USDA Natural Resources Conservation Service

# Ecological site R102BY014SD
# Shallow To Gravel

Last updated: 2/01/2024
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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): 102B–Till Plains

The Till Plains (102B) is located within the Western Lake Section of the Central Lowland Province of the Interior Plains. It is entirely in South Dakota, encompassing 2,215 square miles (Figure 1). The elevation ranges from 1,140 to 1,880 feet. The MLRA is characterized by glaciated, nearly level to hilly plains populated by stagnation and end moraines, glacial outwash terraces, and floodplains as the major landforms. The dominant parent materials are silty drift, glacial till, glacial outwash, and alluvium. (USDA-NRCS 2006)

The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a mesic temperature regime, a udic ustic moisture regime and mixed or smectitic mineralogy. They generally are very deep, well drained to poorly drained, and clayey or loamy. This area is in the western area of the tall grass prairie and supports big bluestem (Andropogon gerardi), little bluestem (Schizachyrium scoparium), Indiangrass (Sorghastrum nutans), porcupine grass (*Hesperostipa spartea*), and green needlegrass (Nassella viridula) as the dominant native species. Cattails (Typha), prairie cordgrass (Spartina pectinate), bulrush (Cyperaceae) and reed canarygrass (Phalaris arundinacea) are commonly found on the poorly drained soils. (USDA-NRCS, 2006).

## Classification relationships

Major Land Resource Area (MLRA): Till Plains (102B) (USDA-NRCS, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Outer Coteau des Prairies (251Bb); Yankton Hills and Valleys (251Bf); Northwest Iowa Plains (251Bd); (Cleland et al., 2007).

US EPA Level IV Ecoregion: Prairie Coteau (46k); James River Lowland (46n); Loess Prairies (47a); Big Sioux Basin (46m) - (USEPA, 2013)

## Ecological site concept

The Shallow to Gravel ecological site typically occurs in the upland areas, but some may be located on a higher floodplain. Soils are somewhat excessively drained and have sand and gravel within 10 to 20 inches of the soil surface. In some areas the surface layer may be stony to extremely stony. The water holding capacity of the sand and gravel is low, leaving less soil moisture for plant growth, production is lower, and species composition will tend towards more drought-tolerant plants. The slopes can range from 0 to 25 percent.

Vegetation in the Reference State includes needle and thread, little bluestem, and prairie dropseed. Forbs include cudweed sagewort, prairie coneflower, and Cuman ragweed. Non-native grasses such as Kentucky bluegrass, smooth brome may invade the site due to changes in disturbance regime.

## Associated sites

| | |
|---|---|
| R102BY009SD | **Sandy**<br>These sites occur on upland areas. The soils are well to moderately well drained and have surface and subsoil textures which are sandy loam, fine sandy loam, and loamy very fine sand. The central concept soil series are Blendon and Henkin, but other series are included. |
| R102BY010SD | **Loamy**<br>These sites occur on upland areas. The soils are well drained and have sand and gravel at a depth of greater than 20 inches below the soil surface. The central concept soil series is Enet, but other series are included. |
| R102BY012SD | **Thin Upland**<br>These sites occur on upland areas. The soils are well drained and will effervesce with acid at or near the surface. The central concept soil series are Betts and Ethan, but other series are included. |
| R102BY016SD | **Very Shallow**<br>These sites occur on upland areas. The soils are excessively drained and have sand and gravel within 10 inches of the soil surface. The central concept soil series is Talmo, but other series are included. |

## Similar sites

| | |
|---|---|
| R102BY010SD | **Loamy**<br>The Loamy site occurs in a similar landscape position and does not have sand and gravel within 10 to 20 inches of the soil surface. The Loamy site will have more big bluestem, less needleandthread and higher production than the Shallow Gravel site. |
| R102BY009SD | **Sandy**<br>The Sandy site occurs in a similar landscape position and does not have sand and gravel within 10 to 20 inches of the soil surface. The Sandy site will have more big bluestem and higher production than the Shallow Gravel site. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Hesperostipa comata ssp. comata*<br>(2) *Hesperostipa spartea* |

## Physiographic features

The Shallow to gravel site occurs on gently to moderately sloping uplands.

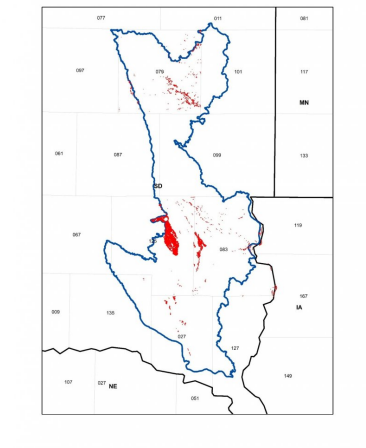



**Figure 2. Site Distribution Map.**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Outwash terrace<br>(2) Outwash plain |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 1,100–1,900 ft |
| Slope | 1–15% |
| Water table depth | 80 in |
| Aspect | Aspect is not a significant factor |

## Climatic features

Major Land Resource Area 102B is considered to have a continental climate with cold winters and relatively hot summers, low to moderate humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of the location of this MLRA 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 24 to 26 inches per year. The average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 14°F (Wentworth 2 WNW, South Dakota, to about 18°F (Canton 4 WNW, SD). July is the warmest month with temperatures averaging from about 72°F (Wentworth 2 WNW, SD), to about 73°F (Canton 4 WNW, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 57°F. This large annual range attests to the continental nature of the climate of this area. Hourly winds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 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) | 125-128 days |
| Freeze-free period (characteristic range) | 138-141 days |
| Precipitation total (characteristic range) | 26-27 in |

| | |
|---|---|
| Frost-free period (actual range) | 123-128 days |
| Freeze-free period (actual range) | 137-143 days |
| Precipitation total (actual range) | 26-27 in |
| Frost-free period (average) | 126 days |
| Freeze-free period (average) | 140 days |
| Precipitation total (average) | 26 in |

## Climate stations used

- (1) MONTROSE 8N [USC00395738], Montrose, SD
- (2) MADISON 2SE [USC00395090], Madison, SD
- (3) WENTWORTH 2.5 WNW [USC00399042], Wentworth, SD
- (4) CANTON [USC00391392], Canton, SD
- (5) CENTERVILLE 6 SE [USC00391579], Beresford, SD
- (6) VERMILLION 2 SE [USC00398622], Vermillion, SD

## Influencing water features

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

## Soil features

These soils are very deep and somewhat excessively well drained. Soil textures include moderately coarse and medium textured soils over sand or sand and gravel between the depths of 15 to 25 inches. Permeability is moderate in the upper part and very rapid in the lower part. Available water capacity is moderate in the upper part and low to very low in the lower part. This site occurs on flats, rises, and side slopes on outwash plains and terraces. Slope ranges from 1 to 15 percent. Runoff as evidenced by patterns of rill, gully, or other water flow is negligible to low, in spite of the slopes, due to the very high intake rate of these soils. Some pedestalling of plants occurs but it is not very evident on casual observation and occurs on less than 5 percent of the plants.

The central concept soil series for this site is Delmont, but other series are included.

These soils are susceptible to wind and water erosion. The hazard of wind erosion is more likely with a loss of vegetative cover. Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition or production.

**Table 4. Representative soil features**

| | |
|---|---|
| Surface texture | (1) Loam |
| Family particle size | (1) Sandy |
| Drainage class | Somewhat excessively drained |
| Permeability class | Moderate |
| Soil depth | 80 in |
| Surface fragment cover <=3" | 5–6% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-40in) | 4 in |
| Calcium carbonate equivalent (0-40in) | 0–10% |
| Electrical conductivity (0-40in) | 0–2 mmhos/cm |

| | |
|---|---|
| Sodium adsorption ratio (0-40in) | 0 |
| Soil reaction (1:1 water) (0-40in) | 6.1–8.4 |
| Subsurface fragment volume <=3" (Depth not specified) | 10–30% |
| Subsurface fragment volume >3" (Depth not specified) | 0–2% |

## Ecological dynamics

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.

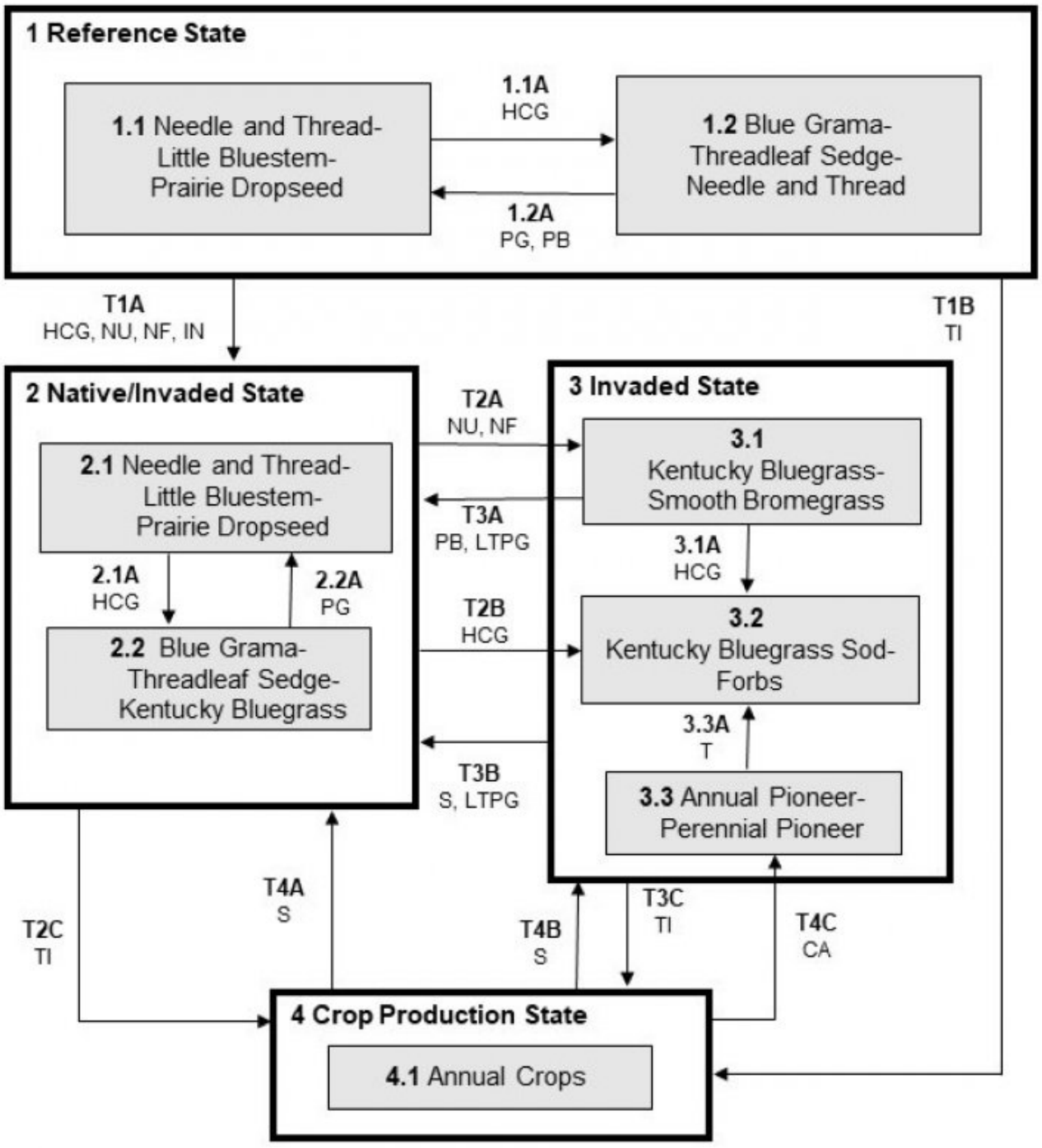
The site which is located in the Till Plains Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and management actions. Under adverse impacts, 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 Needle and Thread-Little Bluestem-Prairie Dropseed 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 to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered.

This ecological site (ES) has been grazed by domestic livestock since they have been introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have changed the ecological dynamics of this site. Heavy continuous grazing (season-long grazing during the typical growing season of April through October and/or repeated seasonal grazing during the same time of year each year) without adequate recovery periods following grazing events causes a departure from the 2.1 Needle and Thread-Little Bluestem-Prairie Dropseed Plant Community Phase. Sedge (Carex) and blue grama (*Bouteloua gracilis*) will increase and eventually develop into a sod. Little bluestem will increase initially and then begin to decrease. Needle and Thread, porcupinegrass, sideoats grama (*Bouteloua curtipendula*), big bluestem (*Andropogon gerardii*), and little bluestem will decrease in frequency and production. Extended periods of non-use 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*) and smooth bromegrass (*Bromus inermis*).

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. 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.

## State and transition model

# Shallow To Gravel – R102BY014SD




**LEGEND**

**Shallow To Gravel – R102BY014SD**

**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 Shallow to Gravel Site in MLRA 66**

| Code | Process |
|---|---|
| T1A | Heavy, continuous grazing, non-use, no fire, invasion |
| T1B | Tillage |
| T2A | Non-use, no fire |
| T2B | Heavy, continuous grazing |
| T2C | Tillage |
| T3A | Long term prescribed grazing, prescribed burning |
| T3B | Long term prescribed grazing, seeding |
| T3C | 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 |
| 2.2A | Prescribed grazing with recovery periods |
| 3.1A | Heavy, continuous grazing |
| 3.3A | Time w/wo disturbances |

**Figure 10. Matrix for the Shallow to Gravel Site in MLRA 66**

## 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 codominated by warm- and cool-season grasses. The primary disturbance mechanisms for this site in the Reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Mid- and tall-statured grass species can decline and a corresponding increase in short-statured warm-season and cool-season grass-like species will occur.

## Community 1.1
## Needle and Thread-Little Bluestem-Prairie Dropseed

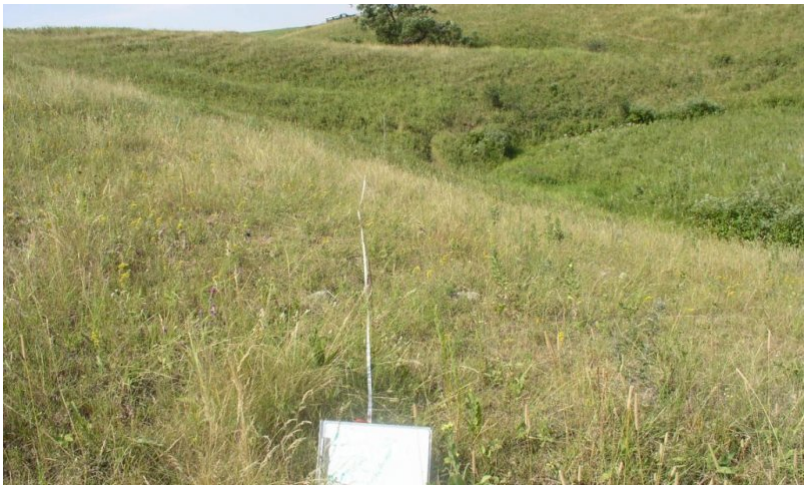


**Figure 11. Typical field of needle and thread, little bluestem, and prairie dropseed in the Shallow to Gravel ecological site in MLRA 102B.**

Interpretations are based primarily on the 1.1 Needle and Thread-Little Bluestem-Prairie Dropseed Plant Community Phase. This community phase was the most dominant both temporally and spatially. The prevailing climate and weather patterns favored the development of this community phase dominated by mid- and tall cool- and warm-season grasses such as needle and thread, little bluestem, prairie dropseed, and blue grama. Other grass and grass-likes species occurring include big bluestem, threadleaf sedge (*Carex filifolia*), porcupinegrass (*Hesperostipa spartea*), plains muhly (*Muhlenbergia cuspidata*), western wheatgrass (*Pascopyrum smithii*), prairie Junegrass (*Koeleria macrantha*), and sand dropseed (*Sporobolus cryptandrus*). The vegetation consisted of about 75 percent grass and grass-like species, 15 percent forbs, and 10 percent shrubs. A variety of leguminous and non-leguminous perennial forbs are present in minor amounts. This is a naturally nitrogen-deficient plant community. 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 regards to site and soil stability, watershed function, and biologic integrity. Transitions or pathways leading to other plant communities are as follows:

**Table 5. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 1630 | 2268 | 2610 |
| Forb | 120 | 270 | 480 |
| Shrub/Vine | 50 | 162 | 310 |
| **Total** | **1800** | **2700** | **3400** |

**Figure 13. Plant community growth curve (percent production by month). SD0214, Till Plains, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 3 | 7 | 17 | 25 | 25 | 15 | 7 | 1 | 0 | 0 |

### Community 1.2
### Blue Grama-Threadleaf Sedge-Needle and Thread

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 75 percent grasses and grass-like species, 15 percent forbs, and 10 percent shrubs. Dominant grass and grass-like species included blue grama, sideoats grama, threadleaf sedge, and needle and thread. Grasses of secondary importance included porcupinegrass, sand dropseed, little bluestem, western wheatgrass, hairy grama (*Bouteloua hirsuta*), and threeawn (Aristida). Forbs commonly found in this plant community included cudweed sagewort (*Artemisia ludoviciana*), prairie coneflower (*Ratibida columnifera*), and Cuman ragweed (*Ambrosia psilostachya*). This plant community had similar plant composition to the 2.2 Blue Grama-Threadleaf Sedge-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 bromegrass. When compared to the 1.1 Needle and thread-Little Bluestem-Prairie Dropseed Plant Community Phase, threadleaf sedge, and blue grama increased. Big bluestem and needlegrasses 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 14. Plant community growth curve (percent production by month). SD0213, Till 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 |

### 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-Threadleaf Sedge-Needle and thread Plant Community Phase.

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

Prescribed grazing, and prescribed burning occurring at relatively frequent intervals (every 3 to 5 years) and 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 Needle and thread-Little Bluestem-Prairie Dropseed Plant Community Phase.

## State 2
## Native/Invaded State

This state is very similar to the Reference State. The invasion of introduced cool-season sodgrasses has altered the natural range of variability for this ecological site (ES). The Native/Invaded State still has strong components of both warm- and cool-season grass species, but invasive introduced cool-season sodgrasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include grazing by domestic livestock and a lack of fire. Timing of fires and grazing coupled with weather events dictate the dynamics that occur within this state. The mid- and tall warm- and cool-season native grasses can decline and an increase in introduced sodgrasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season-long grazing.

### Community 2.1
### Needle and Thread-Little Bluestem-Prairie Dropseed

This community phase most closely resembles the Reference State in appearance and ecological functions (e.g.,

hydrologic, biotic, and soil and site stability). The warm- and cool-season co-dominated community is maintained with grazing systems that allow for adequate recovery periods following grazing events and potentially the combination of grazing and prescribed burning which closely mimics the natural disturbance regime. This community phase closely resembles the 1.1 Needle and Thread-Little Bluestem-Prairie Dropseed Plant Community Phase. The basic difference is the presence of minor amounts of introduced cool-season grasses and forbs. This is likely a naturally nitrogen deficient plant community. A change in the nutrient cycle on this ES possibly due to the introduction of non-native species may be a causative factor leading to the eventual dominance of cool-season introduced grasses in the Invaded State (State 3).

**Figure 15. Plant community growth curve (percent production by month). SD0214, Till Plains, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 3 | 7 | 17 | 25 | 25 | 15 | 7 | 1 | 0 | 0 |

## Community 2.2
## Blue Grama-Threadleaf Sedge-Kentucky Bluegrass

Grazing pressure reduces the mid and tall, less grazing-tolerant species, while the shorter more grazing-tolerant species increase. Litter amounts are reduced and energy capture shifts to slightly earlier in the growing season due to a decline in the later maturing native grass component and an increase in the earlier maturing grass-likes and nonnative grasses. Kentucky bluegrass increases and may approach dominance in this community. Vegetation consists of about 75 percent grass and grass-like species, 15 percent forbs, and 10 percent shrubs. Blue grama, threadleaf sedge, Kentucky bluegrass, and fringed sagewort (*Artemisia frigida*) are the dominant species in the early stages of this community phase. Significant grass species include Kentucky bluegrass, needle and thread, threeawn (Aristida), and sand dropseed. Other grasses present include western wheatgrass, porcupinegrass, and prairie Junegrass. The common forbs include cudweed sagewort, goldenrod (Oligoneuron), green sagewort (*Artemisia campestris*), heath aster (*Symphyotrichum ericoides*), and scurfpea (Cullen). Fringed sagewort (*Artemisia frigida*), brittle cactus (*Opuntia fragilis*), plains pricklypear ( *Opuntia polyacantha*), and rose (Rosa spp.) are the principal shrubs. This community phase is often dispersed throughout the pasture, in an overgrazed/undergrazed pattern, typically referred to as patch grazing. Some areas (overgrazed) will exhibit the impacts of heavy use, while other areas (undergrazed) will have a build-up of litter and a high amount of plant decadence. This is a typical pattern found in properly stocked pastures grazed season-long. In the undergrazed patches, litter buildup reduces plant vigor and density and native seedling recruitment declines. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to small colonies. In the overgrazed patches, plant vigor is reduced and the competitive advantage goes towards the grazing tolerant short-statured species such as Kentucky bluegrass and sedge. This community phase is approaching the threshold which would readily lead to the Invaded State. If management is significantly altered, this community phase can still be reverted back to the 2.1 Needle and Thread-Little Bluestem-Prairie Dropseed community phase. Grazing management that allows for adequate recovery periods will tend to restore the ecological functions of this site. Fire can play a role in reducing the introduced cool-season species. The combination of grazing and fire may be the most effective in moving this community phase toward a community resembling the interpretive plant community. Soil erosion is low. Infiltration is reduced, while runoff is increased compared to the interpretive plant community.

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

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 1055 | 1586 | 2055 |
| Forb | 90 | 190 | 330 |
| Shrub/Vine | 55 | 124 | 215 |
| **Total** | **1200** | **1900** | **2600** |

**Figure 17. Plant community growth curve (percent production by month). SD0213, Till 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 |

### 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-Threadleaf Sedge-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 Needle and Thread-Little Bluestem-Prairie Dropseed Plant Community Phase.

**Conservation practices**

| |
|---|
| Prescribed Grazing |

## State 3
## Invaded State

This state is the result of invasion and dominance of introduced cool-season sodgrasses. The Invaded State is characterized by the dominance of Kentucky bluegrass and smooth bromegrass and an increasing thatch layer that effectively blocks introduction of other plants into the system. 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 these two species. These events may reduce the dominance of the sodgrasses, but due to the large amount of rhizomes in the soil, there is no opportunity for the native species to establish and dominate before the sodgrasses rebound and again dominate 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 apparently 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 sodgrass dominance. Preliminary studies 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.

### Community 3.1
### Kentucky Bluegrass-Smooth Bromegrass

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 and eventually a thatch-mat layer may develop at the 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 likely will 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 (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 1290 | 1980 | 2505 |
| Shrub/Vine | 105 | 240 | 420 |
| Forb | 105 | 180 | 275 |
| **Total** | **1500** | **2400** | **3200** |

**Figure 19. Plant community growth curve (percent production by month). SD0211, Till 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 3.2
## Kentucky Bluegrass Sod-Forbs

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, sedge, 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 a thatch-mat layer often develops at the surface. 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 significantly reduced in this phase.

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

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 795 | 1162 | 1590 |
| Forb | 135 | 225 | 345 |
| Shrub/Vine | 70 | 113 | 165 |
| **Total** | **1000** | **1500** | **2100** |

**Figure 21. Plant community growth curve (percent production by month). SD0211, Till 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 3.3
## Annual Pioneer-Perennial Pioneer

This plant community developed under continuous heavy grazing or other excessive disturbances (e.g., heavy use areas, defoliation by rodents, etc.). 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 invasive or early seral species.

### 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 Kentucky Bluegrass Sod-Forbs 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 Sod-Forbs Plant Community Phase.

## State 4
## Crop Production State

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

### Community 4.1
### Annual Crops

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

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

Non-use and 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, and/or 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 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

Non-use and 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 3.1 Kentucky Bluegrass-Smooth Bromegrass Community Phase within the Invaded State (State 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 3.2 Kentucky Bluegrass Sod-Forbs 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.

### 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, T3B
### State 3 to 2

Long term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as a high-density and low-frequency system 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 the 3.1 Kentucky Bluegrass-Smooth Bromegrass Community Phase within the Invaded State (State 3) over a threshold to the Native/Invaded State (State 2). Seeding followed by long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) may lead this Invaded State (State 3) over a threshold to the Native/Invaded State (State 2).

**Conservation practices**

| |
|---|
| Prescribed Grazing |

### Transition T3C
### 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 Invaded State (State 3) and more specifically to the 3.3 Annual Pioneer-Perennial Pioneer Plant Community Phase.

## Additional community tables

**Table 9. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Cool-season Bunchgrasses** | | | 270–810 | |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 135–810 | – |
| | porcupinegrass | HESP11 | *Hesperostipa spartea* | 135–810 | – |
| | green needlegrass | NAVI4 | *Nassella viridula* | 0–81 | – |
| | Canada wildrye | ELCA4 | *Elymus canadensis* | 0–81 | – |
| 2 | **Mid Warm-season Grasses** | | | 270–810 | |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 135–540 | – |
| | prairie dropseed | SPHE | *Sporobolus heterolepis* | 54–405 | – |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 27–135 | – |

| | | | | | |
|---|---|---|---|---|---|
| | plains muhly | MUCU3 | *Muhlenbergia cuspidata* | 27–135 | – |
| 3 | **Tall Warm-season Grasses** | | | 54–405 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 54–405 | – |
| | prairie sandreed | CALO | *Calamovilfa longifolia* | 0–135 | – |
| | switchgrass | PAVI2 | *Panicum virgatum* | 0–135 | – |
| 4 | **Short Warm-season Grasses** | | | 54–270 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 27–270 | – |
| | hairy grama | BOHI2 | *Bouteloua hirsuta* | 27–270 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 0–81 | – |
| | threeawn | ARIST | *Aristida* | 0–54 | – |
| 5 | **Grass-likes** | | | 54–270 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 54–189 | – |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–135 | – |
| 6 | **Wheatgrass** | | | 0–135 | |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 0–135 | – |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 0–135 | – |
| 7 | **Other Native Grasses** | | | 54–135 | |
| | Graminoid (grass or grass-like) | 2GRAM | *Graminoid (grass or grass-like)* | 0–81 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 27–81 | – |
| | fall rosette grass | DIWI5 | *Dichanthelium wilcoxianum* | 27–54 | – |
| **Forb** | | | | | |
| 8 | **Forbs** | | | 135–405 | |
| | Forb, native | 2FN | *Forb, native* | 27–135 | – |
| | blacksamson echinacea | ECAN2 | *Echinacea angustifolia* | 27–81 | – |
| | blazing star | LIATR | *Liatris* | 27–81 | – |
| | wild bergamot | MOFI | *Monarda fistulosa* | 0–54 | – |
| | northern bedstraw | GABO2 | *Galium boreale* | 0–54 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 27–54 | – |
| | stiff sunflower | HEPA19 | *Helianthus pauciflorus* | 27–54 | – |
| | anemone | ANEMO | *Anemone* | 0–54 | – |
| | field sagewort | ARCA12 | *Artemisia campestris* | 27–54 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 27–54 | – |
| | false boneset | BREU | *Brickellia eupatorioides* | 0–54 | – |
| | purple prairie clover | DAPU5 | *Dalea purpurea* | 27–54 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 27–54 | – |
| | cutleaf anemone | PUPAM | *Pulsatilla patens ssp. multifida* | 0–54 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 27–54 | – |
| | goldenrod | SOLID | *Solidago* | 27–54 | – |
| | white heath aster | SYER | *Symphyotrichum ericoides* | 27–54 | – |
| | aromatic aster | SYOB | *Symphyotrichum oblongifolium* | 0–54 | – |
| | hoary verbena | VEST | *Verbena stricta* | 0–54 | – |
| | American vetch | VIAM | *Vicia americana* | 27–54 | – |
| | milkvetch | ASTRA | *Astragalus* | 0–27 | – |

| | | | | | |
|---|---|---|---|---|---|
| | pussytoes | ANTEN | *Antennaria* | 0–27 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–27 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–27 | – |
| | purple locoweed | OXLA3 | *Oxytropis lambertii* | 0–27 | – |
| | lacy tansyaster | MAPI | *Machaeranthera pinnatifida* | 0–27 | – |
| **Shrub/Vine** | | | | | |
| 9 | **Shrubs** | | | 54–270 | |
| | leadplant | AMCA6 | *Amorpha canescens* | 27–135 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–81 | – |
| | snowberry | SYMPH | *Symphoricarpos* | 0–81 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 0–54 | – |
| | pricklypear | OPUNT | *Opuntia* | 0–54 | – |
| | rose | ROSA5 | *Rosa* | 27–54 | – |

**Table 10. Community 2.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Cool-season Bunchgrasses** | | | 38–285 | |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 38–285 | – |
| | porcupinegrass | HESP11 | *Hesperostipa spartea* | 0–95 | – |
| 2 | **Mid Warm-season Grasses** | | | 38–285 | |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 19–190 | – |
| | prairie dropseed | SPHE | *Sporobolus heterolepis* | 0–95 | – |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–95 | – |
| | plains muhly | MUCU3 | *Muhlenbergia cuspidata* | 0–57 | – |
| 3 | **Tall Warm-season Grasses** | | | 0–57 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 0–38 | – |
| | prairie sandreed | CALO | *Calamovilfa longifolia* | 0–38 | – |
| | switchgrass | PAVI2 | *Panicum virgatum* | 0–19 | – |
| 4 | **Short Warm-season Grasses** | | | 190–475 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 95–475 | – |
| | hairy grama | BOHI2 | *Bouteloua hirsuta* | 19–475 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 0–95 | – |
| | threeawn | ARIST | *Aristida* | 0–76 | – |
| 5 | **Grass-likes** | | | 95–380 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 95–342 | – |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–133 | – |
| 6 | **Wheatgrass** | | | 0–38 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 0–38 | – |
| 7 | **Other Native Grasses** | | | 38–95 | |
| | Graminoid (grass or grass-like) | 2GRAM | *Graminoid (grass or grass-like)* | 0–57 | – |
| | fall rosette grass | DIWI5 | *Dichanthelium wilcoxianum* | 19–38 | |

| | | | | | |
|---|---|---|---|---|---|
| | fall rosette grass | DIWI5 | *Dichanthelium wilcoxianum* | 19–38 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 19–38 | – |
| 8 | **Non-Native Grasses** | | | 95–380 | |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 95–380 | – |
| | smooth brome | BRIN2 | *Bromus inermis* | 0–95 | – |
| **Forb** | | | | | |
| 9 | **Forbs** | | | 95–285 | |
| | Forb, native | 2FN | *Forb, native* | 0–76 | – |
| | field sagewort | ARCA12 | *Artemisia campestris* | 19–76 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 19–76 | – |
| | blazing star | LIATR | *Liatris* | 19–57 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 19–57 | – |
| | goldenrod | SOLID | *Solidago* | 19–57 | – |
| | white heath aster | SYER | *Symphyotrichum ericoides* | 19–57 | – |
| | Forb, introduced | 2FI | *Forb, introduced* | 19–57 | – |
| | hoary verbena | VEST | *Verbena stricta* | 0–38 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–38 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–38 | – |
| | pussytoes | ANTEN | *Antennaria* | 0–19 | – |
| | purple prairie clover | DAPU5 | *Dalea purpurea* | 0–19 | – |
| | blacksamson echinacea | ECAN2 | *Echinacea angustifolia* | 0–19 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 0–19 | – |
| | stiff sunflower | HEPA19 | *Helianthus pauciflorus* | 0–19 | – |
| | American vetch | VIAM | *Vicia americana* | 0–19 | – |
| | aromatic aster | SYOB | *Symphyotrichum oblongifolium* | 0–19 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–19 | – |
| | wild bergamot | MOFI | *Monarda fistulosa* | 0–19 | – |
| | purple locoweed | OXLA3 | *Oxytropis lambertii* | 0–19 | – |
| **Shrub/Vine** | | | | | |
| 10 | **Shrub** | | | 57–190 | |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 19–76 | – |
| | pricklypear | OPUNT | *Opuntia* | 19–57 | – |
| | snowberry | SYMPH | *Symphoricarpos* | 0–57 | – |
| | rose | ROSA5 | *Rosa* | 19–38 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–38 | – |
| | leadplant | AMCA6 | *Amorpha canescens* | 0–38 | – |

**Table 11. Community 3.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Cool-season Bunchgrasses** | | | 0–120 | |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–120 | – |
| 2 | **Mid Warm-season Grasses** | | | 0–72 | |

| | | | | | |
|---|---|---|---|---|---|
| 2 | **Mid Warm-season Grasses** | | | 0–72 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–72 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–48 | – |
| 3 | **Short Warm-season Grasses** | | | 24–240 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 24–168 | – |
| | hairy grama | BOHI2 | *Bouteloua hirsuta* | 0–96 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 0–96 | – |
| | threeawn | ARIST | *Aristida* | 0–24 | – |
| 4 | **Grass-likes** | | | 48–240 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 48–240 | – |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–120 | – |
| 5 | **Wheatgrass** | | | 0–48 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 0–48 | – |
| 6 | **Other Native Grasses** | | | 24–120 | |
| | Graminoid (grass or grass-like) | 2GRAM | *Graminoid (grass or grass-like)* | 0–72 | – |
| | fall rosette grass | DIWI5 | *Dichanthelium wilcoxianum* | 24–48 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–24 | – |
| 7 | **Non-Native Grasses** | | | 720–1680 | |
| | smooth brome | BRIN2 | *Bromus inermis* | 360–1320 | – |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 360–1320 | – |
| **Forb** | | | | | |
| 8 | **Forbs** | | | 120–240 | |
| | Forb, introduced | 2FI | *Forb, introduced* | 24–72 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 24–72 | – |
| | Forb, native | 2FN | *Forb, native* | 0–48 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 24–48 | – |
| | field sagewort | ARCA12 | *Artemisia campestris* | 24–48 | – |
| | blazing star | LIATR | *Liatris* | 24–48 | – |
| | wild bergamot | MOFI | *Monarda fistulosa* | 24–48 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 24–48 | – |
| | goldenrod | SOLID | *Solidago* | 24–48 | – |
| | white heath aster | SYER | *Symphyotrichum ericoides* | 24–48 | – |
| | aromatic aster | SYOB | *Symphyotrichum oblongifolium* | 0–24 | – |
| | hoary verbena | VEST | *Verbena stricta* | 0–24 | – |
| | American vetch | VIAM | *Vicia americana* | 0–24 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–24 | – |
| | purple locoweed | OXLA3 | *Oxytropis lambertii* | 0–24 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–24 | – |
| | purple prairie clover | DAPU5 | *Dalea purpurea* | 0–24 | – |
| | blacksamson echinacea | ECAN2 | *Echinacea angustifolia* | 0–24 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 0–24 | – |
| **Shrub/Vine** | | | | | |
| 9 | **Shrubs** | | | 120–360 | |

| | | | | | |
|---|---|---|---|---|---|
| | snowberry | SYMPH | *Symphoricarpos* | 24–240 | – |
| | rose | ROSA5 | *Rosa* | 24–96 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–72 | – |
| | leadplant | AMCA6 | *Amorpha canescens* | 0–72 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 24–72 | – |
| | pricklypear | OPUNT | *Opuntia* | 0–48 | – |

**Table 12. Community 3.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Mid Warm-season Grasses** | | | 0–75 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–75 | – |
| 2 | **Short Warm-season Grasses** | | | 15–225 | |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 0–225 | – |
| | hairy grama | BOHI2 | *Bouteloua hirsuta* | 0–120 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 0–90 | – |
| | threeawn | ARIST | *Aristida* | 15–75 | – |
| 3 | **Grass-likes** | | | 75–195 | |
| | threadleaf sedge | CAFI | *Carex filifolia* | 75–195 | – |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–75 | – |
| 4 | **Other Native Grasses** | | | 0–30 | |
| | Graminoid (grass or grass-like) | 2GRAM | *Graminoid (grass or grass-like)* | 0–30 | – |
| | fall rosette grass | DIWI5 | *Dichanthelium wilcoxianum* | 0–15 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–15 | – |
| 5 | **Non-Native Grasses** | | | 450–1050 | |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 450–1050 | – |
| | smooth brome | BRIN2 | *Bromus inermis* | 0–150 | – |
| **Forb** | | | | | |
| 6 | **Forbs** | | | 150–300 | |
| | Forb, introduced | 2FI | *Forb, introduced* | 15–105 | – |
| | field sagewort | ARCA12 | *Artemisia campestris* | 15–75 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 15–75 | – |
| | goldenrod | SOLID | *Solidago* | 15–75 | – |
| | white heath aster | SYER | *Symphyotrichum ericoides* | 15–75 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 0–45 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 15–45 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 15–45 | – |
| | blazing star | LIATR | *Liatris* | 0–30 | – |
| | hoary verbena | VEST | *Verbena stricta* | 0–30 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–15 | – |
| | pussytoes | ANTEN | *Antennaria* | 0–15 | – |
| | Forb, native | 2FN | *Forb, native* | 0–15 | – |
| **Shrub/Vine** | | | | | |
| 7 | **Shrubs** | | | 75–150 | |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 15–90 | – |
| | pricklypear | OPUNT | *Opuntia* | 15–75 | – |
| | snowberry | SYMPH | *Symphoricarpos* | 0–45 | – |
| | rose | ROSA5 | *Rosa* | 15–30 | – |

## Animal community

Animal Community – Grazing Interpretations
The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this ES description). Because of this, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity. 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.

Needlegrass/Bluestem/Prairie Dropseed (1.1 & 2.1)
Average Annual Production (lbs./acre, air-dry): 2,700
Stocking Rate* (AUM/acre): 0.74

Grama/Sedge/Kentucky Bluegrass (2.2)
Average Annual Production (lbs./acre, air-dry): 1,900
Stocking Rate* (AUM/acre): 0.52

Kentucky Bluegrass/Smooth Bromegrass (3.1)
Average Annual Production (lbs./acre, air-dry): 2,400
Stocking Rate* (AUM/acre): 0.66

Kentucky Bluegrass Sod/Forbs (3.2)
Average Annual Production (lbs./acre, air-dry): 1,500
Stocking Rate* (AUM/acre): 0.41

Annual/Pioneer, Non-Native Perennial (3.3)
Average Annual Production (lbs./acre, air-dry): 900
Stocking Rate* (AUM/acre): 0.25

*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 B. Infiltration and runoff potential for this site varies from moderate to 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, 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 opportunities for hunting, hiking, photography, bird watching and other activities. The wide variety 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:

• SD125 Turner County, SD did not use the (DgB) Delmont-Graceville complex, 2 to 6 percent slopes (national symbol fzjt) as used in the adjoining SD083 Lincoln County, SD.
• SD125 Turner County, SD did not use the (DmB) Delmont-Enet loams, 2 to 6 percent slopes (national symbol gymf) as used in the adjoining SD027 Clay 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 from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; and Bruce Kunze, Soil Scientist, NRCS.

Data Source Sample Period State County
None

## Other references

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## Approval

Suzanne Mayne-Kinney, 2/01/2024

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



## Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community

cannot be used to identify the ecological site.

| | |
|---|---|
| Author(s)/participant(s) | David Schmidt, Tim Nordquist, Stan Boltz |
| Contact for lead author | |
| 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:** Typically not observable.

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground 5-15%.

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):** Little to no plant litter movement.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class usually 5-6. Typically high root content, organic matter, and granular structure. Soil surface is resistant to erosion.

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:** Healthy, deep rooted native grasses enhance infiltration and reduce runoff.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident.

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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 and tall cool-season bunchgrasses = mid warm-season grasses >>

    Sub-dominant: Tall warm-season rhizomatous grasses = forbs >

    Other: Short warm-season grasses = short grass-like species = shrubs > mid cool-season rhizomatous grasses = short cool-season grasses

    Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass 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):** 50-60%, less than 0.5 inch thick. Litter cover is in contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 1,800-3,400 lbs./acre (air-dry weight). Reference value production is 2,700 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 bromegrass

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

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