina gracilis*

Physiographic features

This site occurs on nearly level lowlands and adjacent to small drainageways and gently undulating floodplains.

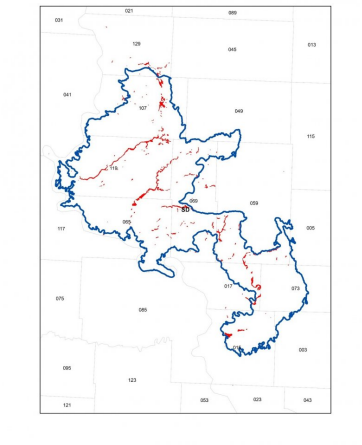


Figure 2. Distribution map

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Pothole
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	396–701 m
Slope	0–1%
Water table depth	0–183 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

This ecological site (ES) has a combination of physical and hydrological features that: 1) typically provides ground water within two feet of the surface for most of the season; 2) allows relatively free movement of water and air in the upper part of the soil; and 3) are rarely to frequently flooded.

Soil features

The common features of soils in this site are the silty clay textured subsoil and slopes of zero to one percent. The soils in this site are poorly drained and formed in alluvium. The silt loam to silty clay loam surface layer is typically one to six inches thick. The soils have a very slow infiltration rate. Areas within this site can become nearly barren due to the accumulation of sodium at the surface. Where vegetation is present, 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 non-restrictive to water movement and root penetration. These soils are somewhat susceptible to water erosion. Slow permeability and salt accumulation strongly influences the soil-water-plant relationship. The central concept soil series for this site are Durrstein and Egas, but other series are included. Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Silty clay loam (2) Silt loam (3) Silty clay
Family particle size	(1) Loamy
Drainage class	Very poorly drained to poorly 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)	10.16–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–40%
Electrical conductivity (0-101.6cm)	0–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–25
Soil reaction (1:1 water) (0-101.6cm)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0%

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 Black 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-Alkali Cordgrass-Nuttall’s Alkaligrass 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 they have been introduced into the area. As this site deteriorates, species such as inland saltgrass (*Distichlis spicata*) and foxtail barley (*Hordeum jubatum*) increase and annual species may invade the site. Grasses such as alkali sacaton (*Sporobolus airoides*), western wheatgrass, slender wheatgrass (*Elymus trachycaulus*), and Nuttall's alkaligrass will decrease in frequency and production. The high sodium and other salts content of the soils greatly influences the plant species present. Plant vigor can vary on a year-to-year basis in relation to current precipitation amounts, which influences the translocation of salts in the soil profile. Typically, only salt tolerant plants are found on this site.

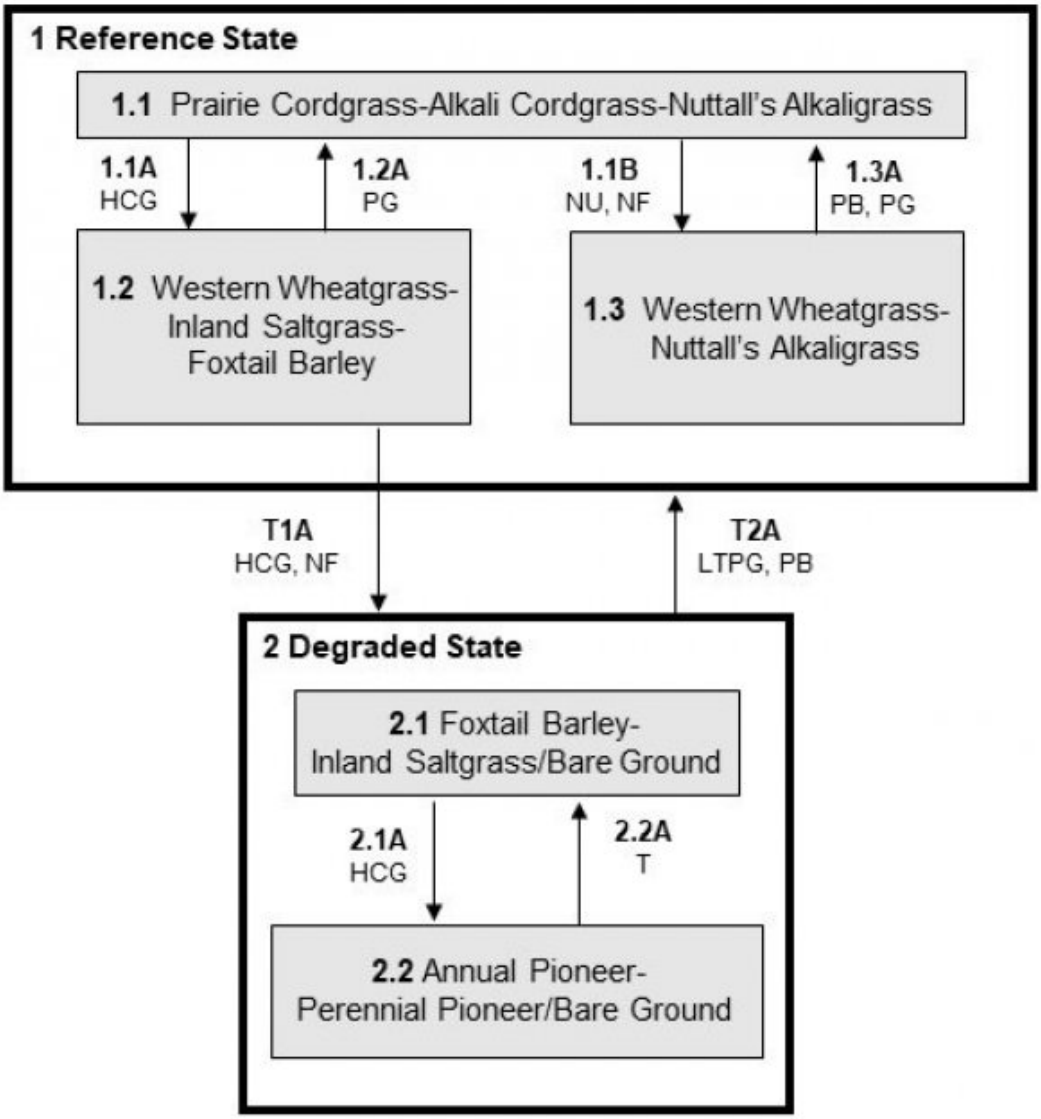
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best 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.

The pie charts may not add up to 100% due to internal rounding errors.

State and transition model

Saline Lowland – R053CY007SD



LEGEND
Saline Lowland – R053CY007SD

HCG – Heavy continuous grazing
LTPG – Long-term prescribed grazing
NF – No fire
NU – Non-use
PB – Prescribed burning
PG – Prescribed grazing
T – Time w/wo disturbances

Figure 9. State-And-Transition model

Code	Process
T1A	Heavy continuous grazing, no fire
T2A	Long term prescribed grazing, prescribed burning
1.1A	Heavy continuous grazing
1.1B	Non-use, no fire
1.2A	Prescribed grazing with recovery periods
1.3A	Prescribed grazing with recovery periods, prescribed burning
2.1A	Heavy continuous grazing
2.2A	Time w/wo disturbances

Figure 10. Matrix

State 1
Reference State

The Saline Lowland site typically occurs in drainageways. Soils are poorly and very poorly drained which have a water table within 0 to 2 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. The soils will have visible salts within 16 inches of the soil surface. The central concept soil series are Durrstein and Egas, but other series are included. This state represents the natural range of variability that dominates the dynamics of this ES. This state is typically co-dominated 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-Alkali Cordgrass-Nutall's Alkaligrass

Interpretations are based primarily on the 1.1 Prairie Cordgrass-Alkali Cordgrass-Nutall's Alkaligrass Plant Community Phase (this is also considered to be climax). This community evolved with grazing by large herbivores, occasional prairie fires, and periodic flooding events and can be found on areas that are properly managed with grazing or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The potential vegetation is about 85 percent grasses and grass-like plants and 15 percent forbs. The major grasses include prairie cordgrass, alkali cordgrass, and Nuttall's alkaligrass. Other grass and grass-like species present include western wheatgrass, slender wheatgrass, inland saltgrass, and foxtail barley. Salt tolerant forbs such as alkali plantain (Plantago eripoda), western dock (*Rumex aquaticus*), and seepweed (Suaeda) are common. Interpretations are based primarily on this plant community phase. This community phase is diverse, stable, productive, and well adapted to both saline soils and the Northern Great Plains climatic conditions. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Litter is properly distributed with very little movement offsite and natural plant mortality is very low. This community is resistant to many disturbances except continuous grazing, tillage, and development into urban or other uses. The diversity in plant species allows for both the fluctuation of flooding, as well as, large variations in climate.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2819	3512	4142
Forb	174	295	460
Shrub/Vine	34	117	219
Total	**3027**	**3924**	**4821**

Figure 12. Plant community growth curve (percent production by month). SD5309, Southern Dark Brown Glaciated Plains, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	16	22	23	14	7	5	0	0

Community 1.2
Western Wheatgrass-Inland Saltgrass-Foxtail Barley

This plant community develops with heavy continuous grazing with lack of adequate recovery periods during the growing season, or annual, early spring seasonal grazing. Lack of litter and reduced plant heights result in higher soil temperatures, poor water infiltration rates, high evapotranspiration, and increased percolation of the high water table, which increases salt concentrations on the surface. This gives inland saltgrass and other salt tolerant species a competitive advantage over less tolerant species. Nuttall's alkaligrass, slender wheatgrass, prairie cordgrass, and alkali cordgrass have decreased while western wheatgrass and inland saltgrass will initially increase in composition. Mat muhly (*Muhlenbergia richardsonis*), foxtail barley, silverleaf cinquefoil (*Potentilla argentea*), dock (Rumex), and

plantain (Plantago) will also increase in composition. As long as the herbaceous component remains intact, the plant community tends to be resilient. However, species composition can be further altered through long-term heavy continuous grazing. With loss of Nuttall's alkaligrass, Prairie cordgrass, Alkali Cordgrass, slender wheatgrass, and much of the western wheatgrass, the inland saltgrass will eventually become the dominant species. This plant community is relatively stable and well adapted to increased salinity. Plant vigor, litter, plant density, and production have decreased. The biological integrity, water, and nutrient cycles of this plant community are becoming impaired.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1894	2452	2707
Forb	123	280	499
Shrub/Vine	–	69	157
Total	**2017**	**2801**	**3363**

Figure 14. Plant community growth curve (percent production by month). SD5307, Southern Dark Brown Glaciated Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	13	20	25	18	11	5	3	0	0

Community 1.3
Western Wheatgrass-Nuttail's Alkaligrass

This plant community occurs when grazing is removed for long periods of time (rest) in the absence of fire. Plant composition is similar to 1.1 Prairie Cordgrass-Alkali Cordgrass-Nuttail's Alkaligrass Plant Community Phase; however, individual species production and frequency will be lower. Much of the nutrients are tied up in excessive litter. The nutrient cycle is slowed due to standing dead plant residues not in contact with a moist soil surface. Aboveground litter also limits sunlight from reaching plant crowns. Tall warm-season grasses (cordgrasses) die off or are reduced in density and vigor and typically develop into small but dense colonies. Thick litter and absence of grazing animals (animal impact) or fire reduces seed germination and establishment. This plant community develops after an extended period of 10 or more years of nonuse by herbivores and exclusion of fire. This plant community is resistant to change without prescribed grazing or fire. The combination of both grazing and fire is most effective in moving this plant community towards the 1.1 Prairie Cordgrass-Alkali Cordgrass-Nuttail's Alkaligrass Plant Community Phase. Soil erosion is low and runoff is virtually unchanged.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2287	3009	3463
Forb	151	252	387
Shrub/Vine	28	101	185
Total	**2466**	**3362**	**4035**

Figure 16. Plant community growth curve (percent production by month). SD5308, Southern Dark Brown Glaciated Plains, lowland cool-season/warm-season codominant.. Cool-season, warm-season codominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	11	19	23	20	12	6	5	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-Inland Saltgrass-Foxtail Barley Plant Community Phase.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and no surface fire for extended periods of time will tend to favor the cool-season grasses and the warm-season grasses will decline causing a shift to the 1.3 Western Wheatgrass-Nuttail's Alkaligrass 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 returned to normal disturbance regime levels and frequencies or periodic light to moderate grazing possibly including periodic rest would have converted this plant community to the 1.1 Prairie Cordgrass-Alkali Cordgrass-Nutall's Alkaligrass Plant Community Phase.

Conservation practices

Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

Prescribed grazing, or prescribed burning occurring at relatively frequent intervals (3 to 5 years) and a return to normal disturbance regime levels and frequencies or periodic light to moderate grazing possibly including periodic rest would have converted this plant community to the 1.1 Prairie Cordgrass-Alkali Cordgrass-Nuttail's Alkaligrass Plant Community Phase.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Invaded State

This State is characterized by the dominance of the shorter-statured, more saline tolerant species such as foxtail barley and inland saltgrass, the increase in bare ground, and the increased presence of salt accumulations on the soil surface. Infiltration is reduced, which allows the moisture and the salts carried by the moisture to be wicked up to the soil surface. The short-statured and shallow rooted species are more capable of withstanding the higher concentrations of salts in the soil surface. As the disturbance level increases, plant density decreases even more, giving way to annual species and invasive perennial species, as well as, a further increase in bare ground.

Community 2.1
Foxtail Barley-Inland Saltgrass/Bare Ground

This plant community developed with heavy continuous season-long grazing where adequate recovery periods between grazing events were not allowed. Patches of inland saltgrass sod are typical and foxtail barley is well distributed throughout the community. Nuttall's alkaligrass and western wheatgrass have been greatly reduced and may persist in remnant amounts, reduced in vigor. Bare ground may develop in micro lows where salt concentrations are highest. A white salt crust is common on the surface. Only a few very salt tolerant annuals such as silverscale saltbush (*Atriplex argentea*) and seepweed can survive. This plant community is resistant to change

due to the grazing tolerance of inland saltgrass and increased surface salts. A significant amount of production and diversity has been lost when compared to 1.1 Prairie Cordgrass-Alkali Cordgrass-Nuttall's Alkaligrass Plant Community Phase. Loss of key cool-season grasses and increased bare ground has negatively impacted energy flow and nutrient cycling. Water infiltration is reduced significantly due to the shallow rooting depth of inland saltgrass and increased bare ground.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	958	1417	1564
Forb	163	359	639
Shrub/Vine	–	18	39
Total	**1121**	**1794**	**2242**

Figure 18. Plant community growth curve (percent production by month). SD5308, Southern Dark Brown Glaciated Plains, lowland cool-season/warm-season codominant.. Cool-season, warm-season codominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	11	19	23	20	12	6	5	0	0

Community 2.2
Annual Pioneer-Perennial Pioneer/Bare Ground

This plant community developed under continuous heavy grazing or other excessive disturbances. The species present in this phase are highly variable, but often include nonnative invasive and early seral species. Plant diversity is low (plant richness may be high, but areas are often dominated by a few species). The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include foxtail barley which will dominate along with plains bluegrass (*Poa arida*), Nuttall's alkaligrass, annual brome (*Bromus tectorum*), and western wheatgrass. The dominant forbs include kochia (*Bassia scoparia*), curly dock (*Rumex crispus*), and other early successional salt tolerant species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of nonnative species due to severe soil disturbances and relatively high percent of bare ground. The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community and the plant communities on adjacent sites.

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 Annual Pioneer-Perennial Pioneer/*Bare Ground* Plant Community Phase.

Pathway 2.2A
Community 2.2 to 2.1

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 2.1 Foxtail Barley-Inland Saltgrass/*Bare Ground* Plant Community Phase

Transition T1A

State 1 to 2

No surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, or heavy continuous grazing will likely lead this 1.2 Western Wheatgrass-Inland Saltgrass-Foxtail Barley Plant Community Phase within the Reference State (State 1) over a threshold resulting in the Degraded State (State 2).

Restoration pathway T2A
State 2 to 1

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 Degraded State (State 2) over a threshold to the Reference State (State 1).

Conservation practices

Prescribed Grazing

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Grasses**			588–1373	
	alkali cordgrass	SPGR	*Spartina gracilis*	196–1177	–
	prairie cordgrass	SPPE	*Spartina pectinata*	196–1177	–
	alkali sacaton	SPAI	*Sporobolus airoides*	78–392	–
	switchgrass	PAVI2	*Panicum virgatum*	0–196	–
2	**Wheatgrass**			392–981	
	western wheatgrass	PASM	*Pascopyrum smithii*	196–785	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	196–588	–
3	**Cool-Season Grasses**			392–785	
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	392–785	–
	foxtail barley	HOJU	*Hordeum jubatum*	39–196	–
	green needlegrass	NAVI4	*Nassella viridula*	39–196	–
4	**Short Warm-Season Grasses**			118–392	
	saltgrass	DISP	*Distichlis spicata*	78–392	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	39–118	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–118	–
5	**Grass-likes**			196–588	
	sedge	CAREX	*Carex*	78–392	–
	spikerush	ELEOC	*Eleocharis*	39–196	–
	rush	JUNCU	*Juncus*	39–196	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–118	–
Forb					
6	**Forbs**			196–392	
	Forb, native	2FN	*Forb, native*	39–157	–
	annual marsh elder	IVAN2	*Iva annua*	0–118	–

	annual marsh elder	IVAN2	*Iva annua*	0–118	
	aster	ASTER	*Aster*	39–118	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	39–118	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	39–118	–
	western dock	RUAQ	*Rumex aquaticus*	39–78	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	39–78	–
	redwool plantain	PLER	*Plantago eriopoda*	39–78	–
	silver cinquefoil	POAR8	*Potentilla argentea*	39–78	–
	lambsquarters	CHAL7	*Chenopodium album*	39–78	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	39–78	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–78	–
	povertyweed	IVAX	*Iva axillaris*	0–78	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	39–78	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–39	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–39	–
	red swampfire	SARU	*Salicornia rubra*	0–39	–
Shrub/Vine					
7	**Shrubs**			39–196	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–118	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–78	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Grasses**			0–280	
	alkali cordgrass	SPGR	*Spartina gracilis*	0–280	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–280	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–140	–
2	**Wheatgrass**			420–841	
	western wheatgrass	PASM	*Pascopyrum smithii*	420–841	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–280	–
3	**Cool-Season Grasses**			140–701	
	foxtail barley	HOJU	*Hordeum jubatum*	140–420	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	0–280	–
	green needlegrass	NAVI4	*Nassella viridula*	0–56	–
4	**Short Warm-Season Grasses**			140–560	
	saltgrass	DISP	*Distichlis spicata*	140–560	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	28–168	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–140	–
5	**Non-Native Grasses**			0–140	
	bluegrass	POA	*Poa*	0–140	–
	smooth brome	BRIN2	*Bromus inermis*	0–56	–
6	**Grass-likes**			140–420	
	spikerush	ELEOC	*Eleocharis*	28–224	–
	sedge	CAREX	*Carex*	28–196	

	sedge	CAREX	*Carex*	28–196	–
	rush	JUNCU	*Juncus*	28–140	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–84	–
Forb					
7	**Forbs**			140–420	
	Forb, introduced	2FI	*Forb, introduced*	0–140	–
	Forb, native	2FN	*Forb, native*	28–140	–
	lambsquarters	CHAL7	*Chenopodium album*	28–84	–
	aster	ASTER	*Aster*	28–84	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	28–84	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	28–84	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	28–84	–
	curly dock	RUCR	*Rumex crispus*	0–56	–
	cocklebur	XANTH2	*Xanthium*	0–56	–
	burningbush	BASC5	*Bassia scoparia*	0–56	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–56	–
	povertyweed	IVAX	*Iva axillaris*	0–56	–
	prickly lettuce	LASE	*Lactuca serriola*	0–56	–
	redwool plantain	PLER	*Plantago eriopoda*	28–56	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	28–56	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	28–56	–
	redroot amaranth	AMRE	*Amaranthus retroflexus*	0–56	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–28	–
	silver cinquefoil	POAR8	*Potentilla argentea*	0–28	–
	annual marsh elder	IVAN2	*Iva annua*	0–28	–
	red swampfire	SARU	*Salicornia rubra*	0–28	–
	western dock	RUAQ	*Rumex aquaticus*	0–28	–
Shrub/Vine					
8	**Shrubs**			0–140	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–112	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–28	–

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Grasses**			168–504	
	alkali cordgrass	SPGR	*Spartina gracilis*	67–504	–
	prairie cordgrass	SPPE	*Spartina pectinata*	67–504	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–101	–
	switchgrass	PAVI2	*Panicum virgatum*	0–67	–
2	**Wheatgrass**			673–1177	
	western wheatgrass	PASM	*Pascopyrum smithii*	504–1009	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	168–673	–
3	**Cool-Season Grasses**			336–841	
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	336–841	

	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	336–841	–
	foxtail barley	HOJU	*Hordeum jubatum*	34–101	–
	green needlegrass	NAVI4	*Nassella viridula*	0–34	–
4	**Short Warm-Season Grasses**			34–168	
	saltgrass	DISP	*Distichlis spicata*	34–168	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	34–67	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–67	–
5	**Non-Native Grasses**			0–67	
	smooth brome	BRIN2	*Bromus inermis*	0–67	–
	bluegrass	POA	*Poa*	0–67	–
6	**Grass-likes**			336–673	
	spikerush	ELEOC	*Eleocharis*	67–404	–
	sedge	CAREX	*Carex*	67–336	–
	rush	JUNCU	*Juncus*	34–168	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–101	–
Forb					
7	**Forbs**			168–336	
	Forb, introduced	2FI	*Forb, introduced*	0–135	–
	aster	ASTER	*Aster*	34–135	–
	Forb, native	2FN	*Forb, native*	34–101	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	34–101	–
	lambsquarters	CHAL7	*Chenopodium album*	34–67	–
	annual marsh elder	IVAN2	*Iva annua*	0–67	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–67	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–67	–
	western dock	RUAQ	*Rumex aquaticus*	0–67	–
	curly dock	RUCR	*Rumex crispus*	0–67	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–34	–
	cocklebur	XANTH2	*Xanthium*	0–34	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–34	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–34	–
	povertyweed	IVAX	*Iva axillaris*	0–34	–
	prickly lettuce	LASE	*Lactuca serriola*	0–34	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–34	–
	redwool plantain	PLER	*Plantago eriopoda*	0–34	–
	silver cinquefoil	POAR8	*Potentilla argentea*	0–34	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–34	–
Shrub/Vine					
8	**Shrubs**			34–168	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–168	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–67	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			0–179	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–179	–
2	**Cool-Season Grasses**			269–807	
	foxtail barley	HOJU	*Hordeum jubatum*	269–807	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	0–90	–
	green needlegrass	NAVI4	*Nassella viridula*	0–18	–
3	**Short Warm-Season Grasses**			179–538	
	saltgrass	DISP	*Distichlis spicata*	179–538	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	18–90	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–90	–
4	**Non-Native Grasses**			0–36	
	bluegrass	POA	*Poa*	0–36	–
5	**Grass-likes**			18–90	
	spikerush	ELEOC	*Eleocharis*	18–90	–
	rush	JUNCU	*Juncus*	0–72	–
	sedge	CAREX	*Carex*	0–54	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–36	–
Forb					
6	**Forbs**			179–538	
	burningbush	BASC5	*Bassia scoparia*	36–448	–
	Forb, introduced	2FI	*Forb, introduced*	0–179	–
	curly dock	RUCR	*Rumex crispus*	18–179	–
	cocklebur	XANTH2	*Xanthium*	0–179	–
	redroot amaranth	AMRE	*Amaranthus retroflexus*	0–143	–
	prickly lettuce	LASE	*Lactuca serriola*	0–90	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	18–90	–
	povertyweed	IVAX	*Iva axillaris*	0–54	–
	lambsquarters	CHAL7	*Chenopodium album*	18–54	–
	Forb, native	2FN	*Forb, native*	0–54	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–36	–
	aster	ASTER	*Aster*	0–36	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–36	–
	red swampfire	SARU	*Salicornia rubra*	0–36	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–18	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–18	–
Shrub/Vine					
7	**Shrubs**			0–36	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–36	–

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.

Cordgrass/Wheatgrass/Alkaligrass (1.1)
Average Annual Production (lbs./acre, air-dry): 3,500
Stocking Rate* (AUM/acre): 0.96

Wheatgrass/Foxtail Barley/Inland Saltgrass (1.2)
Average Annual Production (lbs./acre, air-dry): 2,500
Stocking Rate* (AUM/acre): 0.69

Wheatgrass/Alkaligrass (1.3)
Average Annual Production (lbs./acre, air-dry): 3,000
Stocking Rate* (AUM/acre): 0.82

Foxtail Barley/Inland Saltgrass/*Bare Ground* (2.1)
Average Annual Production (lbs./acre, air-dry): 1,600
Stocking Rate* (AUM/acre): 0.44

Annual/Pioneer, Non-Native Perennial *Bare Ground* (2.3)
Average Annual Production (lbs./acre, air-dry): 1,200
Stocking Rate* (AUM/acre): 0.33

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

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

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in Hydrologic Group D. Infiltration is slow to moderately 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 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:

• SD073 Jerauld County, SD did not use the (HeA) Durrstein-Lane silty clay loams, nearly level (national symbol ctxl) as used in the adjoining SD059 Hand County, SD.
• SD065 Hughes County, SD did not use the (Du) Durrstein-Egas complex (national symbol cw4n) as used in the adjoining SD069 Hyde County, SD.
• SD017 Buffalo County, SD (SD603 Brule and Buffalo Counties Soil survey) did not use the (Dx) Durrstein-Egas loams (national symbol cywl) (R55CY007SD ESD) as used in the adjoining SD073 Jerauld County. SD073 Jerauld County, SD (Dx) Durrstein-Egas loams (national symbol cywl) (R55CY007SD ESD) will need to be split correlated to match SD017 Buffalo County, SD ESD.
• NOTE: one polygon of (Du) Durrstein silt loam (national symbol cxxm) located on the southern edge of SD015 Brule County, SD (SD603 Brule and Buffalo Counties Soil survey) needs to be field investigated. It is the only (Du) Durrstein silt loam polygon located in MLRA 55C.
• 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 using field observations from range-trained personnel. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; and Bruce Kunze, Soil Scientist, NRCS, Shane Deranleau, RMS, NRCS; and Mitch Faulkner, RMS, NRCS.

Data Source Sample Period State County
NONE

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

Suzanne Mayne-Kinney, 1/22/2024

Acknowledgments

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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. Slickspots can occur in complex with this site, and will be mostly bare ground with sparse, salt-tolerant vegetation. Slickspots typically will have salt crusting at the surface.

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 5 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):** Durrstein soils have an E-horizon (leached) at the surface which is medium platy structure parting to granular structure, and typically will not have mollic colors at the surface. Egas soil surface structure is granular, and mollic (higher organic matter) colors of A-horizon down to about 4 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. Surface horizon of Durrstein soils may be platy and appear to be compacted and should not be confused with compaction.

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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: Tall and mid, warm-season grasses > wheatgrasses >

    Sub-dominant: Cool-season bunchgrasses > grass-like species >

    Other: Short, warm-season grasses = forbs > shrubs

    Additional:

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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.

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14. **Average percent litter cover (%) and depth (in):** 85-90 percent plant litter cover, roughly 0.5 inches in depth. Litter cover is in contact with the soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3,500 pounds/acre (air-dry basis)

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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.

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