

# Ecological site R055CY015SD Thin Claypan

Last updated: 1/31/2024  
Accessed: 04/26/2024

## General information

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

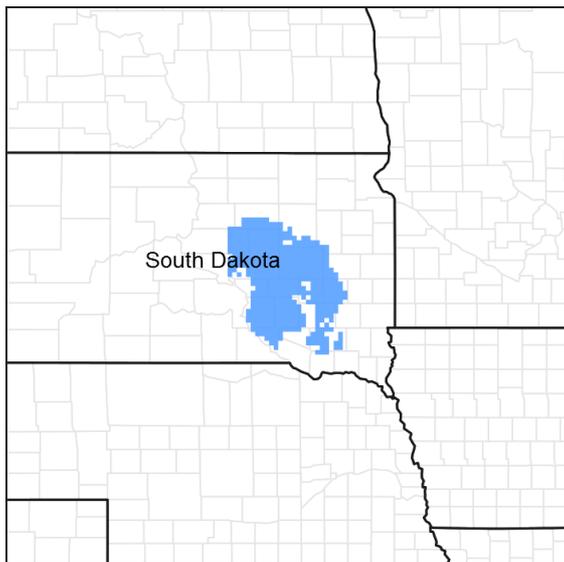


Figure 1. Mapped extent

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

## MLRA notes

Major Land Resource Area (MLRA): 055C–Southern Black Glaciated Plains

The Southern Black Glaciated Plains (55C) is located within the Northern Great Plains Region. It is entirely within South Dakota encompassing about 10,835 square miles (Figure 1). The elevation ranges from 1,310 to 1,970 square feet. The MLRA is on nearly level to undulating glacial till plains interrupted by steeper slopes adjacent to streams and moraines. The James River is an under-fit stream. Its valley was carved by floodwaters draining glacial Lake Dakota and is filled with glacial outwash and alluvial deposits. (USDA-NRCS, 2006).

The dominant soil order in this MLRA is Mollisols. 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 to very poorly drained, and clayey or loamy. This area supports natural prairie vegetation characterized by western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), needle and thread (*Hesperostipa comata*), and porcupinegrass (*Hesperostipa spartea*) with Prairie cordgrass (*Spartina pectinata*), and reed canarygrass (*Phalaris arundinacea*) as the dominant vegetation on the poorly drained soils. (USDA-NRCS, 2006).

## Classification relationships

Major Land Resource Area (MLRA): Southern Black Glaciated Plains (55C) (USDA-NRCS, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Yankton Hills and Valleys Subsection (251Bf); Western Glaciated Plains Section (332B); James River Lowland Subsection (332Bb); 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: Southern Missouri Coteau (42e); Southern Missouri Coteau Slope (42f); James River Lowland (46n) - (USEPA, 2013)

## Ecological site concept

The Thin Claypan ecological site occurs in micro-lows on a nearly level landscape. Soils are moderately well drained and have a claypan (columnar structure) within 6 inches of the soil surface. The natric horizon in the subsoil typically has a Sodium Absorption Ratio (SAR) greater than 13 and/or an Exchangeable Sodium Percentage (ESP) greater than 15. The root restriction of the Natric horizon limits plant growth, production is lower, and species composition will tend towards species that are shallow-rooted and more tolerant of the higher sodium levels. Slopes can range from 0 to 2 percent. Vegetation in the Reference State is co-dominated by cool and warm-season grasses including western wheatgrass and blue grama. Common forbs include scarlet globemallow, cudweed sagewort, and woolly Indianwheat. Non-native grasses such as Kentucky bluegrass may invade due to shifts in disturbance regime.

## Associated sites

R055CY011SD	<b>Clayey</b> These sites occur on upland areas. The soils are well drained and have greater than 40 percent clay in the surface and subsoil. The central concept soil series are Beadle and Stickney, but other series are included.
R055CY013SD	<b>Claypan</b> These sites occur on upland areas. The soils are moderately well drained and have a claypan (columnar structure) within 16 inches, but greater than 6 inches of the soil surface. The central concept soil series is Dudley
R055CY010SD	<b>Loamy</b> These sites occur on upland areas. The soils are well drained and have less than 40 percent clay in the surface and subsoil. The central concept soil series are Clarno and Houdek, but other series are included.

## Similar sites

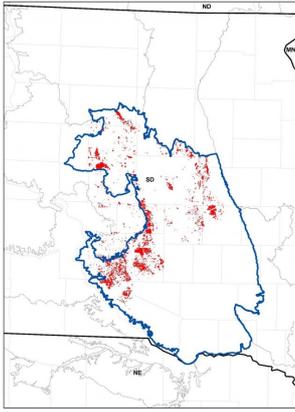
R055CY013SD	<b>Claypan</b> The Claypan site occurs in a similar landscape position but does not have a claypan (columnar structure) within 6 inches of the soil surface. The Claypan site will have more green needlegrass, less blue grama, and higher production than a Thin Claypan site.
-------------	---

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Pascopyrum smithii</i> (2) <i>Bouteloua gracilis</i>

## Physiographic features

This site typically occurs on nearly level to gently sloping, undulating uplands.



**Figure 2. Site Distribution Map.**

**Table 2. Representative physiographic features**

Landforms	(1) Plain (2) Till plain (3) Swale
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	1,300–2,000 ft
Slope	1–4%
Water table depth	30–50 in
Aspect	Aspect is not a significant factor

### Climatic features

MLRA 55C is considered to have a continental climate: Cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains, and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 19 to 25 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 15°F (Howard, South Dakota [SD]), to about 20°F (Wagner, SD). July is the warmest month with temperatures averaging from about 73°F (Howard, SD), to about 77°F (Wagner, 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. Green-up 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)	122-130 days
Freeze-free period (characteristic range)	137-151 days
Precipitation total (characteristic range)	22-26 in

Frost-free period (actual range)	114-131 days
Freeze-free period (actual range)	133-155 days
Precipitation total (actual range)	21-27 in
Frost-free period (average)	125 days
Freeze-free period (average)	144 days
Precipitation total (average)	24 in

## Climate stations used

- (1) FAULKTON 1 NW [USC00392927], Faulkton, SD
- (2) REDFIELD [USC00397052], Redfield, SD
- (3) MILLER [USC00395561], Miller, SD
- (4) HURON RGNL AP [USW00014936], Huron, SD
- (5) DE SMET [USC00392302], De Smet, SD
- (6) HOWARD [USC00394037], Howard, SD
- (7) FORESTBURG 4 NNE [USC00393029], Artesian, SD
- (8) CHAMBERLAIN MUNI AP [USW00094943], Chamberlain, SD
- (9) CHAMBERLAIN 5 S [USC00391621], Chamberlain, SD
- (10) MITCHELL [USC00395669], Mitchell, SD
- (11) MITCHELL MUNI AP [USW00094950], Mitchell, SD
- (12) MITCHELL 2 N [USC00395671], Mitchell, SD
- (13) ALEXANDRIA [USC00390128], Alexandria, SD
- (14) SALEM 5NE [USC00395360], Salem, SD
- (15) BRIDGEWATER [USC00391032], Bridgewater, SD
- (16) MARION [USC00395228], Marion, SD
- (17) MENNO [USC00395481], Menno, SD
- (18) TYNDALL [USC00398472], Tyndall, SD
- (19) WAGNER [USC00398767], Wagner, SD
- (20) ACADEMY 2NE [USC00390043], Platte, SD

## Influencing water features

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

## Soil features

The common features of soils in this site are the clay loam to clay textured subsoils and slopes of 1 to 4 percent. The soils in this site are typically somewhat poorly to moderately well-drained and formed in clayey till. The silt loam to silty clay loam surface layer is 1 to 5 inches thick. The extremely hard clayey Btn horizon has round-topped or "biscuit shaped" columnar or prismatic structured subsoil. These Btn horizons are high in sodium. The soils have a very slow infiltration rate. Wet surface compaction can occur with heavy traffic. This site should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. The soil surface is stable and intact.

Soil series is Jerauld.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetation is removed or severely disturbed. Loss of 30 percent or more of the surface layer of the soils on this site can result in a shift in species composition and loss of production.

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

**Table 4. Representative soil features**

Surface texture	(1) Silt loam (2) Silty clay loam (3) Loam
Family particle size	(1) Clayey
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5 in
Calcium carbonate equivalent (0-40in)	0-15%
Electrical conductivity (0-40in)	2-16 mmhos/cm
Sodium adsorption ratio (0-40in)	2-25
Soil reaction (1:1 water) (0-40in)	5.6-9
Subsurface fragment volume <=3" (Depth not specified)	3-4%
Subsurface fragment volume >3" (Depth not specified)	0-2%

## Ecological dynamics

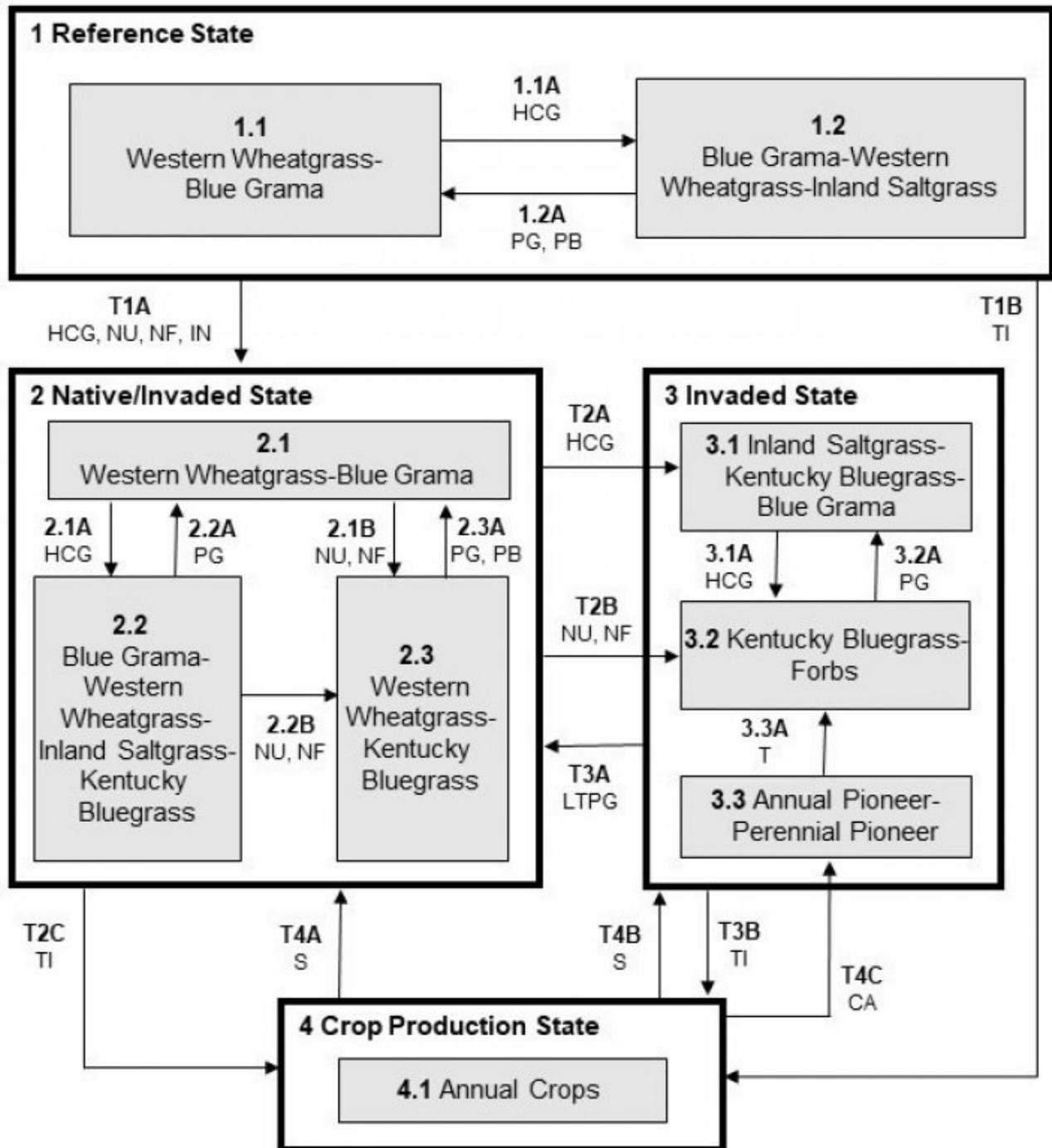
The site which is located in the Southern Black Glaciated Plains Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions, the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Western Wheatgrass-Blue Grama 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.

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

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

## State and transition model

## Thin Claypan – MLRA 55C (8/8/19)



### LEGEND

Thin Claypan – R055CY015SD

- CA – Cropped and abandoned
- HCG – Heavy continuous grazing
- IN – Invasion
- LTPG – Long-term prescribed grazing
- NU – Non-use
- NF – No fire
- PB – Prescribed burning
- PG – Prescribed grazing
- S – Seeding
- T – Time w/wo disturbances
- TI – Tillage

Figure 9. State-And-Transition Model and Legend for the Thin Claypan Site in MLRA 55C.

Code	Process
T1A	Heavy continuous grazing, no use, no fire, invasion
T1B	Tillage
T2A	Heavy continuous grazing
T2B	Non-use, no fire
T2C	Tillage
T3A	Long term prescribed grazing
T3B	Tillage
T4A	Seeding
T4B	Seeding
T4C	Abandonment of cropping
1.1A	Heavy continuous grazing
1.2A	Prescribed grazing with recovery periods, prescribed burning
2.1A	Heavy continuous grazing
2.1B	Non-use, no fire
2.2A	Prescribed grazing with recovery periods
2.2B	Non-use, no fire
2.3A	Prescribed grazing with recovery periods, prescribed burning
3.1A	Heavy continuous grazing
3.2A	Prescribed grazing with recovery periods
3.3A	Time w/wo disturbances

Figure 10. Matrix for the Thin Claypan Site in MLRA 55C.

**State 1**  
**Reference State**

The Reference State represents the natural range of variability that dominates the dynamics of this ecological site (ES). This state is dominated by cool-season grasses with warm-season grasses being subdominant. Prior to European settlement of North America, the primary disturbance mechanisms for this site in the Reference condition included precipitation cycles and grazing by large herding ungulates. Timing of grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, this state can be found on areas that are properly managed with grazing and sometimes on areas receiving occasional short periods of rest. Cool-season species can decline and a corresponding increase in short, warm-season grasses will occur.

## Community 1.1 Western Wheatgrass-Blue Grama

Interpretations are based primarily on the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase (this is also considered to be the Reference Community). This plant community evolved with grazing by large herbivores and variations in precipitation cycles, and can be maintained with prescribed grazing or by occasional short periods of rest or deferment. The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. Cool-season grasses dominate the plant community, while warm-season grasses are subdominant. The major grasses include western wheatgrass and blue grama. Other grasses and grass-likes occurring on this site include buffalograss (*Bouteloua dactyloides*), inland saltgrass (*Distichlis spicata*), needle and thread, and sedge (Cyperaceae). The dominant forbs include scarlet globemallow (*Sphaeralcea coccinea*), cudweed sagewort (*Artemisia ludoviciana*), heath aster (Symphyotrichum ericoides), and woolly Indianwheat (*Plantago patagonica*). Shrubs that can occur in this plant community are brittle cactus (*Opuntia fragilis*), saltbush (Atriplex), and pricklypear (Opuntia). This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation, and temperature). Community dynamics, nutrient and water cycles, and energy flow are functioning at the sites potential. Plant litter is properly distributed with some movement offsite and natural plant mortality is low. Low to moderate available water capacity coupled with high accumulations of sodium and slow permeability strongly influence the soil-water-plant relationships.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	950	1360	1740
Forb	75	120	180
Shrub/Vine	75	120	180
<b>Total</b>	<b>1100</b>	<b>1600</b>	<b>2100</b>

Figure 12. Plant community growth curve (percent production by month). SD5502, Southern Black Glaciated Plains, cool-season dominant, warm-season . Cool-season dominant, warm-season subdominant..

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

## Community 1.2 Blue Grama-Western Wheatgrass-Inland Saltgrass

This plant community can develop from the adverse effects of heavy, continuous seasonal grazing. Short grasses tend to increase to dominate the site, and annual production decreases dramatically. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and high evaporation, which gives blue grama a competitive advantage over cool-season midgrasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur. Blue grama, western wheatgrass, and inland saltgrass are the dominant species. Other grasses and grass-likes occurring include buffalograss, Sandberg bluegrass (*Poa secunda*), sedge, and sometimes annual grasses. Forbs such as cudweed sagewort, scarlet globemallow, and woolly Indianwheat may also be present. Some non-native species will begin to invade this plant community including western salsify (*Tragopogon dubius*), sweet clover (*Melilotus officinalis*), and annual brome grass (*Bromus tectorum*). This plant community is quite resilient. The thick sod and

competitive advantage prevents other species from establishing. This plant community is less productive than the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase. Runoff increases and infiltration will decrease. Soil erosion will be minimal due to the sod forming habit of blue grama.

**Table 6. Annual production by plant type**

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	540	840	1125
Shrub/Vine	45	100	165
Forb	15	60	110
<b>Total</b>	<b>600</b>	<b>1000</b>	<b>1400</b>

**Figure 14. Plant community growth curve (percent production by month). SD5504, Southern Black Glaciated Plains, warm-season dominant, cool-season . Warm-season dominant, cool-season subdominant..**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	24	25	15	7	1	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 Blue Grama-Western Wheatgrass-Inland Saltgrass Plant Community Phase.

### **Pathway 1.2A Community 1.2 to 1.1**

Prescribed grazing, prescribed burning (occurring every 3 to 5 years), 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 Western Wheatgrass-Blue Grama Plant Community Phase.

#### **Conservation practices**

Prescribed Grazing
--------------------

### **State 2 Native/Invaded State**

The Native/Invaded State represents the more common range of variability that exists with higher levels of grazing management, but in the absence of periodic fire due to fire suppression. This state is dominated by cool-season and warm-season grasses. It 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. Taller warm-season species can decline, and a corresponding increase in short statured grass will occur.

### **Community 2.1 Western Wheatgrass-Blue Grama**

This plant community phase is similar to the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase, but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 10 percent by air-dry weight). The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community is dominated by cool-season grasses, with warm-season grasses being subdominant. The major grasses include western wheatgrass and blue grama. Other grass or grass-like species include Nuttall's alkaligrass (*Puccinellia nuttalliana*), buffalograss, inland

saltgrass, prairie junegrass (*Koeleria macrantha*), and needleleaf sedge (*Carex duriuscula*). Forbs would include cudweed sagewort, curlycup gumweed (*Grindelia squarrosa*), heath aster, scarlet globemallow, and western yarrow (*Achillea millefolium*). This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high tolerance to drought. This is a sustainable plant community in regard to site and soil stability, watershed function, and biologic integrity.

## **Community 2.2**

### **Blue Grama-Western Wheatgrass-Inland Saltgrass-Kentucky Bluegrass**

This plant community is a result of heavy, continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 70 percent grasses and grass-like species, 25 percent forbs, and 5 percent shrubs. Dominant grass and grass-like species include western wheatgrass, blue grama, inland saltgrass with minor amounts of Kentucky bluegrass (*Poa pratensis*). Grass and grass-like species of secondary importance include needle and thread, buffalograss, tumblegrass (*Schedonnardus paniculatus*), and sedge. Forbs commonly found in this plant community included cudweed sagewort, prairie coneflower (*Ratibida columnifera*), and western yarrow. When compared to the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase, blue grama and inland saltgrass have increased and Kentucky bluegrass has invaded. Needle and thread and prairie junegrass production has been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. The increase of shorter-statured, more compact rooted species will result in somewhat higher runoff and decreased infiltration. This will cause the site to become drier. These species will also be more competitive.

## **Community 2.3**

### **Western Wheatgrass-Kentucky Bluegrass**

This plant community is a result of Non-use and/or no surface fire for extended periods of time (typically for 10 or more years). This community phase is characterized by an increase in the introduced cool-season sod-grass, Kentucky bluegrass. The community phase is the most dominant both temporally and spatially. Kentucky bluegrass has become nearly co-dominant with western wheatgrass. Warm season grasses are present but minor and tap rooted perennial forbs have decreased. Production and infiltration both decrease and this community phase is at risk of transitioning across a state threshold. With natural or management actions that decrease the composition of the cool-season bunchgrasses and increase the composition of Kentucky bluegrass, transition T2B will be initiated.

## **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 Blue Grama-Western Wheatgrass-Inland Saltgrass-Kentucky Bluegrass Plant Community Phase.

## **Pathway 2.1B**

### **Community 2.1 to 2.3**

Non-use and/or 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, will shift this community to the 2.3 Western Wheatgrass-Kentucky Bluegrass Plant Community Phase.

## **Pathway 2.2A**

### **Community 2.2 to 2.1**

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing (possibly including periodic rest) will convert this plant community to the 2.1 Western Wheatgrass-Blue Grama Plant Community Phase. This pathway could also occur with a return to more normal precipitation levels and frequencies.

## **Pathway 2.2B**

### **Community 2.2 to 2.3**

Non-use and/or 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) will shift this community to the 2.3 Western Wheatgrass-Kentucky Bluegrass Plant Community Phase.

## **Pathway 2.3A**

### **Community 2.3 to 2.1**

Prescribed grazing, prescribed burning (occurring every 3 to 5 years), 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 2.1 Western Wheatgrass-Blue Grama Plant Community Phase.

## **State 3**

### **Invaded State**

The Invaded State is a result of encroachment mainly by invasive introduced cool-season grasses. The ecological processes are not functioning, especially the biotic processes and the hydrologic functions. The introduced cool-season grasses cause reduced infiltration and increased runoff. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early green-up and increased moisture and humidity at the soil surface. Grazing pressure cannot cause a reduction in sod-grass dominance. Production is limited to the sod-forming species. Infiltration continues to decrease, runoff increases, and energy capture into the system is restricted to early season, low producing species. Nutrient cycling is limited by root depth of the dominant species.

## **Community 3.1**

### **Inland Saltgrass-Kentucky Bluegrass-Blue Grama**

This plant community phase is a result of heavy, continuous grazing. It is characterized by a dominance of very grazing tolerant species such as Kentucky bluegrass, inland saltgrass, blue grama, sedges, and forbs. The dominance is at times so complete that other species are difficult to find on the site. Nutrient cycling is greatly reduced, and mid-statured native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in the phase.

## **Community 3.2**

### **Community Phase 3.2 Kentucky Bluegrass-Forbs**

This plant community phase is a result of heavy, continuous grazing and/or extended periods of non-use and no fire. It is characterized by a dominance of Kentucky bluegrass and forbs. Smooth brome grass may also be present on the site. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface and eventually a thatch-mat layer may develop. Nutrient cycling is greatly reduced, and native plants have a difficulty becoming established. When dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will be significantly less than the interpretive plant community. The period that forage palatability is high is relatively short. Energy capture is also reduced due to the shorter active growth period and lack of warm season plant diversity.

## **Community 3.3**

### **Annual Pioneer-Perennial Pioneer**

This plant community developed under continuous, heavy grazing or other excessive disturbances. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include non-native invasive and early seral species. Plant diversity is low (plant richness may be high but areas are often dominated by a few species). 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 plant communities on adjacent sites.

### **Pathway 3.1A** **Community 3.1 to 3.2**

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) and 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, and density), will shift this community to the 3.2 Kentucky Bluegrass-Forbs Plant Community Phase.

### **Pathway 3.2A** **Community 3.2 to 3.1**

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing (possibly including periodic rest) may convert this plant community to the 3.1 Inland Saltgrass-Kentucky Bluegrass-Blue Grama Plant Community Phase.

### **Pathway 3.3A** **Community 3.3 to 3.2**

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 3.2 Kentucky Bluegrass-Forbs Plant Community Phase.

## **State 4** **Crop Production State**

The Crop Production State is characterized by the production of annual crops using a variety of tillage and cropping systems along with management practices.

### **Community 4.1** **Annual Crops**

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

### **Transition T1A** **State 1 to 2**

Non-use, no surface fire for 10 or more years (causing litter levels to become high enough to reduce native grass vigor, diversity, and density), heavy continuous grazing, or the invasion of non-native plant species will likely lead this state over a threshold resulting in the Native/Invaded State (State 2).

### **Transition T1B** **State 1 to 4**

Tillage will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

## Transition T2A, T2B State 2 to 3

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 likely lead this state over a threshold leading to the 3.1 Inland Saltgrass-Kentucky Bluegrass-Blue Grama Plant Community Phase within the Invaded State (State 3). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling. Non-use and/or no surface fire for 10 or more years (causing litter levels to become high enough to reduce native grass vigor, diversity, and density) will likely lead this state over a threshold leading to the 3.2 Kentucky Bluegrass-Forbs Plant Community Phase within the Invaded State (State 3).

## Transition T2C State 2 to 4

Tillage will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

## Restoration pathway T3A State 3 to 2

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 Invaded State (State 3) over a threshold to the Native/Invaded State (State 2).

## Transition T3B State 3 to 4

Tillage will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

## Restoration pathway T4A State 4 to 2

Seeding may lead this Crop Production State (State 4) over a threshold to the Native/Invaded State (State 2).

## Restoration pathway T4B, T4C State 4 to 3

Seeding may lead this Crop Production State (State 4) over a threshold to the Invaded State (State 3). Cropping followed by abandonment may lead this plant community phase over a threshold to the 3.3 Annual Pioneer-Perennial Pioneer Plant Community Phase within the Invaded State (State 3).

## Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Wheatgrass</b>			400–720	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	400–720	–
2	<b>Short Wam--Season Grasses</b>			320–560	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	240–400	–
	saltgrass	DISP	<i>Distichlis spicata</i>	32–240	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	32–240	–

	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–80	–
3	<b>Needlegrass</b>			32–160	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	32–160	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–160	–
4	<b>Mid Warm-Season Grasses</b>			0–80	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–80	–
	alkali sacaton	SPAI	<i>Sporobolus airoides</i>	0–80	–
5	<b>Other Native Grasses</b>			32–80	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	16–80	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	16–48	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–48	–
	tumblegrass	SCPA	<i>Schedonnardus paniculatus</i>	0–16	–
6	<b>Grass-likes</b>			32–160	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	16–128	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	16–80	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–48	–
<b>Forb</b>					
7	<b>Forbs</b>			80–160	
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	16–48	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	16–48	–
	Forb, native	2FN	<i>Forb, native</i>	16–48	–
	textile onion	ALTE	<i>Allium textile</i>	16–32	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	0–32	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	16–32	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	16–32	–
	slimflower scurfpea	PSTE5	<i>Psoralidium tenuiflorum</i>	16–32	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	16–32	–
	Nuttall's violet	VINU2	<i>Viola nuttallii</i>	0–16	–
	deathcamas	ZIGAD	<i>Zigadenus</i>	0–16	–
	mealy goosefoot	CHIN2	<i>Chenopodium incanum</i>	0–16	–
	povertyweed	IVAX	<i>Iva axillaris</i>	0–16	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–16	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0–16	–
<b>Shrub/Vine</b>					
8	<b>Shrubs</b>			80–160	
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	16–64	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–48	–
	saltbush	ATRIP	<i>Atriplex</i>	0–32	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	16–32	–
	brittle pricklypear	OPFR	<i>Opuntia fragilis</i>	16–32	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	16–32	–
	rose	ROSA5	<i>Rosa</i>	16–32	–

Table 8. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Wheatgrass</b>			100–200	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	100–200	–
2	<b>Short Warm-Season Grasses</b>			300–500	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	200–400	–
	saltgrass	DISP	<i>Distichlis spicata</i>	50–300	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	50–250	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–30	–
3	<b>Needlegrass</b>			0–50	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–50	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–30	–
4	<b>Other Native Grasses</b>			20–50	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–40	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	10–40	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	10–30	–
	tumblegrass	SCPA	<i>Schedonnardus paniculatus</i>	0–20	–
5	<b>Grass-likes</b>			50–150	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	20–100	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	10–70	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–30	–
6	<b>Non-Native Grasses</b>			0–100	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–100	–
	bluegrass	POA	<i>Poa</i>	0–30	–
<b>Forb</b>					
7	<b>Forbs</b>			20–100	
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–50	–
	sweetclover	MELIL	<i>Melilotus</i>	0–50	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0–30	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0–30	–
	mealy goosefoot	CHIN2	<i>Chenopodium incanum</i>	0–20	–
	Forb, native	2FN	<i>Forb, native</i>	0–20	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	0–20	–
	common dandelion	TAOF	<i>Taraxacum officinale</i>	0–20	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	0–20	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–20	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	10–20	–
	curly dock	RUCR	<i>Rumex crispus</i>	0–20	–
	slimflower scurfpea	PSTE5	<i>Psoralidium tenuiflorum</i>	0–10	–
	deathcamas	ZIGAD	<i>Zigadenus</i>	0–10	–
	toxic onion	ALTE	<i>Allium toxicum</i>	0–10	–

	texture onion	ALTE	Annual texture	0-10	-
	field sagewort	ARCA12	<i>Artemisia campestris</i>	0-10	-
	povertyweed	IVAX	<i>Iva axillaris</i>	0-10	-
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0-10	-
<b>Shrub/Vine</b>					
8	<b>Shrubs</b>			50-150	
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	10-40	-
	brittle pricklypear	OPFR	<i>Opuntia fragilis</i>	10-40	-
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	10-40	-
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	10-30	-
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0-30	-
	saltbush	ATRIP	<i>Atriplex</i>	0-10	-
	rose	ROSA5	<i>Rosa</i>	0-10	-

## Animal community

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. Stocking rates are calculated using Animal-Unit-Month (AUM), which is the amount of air-dry forage required to feed a cow, with or without calf, for one month.

### Western Wheatgrass/Blue Grama (1.1)

Average Annual Production (lbs./acre, air-dry): 1,600

Stocking Rate\* (AUM/acre): 0.44

### Blue Grama/Inland Saltgrass/Western Wheatgrass (1.2)

Average Annual Production (lbs./acre, air-dry): 1,000

Stocking Rate\* (AUM/acre): 0.27

### Cactus/Inland Saltgrass/Blue Grama (1.3)

Average Annual Production (lbs./acre, air-dry): 600

Stocking Rate\* (AUM/acre): 0.16

### Annual/Pioneer Perennial (2.1)

Average Annual Production (lbs./acre, air-dry): 400

Stocking Rate\* (AUM/acre): 0.11

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

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

## Hydrological functions

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

## Recreational uses

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

## Wood products

No appreciable wood products are typically present on this site.

## Other products

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

## Other information

Ecological Site Correlation Issues and Questions:

- SD005 Beadle County, SD did not use the (DfA) Dudley-Jerauld silt loams, 0 to 2 percent slopes (national symbol 2wkph) as used in the adjoining SD111 Sanborn County, SD.
- SD077 Kingsbury County, SD did not use the (St) Stickney-Jerauld silt loam (national symbol cwzr) as used in the adjoining SD005 Beadle County, SD. NOTE: Kingsbury County is the newer survey (correlated 1991), Beadle County is an older survey with outdated map unit concepts. The (St) Stickney-Dudley silt loams, 0 to 2 percent slopes (national symbol 2wkpf) map unit used in Kingsbury County is the correct map unit concept.
- SD043 Douglas County, SD did not use the (Da) DeGrey-Jerauld silt loams (national symbol cxf0) as used in the adjoining SD023 Charles Mix County, SD.
- 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.

Data Source Sample Period State County  
SCS-RANGE-417 (0017146073) 9/16/1971 SD Jerauld  
SCS-RANGE-417 (0018546097) 9/26/1985 SD Miner

## 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.

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 Endangered 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.

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.

USDA, NRCS. *National Soil Information System, Information Technology Center*, (<http://soils.usda.gov/technical/nasis/>)

USDA, NRCS. 2019. *The PLANTS Database* (<http://plants.usda.gov>, 13 March 2019).

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 13 March 2019).

High Plains Regional Climate Center, University of Nebraska. (<http://www.hprcc.unl.edu/>)

USDA, NRCS. *National Water and Climate Center*. (<http://wcc.nrcs.usda.gov>)

USDA, NRCS. *National Range and Pasture Handbook*, September 1997

USDA, NRCS. 2001. *The PLANTS Database, Version 3.1* (<http://plants.usda.gov>). National Plant Data Center.

## **Contributors**

Stan Boltz

## **Approval**

Suzanne Mayne-Kinney, 1/31/2024

## **Acknowledgments**

Lance Howe ([Lance.Howe@usda.gov](mailto:Lance.Howe@usda.gov)), Soil Survey Office Leader, USDA-NRCS, Redfield, SD; and Steve Winter ([Steven.Winter@usda.gov](mailto:Steven.Winter@usda.gov)), Soil Scientist, USDA-NRCS, Redfield, SD

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

This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. Officially approved for publication by David Kraft as of 11/12/2020.

## **Non-discrimination Statement**

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint

filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, available online and at any USDA office, or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632- 9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

## Rangeland health reference sheet

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

Author(s)/participant(s)	David Schmidt, Tim Nordquist, Stan Boltz
Contact for lead author	david.schmidt@sd.usda.gov 605-352-1236
Date	12/07/2004
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.
- 

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 typically 5-45 percent. Associated slick spots are not a part of this site, and will have considerably more bare ground.
- 

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.

- 
7. **Amount of litter movement (describe size and distance expected to travel):** Plant litter may be moved during ponding events and small accumulations of litter may be visible.
- 
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class roughly 2-4. Moderate root content. Soil surface is somewhat resistant to erosion. Crusts may be present (e.g., biological and physical crusts).
- 
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth and color of A-horizon.
- 
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Rhizomatous grasses provide for moderate infiltration, but shallow pan reduces effective infiltration.
- 
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 evident. At less than four inches, an extremely dense clay B horizon exists, which has a round-topped columnar structure.
- 
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: Mid cool-season rhizomatous grass >
- Sub-dominant: Short warm-season grasses >>
- Other: Mid/tall cool-season bunchgrasses = short grass-likes = forbs = shrubs > mid warm-season grasses = short cool-season grasses.
- Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth brome grass do not fit into reference plant community F/S 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):** Litter cover is in contact with soil surface.
- 
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,100–2,100 lbs./acre air-dry weight, average 1,600 lbs./acre air-dry weight.
- 
16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize**

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

---

17. **Perennial plant reproductive capability:** All species are capable of reproducing.
-