

# Ecological site R055CY013SD Claypan

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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.

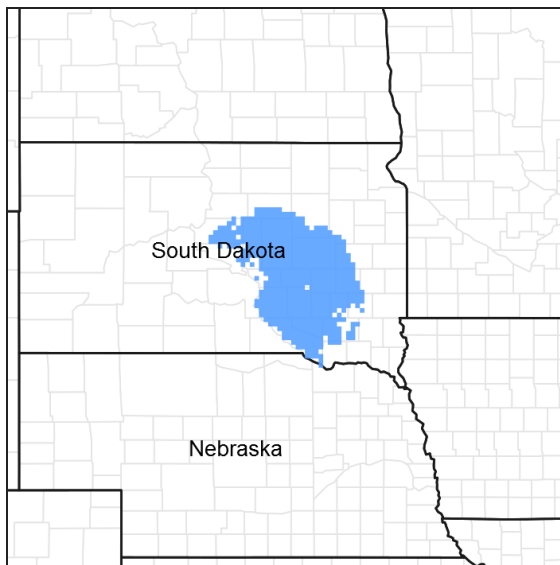


Figure 1. Mapped extent

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): 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 Claypan ecological site typically occurs on nearly level slopes in the upland areas. Soils are moderately well drained and has a claypan (columnar structure) within 16 inches of the soil surface due to the sodium affected subsoil. 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 shallow rooted and more tolerant of the higher sodium levels. Slopes can range from 0 to 3 percent. Vegetation in the Reference State is dominated by cool-season grasses and short warm-season grasses. This includes western wheatgrass, green needlegrass, and blue grama. Non-native grasses such as smooth brome grass and Kentucky bluegrass may invade due to shifts in disturbance regime.

### Associated sites

|             |  |
|-------------|--|
| R055CY010SD | <b>Loamy</b><br>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.   |
| R055CY011SD | <b>Clayey</b><br>These sites occur on upland areas. The soils are well drained, have greater than 40 percent clay in the surface and subsoil, and do not have a claypan between 6 and 16 inches. The central concept soil series is Beadle, but other series are included. |

### Similar sites

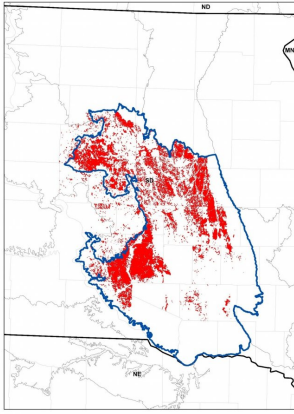
|             |   |
|-------------|---|
| R055CY011SD | <b>Clayey</b><br>The Clayey site occurs in a similar landscape position and does not have a claypan (columnar structure) between 6 and 16 inches of the soil surface. The Clayey site will have more green needlegrass, less blue grama, and higher production than a Claypan site. |
|-------------|---|

Table 1. Dominant plant species

|            |   |
|------------|---|
| Tree       | Not specified   |
| Shrub      | Not specified   |
| Herbaceous | (1) <i>Nassella viridula</i><br>(2) <i>Pascopyrum smithii</i> |

### Physiographic features

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



**Figure 2. Distribution Map of the Claypan Site within MLRA 55C. In many cases, data is not spatially consistent across political boundaries due to the method with which soils were mapped; e. g. county subsets.**

**Table 2. Representative physiographic features**

|                    |  |
|--------------------|--|
| Landforms          | (1) Plain<br>(2) Till plain<br>(3) Flood plain |
| Flooding duration  | Brief (2 to 7 days)                            |
| Flooding frequency | None to frequent                               |
| Ponding frequency  | None   |
| Elevation          | 396–610 m                                      |
| Slope              | 1–5%   |
| Water table depth  | 91–203 cm                                      |
| 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)  | 123-129 days |
| Freeze-free period (characteristic range) | 139-148 days |

|  |              |
|--|--------------|
| Precipitation total (characteristic range) | 559-660 mm   |
| Frost-free period (actual range)           | 120-130 days |
| Freeze-free period (actual range)          | 134-155 days |
| Precipitation total (actual range)         | 533-686 mm   |
| Frost-free period (average)                | 126 days     |
| Freeze-free period (average)               | 144 days     |
| Precipitation total (average)              | 610 mm       |

## Climate stations used

- (1) REDFIELD [USC00397052], Redfield, SD
- (2) MILLER [USC00395561], Miller, SD
- (3) HURON RGNL AP [USW00014936], Huron, SD
- (4) DE SMET [USC00392302], De Smet, SD
- (5) HOWARD [USC00394037], Howard, SD
- (6) FORESTBURG 4 NNE [USC00393029], Artesian, SD
- (7) CHAMBERLAIN MUNI AP [USW00094943], Chamberlain, SD
- (8) CHAMBERLAIN 5 S [USC00391621], Chamberlain, SD
- (9) ACADEMY 2NE [USC00390043], Platte, SD
- (10) MITCHELL MUNI AP [USW00094950], Mitchell, SD
- (11) MITCHELL [USC00395669], Mitchell, SD
- (12) BRIDGEWATER [USC00391032], Bridgewater, SD
- (13) MARION [USC00395228], Marion, SD
- (14) SALEM 5NE [USC00395360], Salem, SD
- (15) ARMOUR [USC00390296], Armour, SD
- (16) WAGNER [USC00398767], Wagner, SD
- (17) TYNDALL [USC00398472], Tyndall, SD
- (18) MENNO [USC00395481], Menno, 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 clay loam to clay textured subsoils and slopes of 1 to 5 percent. The soils in this site are moderately well to somewhat poorly drained and formed in till and drift over till, or alluvium. The loam to silt loam surface layer is 4 to 11 inches thick. The extremely hard clayey Btn horizon has round-topped or "biscuit shaped" columnar structure. These Btn horizons are high in sodium. This site should show slight to no evidence of rills, wind scoured areas or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact.

Soil series is Dudley.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetation is diminished. Low available water capacity and very slow permeability strongly influences the soil-water-plant relationship.

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) Loam<br>(2) Silt loam                          |
| Drainage class   | Somewhat poorly drained to moderately well drained |
| Permeability class                                       | Very slow  |
| Soil depth   | 203 cm   |
| Surface fragment cover <=3"                              | 0–4%   |
| Surface fragment cover >3"                               | 0%   |
| Available water capacity<br>(0-101.6cm)                  | 12.7–17.78 cm                                      |
| Calcium carbonate equivalent<br>(0-101.6cm)              | 0–15%  |
| Electrical conductivity<br>(0-101.6cm)                   | 2–16 mmhos/cm                                      |
| Sodium adsorption ratio<br>(0-101.6cm)                   | 0–20   |
| Soil reaction (1:1 water)<br>(0-101.6cm)                 | 5.6–9  |
| Subsurface fragment volume <=3"<br>(Depth not specified) | 0–5%   |
| Subsurface fragment volume >3"<br>(Depth not specified)  | 0–2%   |

## Ecological dynamics

### State and Community Phases

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

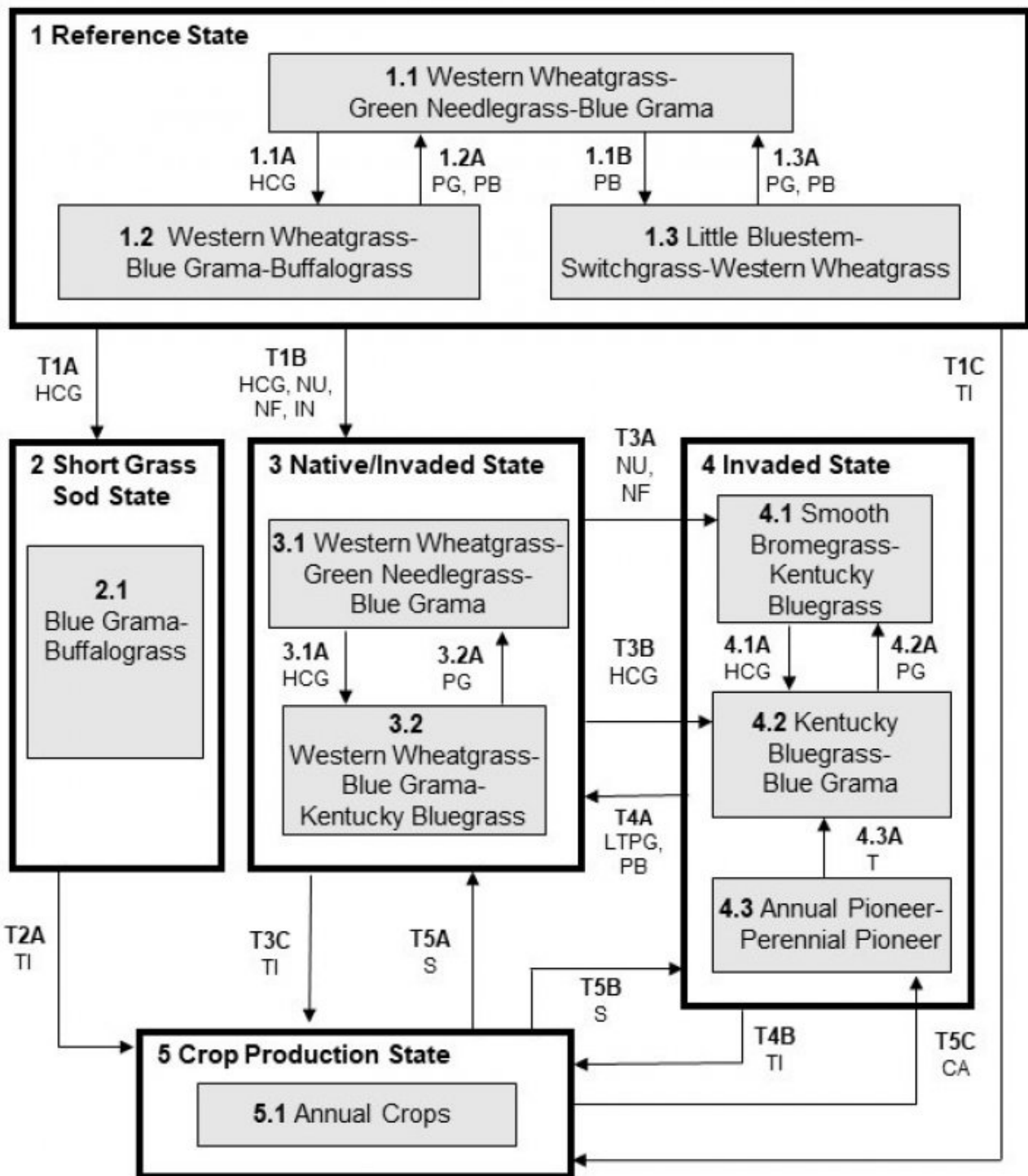
The site which is located in the Southern Black Glaciated Plains Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and management actions. 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-Green Needlegrass-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. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

This ecological site (ES) has been grazed by domestic livestock since they were introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have changed the ecological dynamics of this site. Continuous season-long grazing (during the typical growing season of May through October) or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following grazing events causes departure from the 3.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase. Blue grama (*Bouteloua gracilis*) will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, needle and thread, porcupinegrass, sideoats grama (*Bouteloua curtipendula*), big bluestem (*Andropogon gerardii*), and little bluestem (*Schizachyrium scoparium*) will decrease in frequency and production. Extended periods of nonuse and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), green needlegrass, and cheatgrass (*Bromus tectorum*).

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 associated plant composition tables 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.

## **State and transition model**

# Claypan – R055CY013SD



## LEGEND

Claypan – R055CY013SD

- 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 Claypan Site in MLRA 55C.

| Code | Process  |
|------|--|
| T1A  | Heavy continuous grazing                                     |
| T1B  | Heavy continuous grazing, non-use, no fire, invasion         |
| T1C  | Tillage  |
| T2A  | Tillage  |
| T3A  | Non-use, no fire   |
| T3B  | Heavy continuous grazing                                     |
| T3C  | Tillage  |
| T4A  | Long term prescribed grazing, prescribed burning             |
| T4B  | Tillage  |
| T5A  | Seeding  |
| T5B  | Seeding  |
| T5C  | Abandonment of cropping                                      |
| 1.1A | Heavy continuous grazing                                     |
| 1.1B | Prescribed burning   |
| 1.2A | Prescribed grazing with recovery periods, prescribed burning |
| 1.3A | Prescribed grazing with recovery periods, prescribed burning |
| 3.1A | Heavy continuous grazing                                     |
| 3.2A | Prescribed grazing with recovery periods                     |
| 4.1A | Heavy continuous grazing                                     |
| 4.2A | Prescribed grazing with recovery periods                     |
| 4.3A | Time, w/wo disturbances                                      |

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

## State 1 Reference State

The Reference State represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state was dominated by cool-season grasses, with warm-season grasses being subdominant. Prior to European settlement in North America, the primary disturbance mechanisms for this site in the Reference condition included periods of below and above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. Cool-season and taller warm-season grasses would have declined and a corresponding increase in short, warm-season grasses would have occurred. Today, a similar state, the Native/Invaded State (State 3) 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.

## Community 1.1 Western Wheatgrass-Green Needlegrass-Blue Grama

Interpretations are based primarily on the 1.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase (this is also considered to be the Reference Community). The potential vegetation was about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community was dominated by cool-season grasses. The major grasses included western wheatgrass, green needlegrass, and blue grama. Other grass or grass-like species included needle and thread, big bluestem, little bluestem, sideoats grama, slender wheatgrass (*Elymus trachycaulus*), porcupinegrass, and fowl bluegrass (*Poa palustris*). This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high tolerance to drought. This was a sustainable plant community in regard to site and soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type



| Plant Type      | Low<br>(Kg/Hectare) | Representative Value<br>(Kg/Hectare) | High<br>(Kg/Hectare) |
|-----------------|---------------------|--------------------------------------|----------------------|
| Grass/Grasslike | 1737                | 2294                                 | 2819                 |
| Forb            | 118                 | 194                                  | 291                  |
| Shrub/Vine      | 50                  | 90                                   | 140                  |
| <b>Total</b>    | <b>1905</b>         | <b>2578</b>                          | <b>3250</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

### Western Wheatgrass-Blue Grama-Buffalograss

This plant community evolved under heavy, continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses included western wheatgrass, blue grama, buffalograss (*Bouteloua dactyloides*), green needlegrass, sideoats grama, and needle and thread. Grasses of secondary importance included little bluestem, porcupinegrass, big bluestem, and sedge (*Abildgaardia*). Forbs commonly found in this plant community included cudweed sagewort (*Artemisia ludoviciana*), prairie coneflower (*Ratibida columnifera*), and western yarrow (*Achillea millefolium*). This plant community had similar plant composition to the 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass Plant Community Phase. The main difference is that this plant community phase did not have the presence of non-native invasive species such as Kentucky bluegrass and smooth brome grass. When compared to the 1.1 Western Wheatgrass-Green Needlegrass-Big Bluestem Plant Community Phase, blue grama and buffalograss increased. Green needlegrass and porcupinegrass decreased and production of mid- and tall warm-season grasses was also reduced. This plant community was moderately resistant to change. The herbaceous species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term.

Figure 13. Plant community growth curve (percent production by month). SD5503, Southern Black Glaciated Plains, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0   | 0   | 3   | 10  | 20  | 28  | 21  | 10  | 5   | 3   | 0   | 0   |

## Community 1.3

### Little Bluestem-Switchgrass-Western Wheatgrass

This plant community was a result of fire occurring at relatively frequent intervals. This phase could have also resulted from a combination of grazing events immediately following early season fire (i.e., large ungulates attracted to highly nutritious vegetative growth following a fire). These events would have caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would have increased in vigor and production leading to a temporary shift to this phase. Needlegrasses would have decreased most significantly amongst the cool-season grasses. The potential vegetation was about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses. The major grasses included little bluestem, big bluestem, switchgrass, Indiangrass (*Sorghastrum nutans*), sideoats grama, and western wheatgrass. Other grass or grass-like species included green needlegrass, porcupinegrass, needle and thread, blue grama, slender wheatgrass, tall dropseed (*Sporobolus compositus*), and sedges (*Cyperaceae*). This plant community was not resistant to change and would have readily shifted back to the 1.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase with a return of more normal fire return intervals.

**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 Western Wheatgrass-Blue Grama-Buffalograss Plant Community Phase.

### **Pathway 1.1B Community 1.1 to 1.3**

Prescribed burning (occurring at relatively frequent intervals every 3 to 5 years), a return to normal disturbance regime levels and frequencies, periodic light to moderate grazing possibly including periodic rest, and occasional grazing events immediately following early season fire caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would increase in vigor and production leading to a temporary shift to the 1.3 Little Bluestem-Switchgrass-Western Wheatgrass Plant Community Phase.

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

Prescribed grazing, and/or prescribed burning (occurring at relatively frequent intervals, every 3 to 5 years), a return to normal disturbance regime levels and frequencies, or periodic light to moderate grazing, possibly including periodic rest, will convert this plant community to the 1.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase.

### **Pathway 1.3A Community 1.3 to 1.1**

Prescribed grazing (alternating season of use and providing adequate recovery periods), periodic light to moderate grazing (possibly including periodic rest, or occurring at relatively frequent intervals, every 3 to 5 years), and a return to normal disturbance regime levels may convert this plant community to the 1.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase.

## **State 2 Shortgrass Sod State**

The Shortgrass Sod State is the result of heavy, continuous grazing, and in the absence of periodic fire due to fire suppression. This state is dominated by blue grama and buffalograss forming a dense sod layer that effectively blocks introduction of other plants into the system. Taller cool-season species will decline and a corresponding increase in short-statured grass will occur. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the sod grass dominance.

### **Community 2.1 Blue Grama-Buffalograss**

This plant community evolved under heavy, continuous season grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses typically included blue grama and buffalograss. Grasses of secondary importance included sedge and western wheatgrass. Forbs commonly found in this plant

community included cudweed sagewort, scurfpea (Cullen), and western yarrow. When compared to the 1.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase, blue grama and buffalograss (*Bouteloua dactyloides*) were dominant on this plant community. Cool-season grasses decreased significantly. This vegetation state was very resistant to change. The herbaceous species present were well adapted to grazing. This plant community was less productive than other phases. The thick sod prevented other species from getting established.

**Figure 15. Plant community growth curve (percent production by month). SD5505, Southern Black Glaciated Plains, warm-season dominant.. Warm-season dominant..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0   | 0   | 2   | 5   | 15  | 25  | 30  | 15  | 7   | 1   | 0   | 0   |

### State 3 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 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 cool-season species can decline and a corresponding increase in short statured grass will occur.

### Community 3.1 Western Wheatgrass-Green Needlegrass-Blue Grama

This plant community phase is similar to the 1.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth brome grass (up to about 15 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, green needlegrass, and blue grama. Other grass or grass-like species include needle and thread, big bluestem, little bluestem, sideoats grama, slender wheatgrass, porcupinegrass, and fowl bluegrass. 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 regards to site and soil stability, watershed function, and biologic integrity.

**Figure 16. 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 3.2 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass

This plant community is a result of heavy, continuous grazing, continuous season-long grazing, or from over utilization during extended drought periods. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grasses include western wheatgrass, blue grama, and Kentucky bluegrass. Grasses of secondary importance include sideoats grama, little bluestem, green needlegrass, needle and thread, porcupinegrass, big bluestem, buffalograss, smooth brome grass, and sedge. Forbs commonly found in this plant community include cudweed sagewort, prairie coneflower, and western yarrow. When compared to the 3.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase, blue grama has increased. Green needlegrass and sideoats grama have decreased and production of mid- and tall warm-season grasses has also 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.

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

| Plant Type      | Low<br>(Kg/Hectare) | Representative Value<br>(Kg/Hectare) | High<br>(Kg/Hectare) |
|-----------------|---------------------|--------------------------------------|----------------------|
| Grass/Grasslike | 1239                | 1706                                 | 2152                 |
| Forb            | 90                  | 143                                  | 213                  |
| Shrub/Vine      | 17                  | 56                                   | 101                  |
| <b>Total</b>    | <b>1346</b>         | <b>1905</b>                          | <b>2466</b>          |

**Figure 18. 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   |

**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, will shift this community to the 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass 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 will convert this plant community to the 3.1 Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community Phase.

**State 4  
Invaded State**

The Invaded State is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass and smooth brome grass and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant introduced grass species. The nutrient cycle is also impaired and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant introduced grass species. Studies indicate that soil biological activity is altered and this shift exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies 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. Once the state is well established, even drastic events such as high intensity fires driven by high fuel loads of litter and thatch will not result in more than a very short-term reduction of Kentucky bluegrass. These events may reduce the dominance of Kentucky bluegrass but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish before Kentucky bluegrass rebounds.

**Community 4.1  
Smooth Bromegrass-Kentucky Bluegrass**

This plant community phase is a result of extended periods of non-use and no fire. It is characterized by a dominance of smooth bromegrass and Kentucky bluegrass. 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. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. When dominated by smooth

bromegrass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced.

**Table 7. Annual production by plant type**

| Plant Type      | Low<br>(Kg/Hectare) | Representative Value<br>(Kg/Hectare) | High<br>(Kg/Hectare) |
|-----------------|---------------------|--------------------------------------|----------------------|
| Grass/Grasslike | 1536                | 2508                                 | 2998                 |
| Forb            | 123                 | 211                                  | 319                  |
| Shrub/Vine      | 22                  | 83                                   | 157                  |
| <b>Total</b>    | <b>1681</b>         | <b>2802</b>                          | <b>3474</b>          |

**Figure 20. Plant community growth curve (percent production by month). SD5501, Southern Black Glaciated Plains, cool-season dominant.. Cool-season dominant..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0   | 0   | 4   | 12  | 25  | 36  | 10  | 5   | 4   | 4   | 0   | 0   |

## Community 4.2 Kentucky Bluegrass-Blue Grama

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass and blue grama. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface and eventually a thatch-mat layer may develop at the surface as well.. Nutrient cycling is greatly reduced and 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. The period that palatability is high is relatively short as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase.

**Table 8. Annual production by plant type**

| Plant Type      | Low<br>(Kg/Hectare) | Representative Value<br>(Kg/Hectare) | High<br>(Kg/Hectare) |
|-----------------|---------------------|--------------------------------------|----------------------|
| Grass/Grasslike | 824                 | 1170                                 | 1496                 |
| Forb            | 62                  | 135                                  | 224                  |
| Shrub/Vine      | 11                  | 40                                   | 73                   |
| <b>Total</b>    | <b>897</b>          | <b>1345</b>                          | <b>1793</b>          |

**Figure 22. 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 4.3 Annual Pioneer-Perennial Pioneer

The Annual Pioneer-Perennial Pioneer 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 the plant communities on adjacent sites. This community can be renovated to improve the production capability; however, if management changes are not made the vegetation could revert back to early seral species.

### **Pathway 4.1A** **Community 4.1 to 4.2**

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 4.2 Kentucky Bluegrass-Blue Gama Plant Community Phase.

### **Pathway 4.2A** **Community 4.2 to 4.1**

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 4.1 Smooth Bromegrass-Kentucky Bluegrass Plant Community Phase.

#### **Conservation practices**

Prescribed Grazing

### **Pathway 4.3A** **Community 4.3 to 4.2**

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 4.2 Kentucky Bluegrass-Blue Grama Plant Community Phase.

#### **Conservation practices**

Integrated Pest Management (IPM)

## **State 5** **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 5.1** **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**

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, typically beginning early in the season) will convert this plant community to the 2.1 Blue Grama-Buffalograss Plant Community Phase within the Shortgrass Sod State (State 2).

## **Transition T1B**

### **State 1 to 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, heavy continuous grazing, or invasion of non-native plant species will likely lead this state over a threshold resulting in the Native/Invaded State (State 3).

## **Transition T5**

### **State 1 to 4**

Encroachment of non-native invasive and noxious species, abandonment of cropping, or seeding of introduced or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 4), and more specifically to the 4.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

## **Transition T1C**

### **State 1 to 5**

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops Plant Community Phase within the Crop Production State (State 5).

## **Transition T5**

### **State 2 to 4**

Encroachment of non-native invasive or noxious species, abandonment of cropping, or seeding of introduced or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 4), and more specifically to the 4.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

## **Transition T2A**

### **State 2 to 5**

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops Plant Community Phase within the Crop Production State (State 5).

## **Transition T3A, T3B**

### **State 3 to 4**

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 likely lead this state over a threshold leading to the 4.1 Smooth Bromegrass-Kentucky Bluegrass Community Phase within the Invaded State (State 4). 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 4.2 Kentucky Bluegrass-Blue Grama Community Phase within the Invaded State (State 4). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

## **Transition T3C**

### **State 3 to 5**

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops Plant Community Phase within the Crop Production State (State 5).

## Restoration pathway T4A State 4 to 3

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 plant community phase over a threshold to the Native/Invaded State (State 3).

## Transition T4B State 4 to 5

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops Community Phase within the Crop Production State (State 5).

## Restoration pathway T5A State 5 to 3

Seeding may lead this Crop Production State (State 5) over a threshold to the Native/Invaded State (State 3).

## Restoration pathway T5B, T5C State 5 to 4

Seeding may lead this Crop Production State (State 5) over a threshold to the Invaded State (State 4). Cropping followed by abandonment may lead this plant community phase over a threshold to the Invaded State (State 4) and more specifically to the 4.3 Annual Pioneer-Perennial Pioneer Plant Community Phase.

## Additional community tables

Table 9. Community 1.1 plant community composition

| Group                  | Common Name                      | Symbol | Scientific Name                        | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|------------------------|----------------------------------|--------|--|--------------------------------|------------------|
| <b>Grass/Grasslike</b> |                                  |        |  |                                |                  |
| 1                      | <b>Cool-Season Bunchgrasses</b>  |        |  | 387–773                        |                  |
|                        | green needlegrass                | NAVI4  | <i>Nassella viridula</i>               | 258–773                        | –                |
|                        | fowl bluegrass                   | POPA2  | <i>Poa palustris</i>                   | 129–516                        | –                |
|                        | needle and thread                | HECOC8 | <i>Hesperostipa comata ssp. comata</i> | 129–516                        | –                |
|                        | porcupinegrass                   | HESP11 | <i>Hesperostipa spartea</i>            | 129–516                        | –                |
| 2                      | <b>Wheatgrass</b>                |        |  | 387–773                        |                  |
|                        | western wheatgrass               | PASM   | <i>Pascopyrum smithii</i>              | 387–773                        | –                |
|                        | slender wheatgrass               | ELTR7  | <i>Elymus trachycaulus</i>             | 52–258                         | –                |
| 3                      | <b>Short Warm-Season Grasses</b> |        |  | 129–387                        |                  |
|                        | blue grama                       | BOGR2  | <i>Bouteloua gracilis</i>              | 129–387                        | –                |
|                        | buffalograss                     | BODA2  | <i>Bouteloua dactyloides</i>           | 52–206                         | –                |
|                        | saltgrass                        | DISP   | <i>Distichlis spicata</i>              | 0–77                           | –                |
|                        | threeawn                         | ARIST  | <i>Aristida</i>                        | 0–52                           | –                |
| 4                      | <b>Tall Warm-Season Grasses</b>  |        |  | 129–258                        |                  |
|                        | big bluestem                     | ANGE   | <i>Andropogon gerardii</i>             | 52–258                         | –                |
|                        | switchgrass                      | PAVI2  | <i>Panicum virgatum</i>                | 0–206                          | –                |
|                        | prairie sandreed                 | CALO   | <i>Calamovilfa longifolia</i>          | 0–129                          | –                |
| 5                      | <b>Mid Warm-Season Grasses</b>   |        |  | 129–258                        |                  |



|                   |                                 |        |  |         |   |
|-------------------|---------------------------------|--------|--|---------|---|
|                   | sideoats grama                  | BOCU   | <i>Bouteloua curtipendula</i>                        | 52–258  | – |
|                   | little bluestem                 | SCSC   | <i>Schizachyrium scoparium</i>                       | 52–258  | – |
| 6                 | <b>Other Native Grasses</b>     |        |  | 26–129  |   |
|                   | Graminoid (grass or grass-like) | 2GRAM  | <i>Graminoid (grass or grass-like)</i>               | 0–129   | – |
|                   | prairie Junegrass               | KOMA   | <i>Koeleria macrantha</i>                            | 26–77   | – |
|                   | tumblegrass                     | SCPA   | <i>Schedonnardus paniculatus</i>                     | 0–52    | – |
|                   | Scribner's rosette grass        | DIOLS  | <i>Dichanthelium oligosanthes var. scribnerianum</i> | 0–52    | – |
| 7                 | <b>Grass-likes</b>              |        |  | 52–258  |   |
|                   | sedge                           | CAREX  | <i>Carex</i>   | 52–206  | – |
|                   | Grass-like (not a true grass)   | 2GL    | <i>Grass-like (not a true grass)</i>                 | 0–77    | – |
| <b>Forb</b>       |                                 |        |  |         |   |
| 8                 | <b>Forbs</b>                    |        |  | 129–258 |   |
|                   | Forb, native                    | 2FN    | <i>Forb, native</i>                                  | 26–77   | – |
|                   | white sagebrush                 | ARLU   | <i>Artemisia ludoviciana</i>                         | 26–77   | – |
|                   | western yarrow                  | ACMIO  | <i>Achillea millefolium var. occidentalis</i>        | 26–52   | – |
|                   | scarlet beeblossom              | GACO5  | <i>Gaura coccinea</i>                                | 26–52   | – |
|                   | silverleaf Indian breadroot     | PEAR6  | <i>Pediomelum argophyllum</i>                        | 26–52   | – |
|                   | goldenrod                       | SOLID  | <i>Solidago</i>                                      | 26–52   | – |
|                   | scarlet globemallow             | SPCO   | <i>Sphaeralcea coccinea</i>                          | 26–52   | – |
|                   | white heath aster               | SYER   | <i>Symphotrichum ericoides</i>                       | 26–52   | – |
|                   | American vetch                  | VIAM   | <i>Vicia americana</i>                               | 26–52   | – |
|                   | field sagewort                  | ARCA12 | <i>Artemisia campestris</i>                          | 0–52    | – |
|                   | Nuttall's violet                | VINU2  | <i>Viola nuttallii</i>                               | 0–26    | – |
|                   | curlycup gumweed                | GRSQ   | <i>Grindelia squarrosa</i>                           | 0–26    | – |
|                   | rush skeletonplant              | LYJU   | <i>Lygodesmia juncea</i>                             | 0–26    | – |
|                   | leafy wildparsley               | MUDI   | <i>Musineon divaricatum</i>                          | 0–26    | – |
|                   | textile onion                   | ALTE   | <i>Allium textile</i>                                | 0–26    | – |
|                   | pussytoes                       | ANTEN  | <i>Antennaria</i>                                    | 0–26    | – |
|                   | milkweed                        | ASCLE  | <i>Asclepias</i>                                     | 0–26    | – |
|                   | mouse-ear chickweed             | CERAS  | <i>Cerastium</i>                                     | 0–26    | – |
|                   | wavyleaf thistle                | CIUN   | <i>Cirsium undulatum</i>                             | 0–26    | – |
| <b>Shrub/Vine</b> |                                 |        |  |         |   |
| 9                 | <b>Shrubs</b>                   |        |  | 52–129  |   |
|                   | snowberry                       | SYMPH  | <i>Symphoricarpos</i>                                | 26–77   | – |
|                   | Shrub (>.5m)                    | 2SHRUB | <i>Shrub (&gt;.5m)</i>                               | 0–52    | – |
|                   | prairie sagewort                | ARFR4  | <i>Artemisia frigida</i>                             | 0–52    | – |
|                   | rose                            | ROSA5  | <i>Rosa</i>  | 26–52   | – |

Table 10. Community 3.2 plant community composition

| Group                  | Common Name                     | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|------------------------|---------------------------------|--------|-----------------|--------------------------------|------------------|
| <b>Grass/Grasslike</b> |                                 |        |                 |                                |                  |
| 1                      | <b>Cool-Season Bunchgrasses</b> |        |                 | 95–286                         |                  |

|             |                                  |        |  |         |   |
|-------------|----------------------------------|--------|--|---------|---|
|             | green needlegrass                | NAVI4  | <i>Nassella viridula</i>                             | 38–286  | – |
|             | needle and thread                | HECOC8 | <i>Hesperostipa comata ssp. comata</i>               | 19–152  | – |
|             | porcupinegrass                   | HESP11 | <i>Hesperostipa spartea</i>                          | 19–152  | – |
|             | fowl bluegrass                   | POPA2  | <i>Poa palustris</i>                                 | 0–114   | – |
| 2           | <b>Wheatgrass</b>                |        |  | 286–572 |   |
|             | western wheatgrass               | PASM   | <i>Pascopyrum smithii</i>                            | 286–572 | – |
|             | slender wheatgrass               | ELTR7  | <i>Elymus trachycaulus</i>                           | 0–76    | – |
| 3           | <b>Short Warm-Season Grasses</b> |        |  | 286–476 |   |
|             | blue grama                       | BOGR2  | <i>Bouteloua gracilis</i>                            | 191–476 | – |
|             | buffalograss                     | BODA2  | <i>Bouteloua dactyloides</i>                         | 38–229  | – |
|             | saltgrass                        | DISP   | <i>Distichlis spicata</i>                            | 0–95    | – |
|             | threeawn                         | ARIST  | <i>Aristida</i>                                      | 0–57    | – |
| 4           | <b>Tall Warm-Season Grasses</b>  |        |  | 0–95    |   |
|             | big bluestem                     | ANGE   | <i>Andropogon gerardii</i>                           | 0–57    | – |
|             | prairie sandreed                 | CALO   | <i>Calamovilfa longifolia</i>                        | 0–57    | – |
|             | switchgrass                      | PAVI2  | <i>Panicum virgatum</i>                              | 0–57    | – |
| 5           | <b>Mid Warm-Season Grasses</b>   |        |  | 0–95    |   |
|             | sideoats grama                   | BOCU   | <i>Bouteloua curtipendula</i>                        | 0–95    | – |
|             | little bluestem                  | SCSC   | <i>Schizachyrium scoparium</i>                       | 0–95    | – |
| 6           | <b>Other Native Grasses</b>      |        |  | 19–95   |   |
|             | Graminoid (grass or grass-like)  | 2GRAM  | <i>Graminoid (grass or grass-like)</i>               | 0–95    | – |
|             | Scribner's rosette grass         | DIOLS  | <i>Dichanthelium oligosanthes var. scribnerianum</i> | 0–38    | – |
|             | prairie Junegrass                | KOMA   | <i>Koeleria macrantha</i>                            | 19–38   | – |
|             | tumblegrass                      | SCPA   | <i>Schedonnardus paniculatus</i>                     | 0–38    | – |
| 7           | <b>Grass-likes</b>               |        |  | 19–191  |   |
|             | sedge                            | CAREX  | <i>Carex</i>   | 19–191  | – |
|             | Grass-like (not a true grass)    | 2GL    | <i>Grass-like (not a true grass)</i>                 | 0–57    | – |
| 8           | <b>Non-Native Grasses</b>        |        |  | 95–476  |   |
|             | Kentucky bluegrass               | POPR   | <i>Poa pratensis</i>                                 | 57–476  | – |
|             | brome                            | BROMU  | <i>Bromus</i>  | 19–191  | – |
|             | quackgrass                       | ELRE4  | <i>Elymus repens</i>                                 | 0–95    | – |
|             | smooth brome                     | BRIN2  | <i>Bromus inermis</i>                                | 0–95    | – |
| <b>Forb</b> |                                  |        |  |         |   |
| 9           | <b>Forbs</b>                     |        |  | 95–191  |   |
|             | sweetclover                      | MELIL  | <i>Melilotus</i>                                     | 0–95    | – |
|             | Forb, introduced                 | 2FI    | <i>Forb, introduced</i>                              | 0–76    | – |
|             | white sagebrush                  | ARLU   | <i>Artemisia ludoviciana</i>                         | 19–76   | – |
|             | Forb, native                     | 2FN    | <i>Forb, native</i>                                  | 19–57   | – |
|             | western yarrow                   | ACMIO  | <i>Achillea millefolium var. occidentalis</i>        | 19–57   | – |
|             | white heath aster                | SYER   | <i>Symphotrichum ericoides</i>                       | 19–57   | – |
|             | goldenrod                        | SOLID  | <i>Solidago</i>                                      | 19–57   | – |

|                   |                             |        |                               |       |   |
|-------------------|-----------------------------|--------|-------------------------------|-------|---|
|                   | scarlet globemallow         | SPCU   | <i>Spnaeraicea coccinea</i>   | 19–38 | – |
|                   | common dandelion            | TAOF   | <i>Taraxacum officinale</i>   | 0–38  | – |
|                   | yellow salsify              | TRDU   | <i>Tragopogon dubius</i>      | 19–38 | – |
|                   | field sagewort              | ARCA12 | <i>Artemisia campestris</i>   | 0–38  | – |
|                   | silverleaf Indian breadroot | PEAR6  | <i>Pediomelum argophyllum</i> | 19–38 | – |
|                   | curlycup gumweed            | GRSQ   | <i>Grindelia squarrosa</i>    | 0–38  | – |
|                   | rush skeletonplant          | LYJU   | <i>Lygodesmia juncea</i>      | 0–19  | – |
|                   | mouse-ear chickweed         | CERAS  | <i>Cerastium</i>              | 0–19  | – |
|                   | wavyleaf thistle            | CIUN   | <i>Cirsium undulatum</i>      | 0–19  | – |
|                   | pussytoes                   | ANTEN  | <i>Antennaria</i>             | 0–19  | – |
|                   | leafy wildparsley           | MUDI   | <i>Musineon divaricatum</i>   | 0–19  | – |
|                   | American vetch              | VIAM   | <i>Vicia americana</i>        | 0–19  | – |
| <b>Shrub/Vine</b> |                             |        |                               |       |   |
| 10                | <b>Shrubs</b>               |        |                               | 19–95 |   |
|                   | prairie sagewort            | ARFR4  | <i>Artemisia frigida</i>      | 0–57  | – |
|                   | snowberry                   | SYMPH  | <i>Symphoricarpos</i>         | 19–57 | – |
|                   | Shrub (>.5m)                | 2SHRUB | <i>Shrub (&gt;.5m)</i>        | 0–38  | – |
|                   | rose                        | ROSA5  | <i>Rosa</i>                   | 0–19  | – |

Table 11. Community 4.1 plant community composition

| Group                  | Common Name                      | Symbol | Scientific Name                                      | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|------------------------|----------------------------------|--------|--|--------------------------------|------------------|
| <b>Grass/Grasslike</b> |                                  |        |  |                                |                  |
| 1                      | <b>Cool-Season Bunchgrasses</b>  |        |  | 0–224                          |                  |
|                        | green needlegrass                | NAVI4  | <i>Nassella viridula</i>                             | 0–196                          | –                |
|                        | fowl bluegrass                   | POPA2  | <i>Poa palustris</i>                                 | 0–112                          | –                |
| 2                      | <b>Wheatgrass</b>                |        |  | 0–280                          |                  |
|                        | western wheatgrass               | PASM   | <i>Pascopyrum smithii</i>                            | 0–280                          | –                |
| 3                      | <b>Short Warm-Season Grasses</b> |        |  | 0–196                          |                  |
|                        | blue grama                       | BOGR2  | <i>Bouteloua gracilis</i>                            | 0–140                          | –                |
|                        | saltgrass                        | DISP   | <i>Distichlis spicata</i>                            | 0–84                           | –                |
|                        | threeawn                         | ARIST  | <i>Aristida</i>                                      | 0–56                           | –                |
|                        | buffalograss                     | BODA2  | <i>Bouteloua dactyloides</i>                         | 0–56                           | –                |
| 4                      | <b>Other Native Grasses</b>      |        |  | 0–140                          |                  |
|                        | Graminoid (grass or grass-like)  | 2GRAM  | <i>Graminoid (grass or grass-like)</i>               | 0–140                          | –                |
|                        | Scribner's rosette grass         | DIOLS  | <i>Dichanthelium oligosanthes var. scribnerianum</i> | 0–28                           | –                |
|                        | prairie Junegrass                | KOMA   | <i>Koeleria macrantha</i>                            | 0–28                           | –                |
| 5                      | <b>Grass-likes</b>               |        |  | 0–140                          |                  |
|                        | sedge                            | CAREX  | <i>Carex</i>   | 0–140                          | –                |
|                        | Grass-like (not a true grass)    | 2GL    | <i>Grass-like (not a true grass)</i>                 | 0–84                           | –                |
| 6                      | <b>Non-Native Grasses</b>        |        |  | 841–1961                       |                  |
|                        | smooth brome                     | BRIN2  | <i>Bromus inermis</i>                                | 560–1821                       | –                |
|                        | Kentucky bluegrass               | POPR   | <i>Poa pratensis</i>                                 | 140–701                        | –                |

|                   |                             |        |   |         |   |
|-------------------|-----------------------------|--------|---|---------|---|
|                   | brome                       | BROMU  | <i>Bromus</i>                                 | 28–420  | – |
|                   | quackgrass                  | ELRE4  | <i>Elymus repens</i>                          | 0–224   | – |
| <b>Forb</b>       |                             |        |   |         |   |
| 7                 | <b>Forbs</b>                |        |   | 140–280 |   |
|                   | sweetclover                 | MELIL  | <i>Melilotus</i>                              | 0–224   | – |
|                   | Forb, introduced            | 2FI    | <i>Forb, introduced</i>                       | 0–168   | – |
|                   | Forb, native                | 2FN    | <i>Forb, native</i>                           | 0–84    | – |
|                   | silverleaf Indian breadroot | PEAR6  | <i>Pediomelum argophyllum</i>                 | 0–84    | – |
|                   | goldenrod                   | SOLID  | <i>Solidago</i>                               | 28–84   | – |
|                   | white sagebrush             | ARLU   | <i>Artemisia ludoviciana</i>                  | 28–84   | – |
|                   | common dandelion            | TAOF   | <i>Taraxacum officinale</i>                   | 28–84   | – |
|                   | yellow salsify              | TRDU   | <i>Tragopogon dubius</i>                      | 28–84   | – |
|                   | scarlet globemallow         | SPCO   | <i>Sphaeralcea coccinea</i>                   | 0–56    | – |
|                   | white heath aster           | SYER   | <i>Symphotrichum ericoides</i>                | 28–56   | – |
|                   | western yarrow              | ACMIO  | <i>Achillea millefolium var. occidentalis</i> | 0–56    | – |
|                   | pussytoes                   | ANTEN  | <i>Antennaria</i>                             | 0–28    | – |
|                   | field sagewort              | ARCA12 | <i>Artemisia campestris</i>                   | 0–28    | – |
|                   | mouse-ear chickweed         | CERAS  | <i>Cerastium</i>                              | 0–28    | – |
|                   | curlycup gumweed            | GRSQ   | <i>Grindelia squarrosa</i>                    | 0–28    | – |
| <b>Shrub/Vine</b> |                             |        |   |         |   |
| 8                 | <b>Shrubs</b>               |        |   | 28–140  |   |
|                   | snowberry                   | SYMPH  | <i>Symphoricarpos</i>                         | 28–112  | – |
|                   | rose                        | ROSA5  | <i>Rosa</i>                                   | 28–56   | – |
|                   | Shrub (>.5m)                | 2SHRUB | <i>Shrub (&gt;.5m)</i>                        | 0–56    | – |
|                   | prairie sagewort            | ARFR4  | <i>Artemisia frigida</i>                      | 0–28    | – |

Table 12. Community 4.2 plant community composition

| Group                  | Common Name                      | Symbol | Scientific Name                        | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|------------------------|----------------------------------|--------|--|--------------------------------|------------------|
| <b>Grass/Grasslike</b> |                                  |        |  |                                |                  |
| 1                      | <b>Cool-Season Bunchgrasses</b>  |        |  | 0–67                           |                  |
|                        | fowl bluegrass                   | POPA2  | <i>Poa palustris</i>                   | 0–67                           | –                |
| 2                      | <b>Wheatgrass</b>                |        |  | 0–67                           |                  |
|                        | western wheatgrass               | PASM   | <i>Pascopyrum smithii</i>              | 0–67                           | –                |
| 3                      | <b>Short Warm-Season Grasses</b> |        |  | 135–336                        |                  |
|                        | blue grama                       | BOGR2  | <i>Bouteloua gracilis</i>              | 67–336                         | –                |
|                        | buffalograss                     | BODA2  | <i>Bouteloua dactyloides</i>           | 13–135                         | –                |
|                        | saltgrass                        | DISP   | <i>Distichlis spicata</i>              | 0–108                          | –                |
|                        | threeawn                         | ARIST  | <i>Aristida</i>                        | 0–40                           | –                |
| 4                      | <b>Other Native Grasses</b>      |        |  | 13–67                          |                  |
|                        | Graminoid (grass or grass-like)  | 2GRAM  | <i>Graminoid (grass or grass-like)</i> | 0–67                           | –                |
|                        | prairie Junegrass                | KOMA   | <i>Koeleria macrantha</i>              | 13–27                          | –                |
|                        | tumblegrass                      | SCPA   | <i>Schedonnardus paniculatus</i>       | 0–13                           | –                |
|                        | Scribner's rosette grass         | DIQIS  | <i>Dichanthelium oligosanthes var.</i> | 0–13                           | –                |

|                   |                               |        |  |         |   |
|-------------------|-------------------------------|--------|--|---------|---|
|                   | Common sedge grass            | CROCO  | <i>Crocodon sibiricum</i> var. <i>scribnerianum</i>  | 0-10    | - |
| 5                 | <b>Grass-likes</b>            |        |  | 40-202  |   |
|                   | sedge                         | CAREX  | <i>Carex</i>   | 40-202  | - |
|                   | Grass-like (not a true grass) | 2GL    | <i>Grass-like (not a true grass)</i>                 | 0-27    | - |
| 6                 | <b>Non-Native Grasses</b>     |        |  | 336-673 |   |
|                   | Kentucky bluegrass            | POPR   | <i>Poa pratensis</i>                                 | 135-605 | - |
|                   | brome                         | BROMU  | <i>Bromus</i>  | 27-269  | - |
|                   | quackgrass                    | ELRE4  | <i>Elymus repens</i>                                 | 27-161  | - |
|                   | smooth brome                  | BRIN2  | <i>Bromus inermis</i>                                | 0-108   | - |
| <b>Forb</b>       |                               |        |  |         |   |
| 7                 | <b>Forbs</b>                  |        |  | 67-202  |   |
|                   | Forb, introduced              | 2FI    | <i>Forb, introduced</i>                              | 13-108  | - |
|                   | sweetclover                   | MELIL  | <i>Melilotus</i>                                     | 0-94    | - |
|                   | curlycup gumweed              | GRSQ   | <i>Grindelia squarrosa</i>                           | 13-67   | - |
|                   | goldenrod                     | SOLID  | <i>Solidago</i>                                      | 13-54   | - |
|                   | white sagebrush               | ARLU   | <i>Artemisia ludoviciana</i>                         | 13-54   | - |
|                   | field sagewort                | ARCA12 | <i>Artemisia campestris</i>                          | 0-40    | - |
|                   | western yarrow                | ACMIO  | <i>Achillea millefolium</i> var. <i>occidentalis</i> | 13-40   | - |
|                   | common dandelion              | TAOF   | <i>Taraxacum officinale</i>                          | 13-40   | - |
|                   | yellow salsify                | TRDU   | <i>Tragopogon dubius</i>                             | 13-40   | - |
|                   | white heath aster             | SYER   | <i>Symphotrichum ericoides</i>                       | 0-27    | - |
|                   | Forb, native                  | 2FN    | <i>Forb, native</i>                                  | 0-27    | - |
|                   | silverleaf Indian breadroot   | PEAR6  | <i>Pediomelum argophyllum</i>                        | 13-27   | - |
|                   | pussytoes                     | ANTEN  | <i>Antennaria</i>                                    | 0-13    | - |
|                   | scarlet globemallow           | SPCO   | <i>Sphaeralcea coccinea</i>                          | 0-13    | - |
| <b>Shrub/Vine</b> |                               |        |  |         |   |
| 8                 | <b>Shrubs</b>                 |        |  | 13-67   |   |
|                   | snowberry                     | SYMPH  | <i>Symphoricarpos</i>                                | 0-40    | - |
|                   | prairie sagewort              | ARFR4  | <i>Artemisia frigida</i>                             | 13-40   | - |
|                   | rose                          | ROSA5  | <i>Rosa</i>  | 0-13    | - |
|                   | Shrub (>.5m)                  | 2SHRUB | <i>Shrub (&gt;.5m)</i>                               | 0-13    | - |

## 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/Needlegrass/Blue Grama (1.1 & 3.1)

Average Annual Production (lbs./acre, air-dry): 2,300

Stocking Rate\* (AUM/acre): 0.63

Western Wheatgrass/Blue Grama/Kentucky Bluegrass (3.2)

Average Annual Production (lbs./acre, air-dry): 1,700

Stocking Rate\* (AUM/acre): 0.47

Smooth Bromegrass/Kentucky Bluegrass (4.1)

Average Annual Production (lbs./acre, air-dry): 2,500

Stocking Rate\* (AUM/acre): 0.69

Kentucky Bluegrass/Blue Grama (4.2)

Average Annual Production (lbs./acre, air-dry): 1,200

Stocking Rate\* (AUM/acre): 0.33

Annual/Pioneer, Non-Native Perennial (4.3)

Average Annual Production (lbs./acre, air-dry): 800

Stocking Rate\* (AUM/acre): 0.22

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

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

## Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration varies from very slow to slow and runoff potential for this site varies from high to very high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, bluegrass, and 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:

- SD069 Hyde County, SD did not use the (CnA) Cavo-Glenham loams, nearly level (national symbol ctwt) as used in the adjoining SD059 Hand County, SD.

- SD115 Spink County, SD did not use the (HIA) Houdek-Dudley complex, 0 to 2 percent slopes (national symbol 2wbpw) as used in the adjoining SD059 Hand County, SD.
- SD115 Spink County, SD did not use the (DtA) Dudley-Tetonka silt loams (national symbol cwym) as used in the adjoining SD005 Beadle County, SD.
- SD111 Sanborn County, SD did not use the (DtA) Dudley-Tetonka silt loams (national symbol cwym) as used in the adjoining SD005 Beadle County, SD.
- SD073 Jerauld County, SD did not use the (DtA) Dudley-Tetonka silt loams (national symbol cwym) as used in the adjoining SD005 Beadle County, SD.
- SD035 Davison County, SD did not use the (HdA) Houdek-Dudley complex, 0 to 2 percent slopes (national symbol 2wbpw) as used in the adjoining SD003 Aurora County, SD.
- SD097 Miner County, SD did not use the (DsA) Stickney-Dudley silt loams, 0 to 2 percent slopes (national symbol 2wkpg) as used in the adjoining SD602 Hanson and Hutchinson Counties, SD.
- SD005 Beadle County, SD did not use the (Ws) Woonsocket-Whitelake fine sandy loams, 0 to 2 percent slopes (national symbol cz6g) as used in the adjoining SD115 Spink County, SD.
- SD005 Beadle County, SD did not use the (Nv) Northville-Farmsworth-Hoven silt loams, 0 to 2 percent slopes (national symbol cz59) as used in the adjoining SD115 Spink County, SD.
- SD005 Beadle County, SD did not use the (Su) Stickney-Dudley-Hoven silt loams, 0 to 2 percent slopes (national symbol 2wkpf) as used in the adjoining SD115 Spink 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

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 (0028546097) 10/9/1985 SD Miner

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## **Contributors**

Stan Boltz

## **Approval**

Suzanne Mayne-Kinney, 1/31/2024

## **Acknowledgments**

Contact for Lead Authors: Natural Resources Conservation Service (USDA-NRCS), Redfield Soil Survey Office Redfield, SD; 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.

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## **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.  

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- 2. Presence of water flow patterns:** Barely observable.  

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

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- 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than 15 percent and less than 2 inches in diameter.  

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

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

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- 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.  

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- 8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class roughly 3-5. Relatively high root content. Soil surface is resistant to erosion.  

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- 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.  

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

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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 eight inches, an extremely dense clay B horizon with round-topped columnar or prismatic structure exists.

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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: Mid cool-season rhizomatous grasses > mid and tall cool-season bunchgrasses >>

Sub-dominant: Short warm-season grasses > tall warm-season rhizomatous grass = short warm season grass = short cool-season grass = forb

Other: Tall warm-season grasses = mid warm-season grasses = forbs = short grass-likes > short cool-season grasses = shrubs.

Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth brome grass do not fit into reference plant community F/S groups.

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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):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,700–2,900 lbs./acre air-dry weight, average 2,300 lbs./acre air-dry weight.

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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, also Kentucky bluegrass, smooth brome grass.

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

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