

## Ecological site R102DY014SD Shallow Gravel

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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.

### MLRA notes

Major Land Resource Area (MLRA): 102D–Prairie Coteau

This area makes up about 7,867 square miles (20,375 square kilometers), consisting mostly of nearly level to undulating till plains with potholes and moraines. Elevation ranges from 1,150 to 2,130 feet (350 to 650 meters). The average annual precipitation is 22 to 29 inches (559 to 734 millimeters). The average annual temperature is 42 to 45 degrees F (6 to 7 degrees C). The dominant soil order in this MLRA is Mollisols. The soils in this area dominantly have a frigid temperature regime, and an aquic or udic moisture regime. They are generally very deep and loamy. Soils range from well drained to very poorly drained. Parent materials are dominantly fine-loamy till to clayey material, with smaller amounts of outwash, glaciofluvial deposits, eolian deposits, alluvium, and, to a lesser extent, loess and organic materials.

### Classification relationships

\*Fenneman (1916) Physiographic Regions\*

Division - Interior Plains

East:

Province - Central Lowland

Section - Western Lake / Dissected Till Plains (12b/12e)

\*USFS (2007) Ecoregions\*

Domain - Humid Temperate

Division - Prairie

Province - Prairie Parkland (Temperate)

Section - North-Central Glaciated Plains (251B)

\*EPA Ecoregions (Omernik 1997)\*

I - Great Plains (9)

II - Temperate Prairies (9.2)

III - Aspen Parkland/Northern Glaciated Plains (9.2.1)

### Ecological site concept

The Shallow Gravel ecological site typically occurs in the upland areas, but some maybe located on a higher floodplain. Soils are somewhat excessively drained and has sand and gravel within 10 to 20 inches of the soil surface. In some areas the surface layer may consist of 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. Slopes can range from 0 to 40 percent. Vegetation in the Reference State includes needleandthread, little bluestem, and prairie dropseed. Forbs include cudweed sagewort, prairie coneflower, and western ragweed. Non-native grasses such as Kentucky bluegrass, smooth brome may invade the site due to changes in disturbance regime.

## Associated sites

R102DY009SD	<b>Sandy</b> 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.
R102DY016SD	<b>Very Shallow</b> These sites occur on upland areas. The soils are excessively drained and have sand and gravel within 10 inches of the soil surface.
R102DY010SD	<b>Loamy</b> 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.
R102DY012SD	<b>Thin Upland</b> These sites occur on upland areas. The soils are well drained and will effervesce with acid at or near the surface.

## Similar sites

R102DY009SD	<b>Sandy</b> 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.
R102DY010SD	<b>Loamy</b> 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.

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Hesperostipa comata ssp. comata</i> (2) <i>Schizachyrium scoparium</i>

## Physiographic features

This site primarily occurs on outwash plains in uplands.

**Table 2. Representative physiographic features**

Landforms	(1) Outwash plain
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	305–610 m
Slope	0–12%
Water table depth	0 cm
Aspect	Aspect is not a significant factor

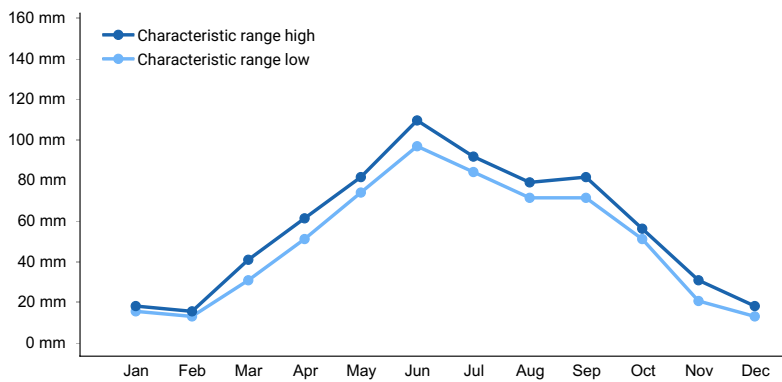
## Climatic features

The average annual precipitation is 22 to 28 inches. Half or more of the precipitation falls during the growing season. Rainfall typically occurs during high-intensity, convective thunderstorms in summer. In the western part of the MLRA, rainfall is less abundant and not always adequate for full maturation of crops. Precipitation in winter is

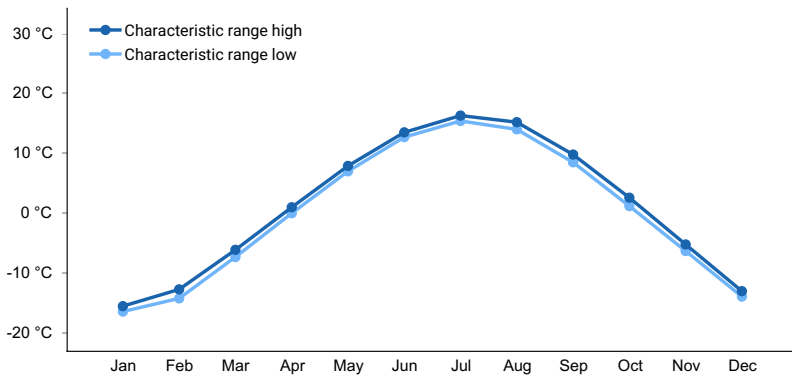
typically snow. The average annual temperature is 42 to 45 degrees F. The freeze-free period averages 142 days and ranges from 131 to 150 days.

**Table 3. Representative climatic features**

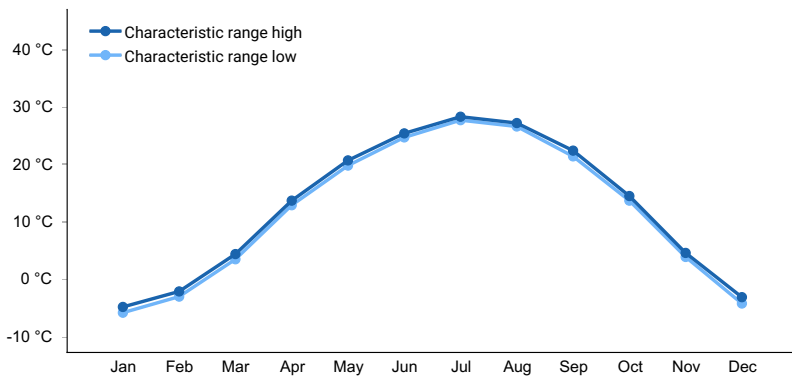
Frost-free period (characteristic range)	114-129 days
Freeze-free period (characteristic range)	138-149 days
Precipitation total (characteristic range)	610-686 mm
Frost-free period (actual range)	110-131 days
Freeze-free period (actual range)	131-151 days
Precipitation total (actual range)	559-711 mm
Frost-free period (average)	122 days
Freeze-free period (average)	142 days
Precipitation total (average)	635 mm



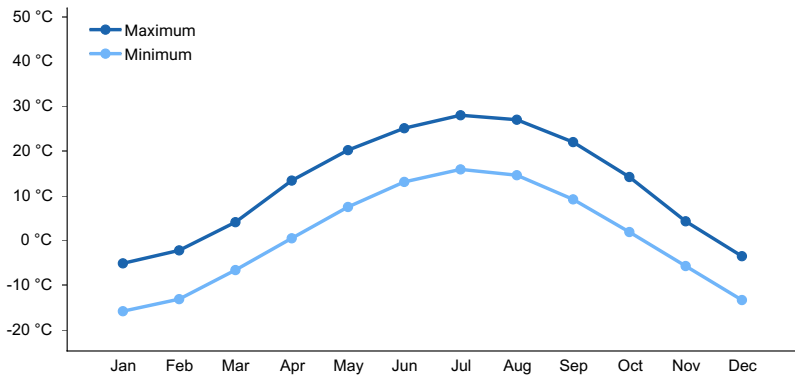
**Figure 1. Monthly precipitation range**



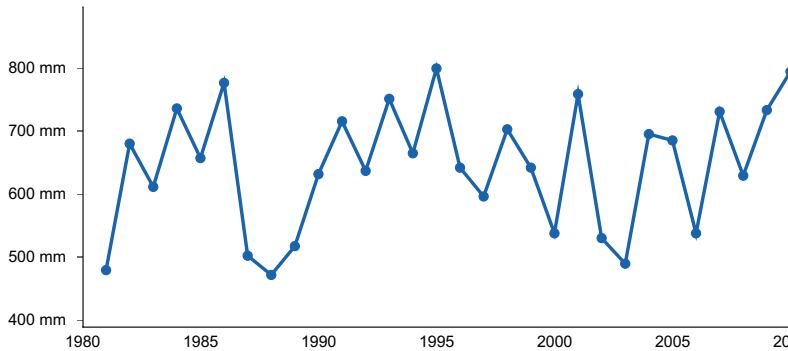
**Figure 2. Monthly minimum temperature range**



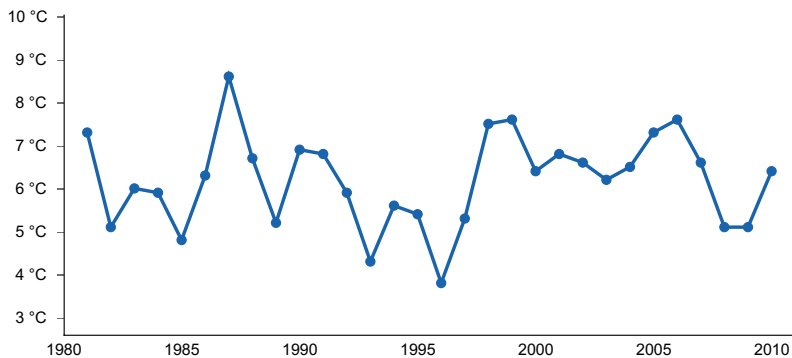
**Figure 3. Monthly maximum temperature range**



**Figure 4. Monthly average minimum and maximum temperature**



**Figure 5. Annual precipitation pattern**



**Figure 6. Annual average temperature pattern**

### Climate stations used

- (1) ROY LAKE [USC00397326], Lake City, SD
- (2) WAUBAY NWR [USC00398980], Waubay, SD
- (3) WEBSTER [USC00399004], Webster, SD
- (4) WATERTOWN 1W [USC00398930], Watertown, SD
- (5) WATERTOWN RGNL AP [USW00014946], Watertown, SD
- (6) CASTLEWOOD [USC00391519], Castlewood, SD
- (7) CLEAR LAKE [USC00391777], Clear Lake, SD
- (8) ARLINGTON 1 W [USC00390281], Arlington, SD
- (9) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (10) TYLER [USC00218429], Tyler, MN

### Influencing water features

No wetland features are associated with this site.

### Soil features

Soils are typically formed in alluvium over outwash. Surface textures range from loam to silt loam. Soils are somewhat excessively drained and typically have gravel within 10 to 20 inches of the surface. In some areas, the surface layer may be stony.

**Table 4. Representative soil features**

Parent material	(1) Alluvium
Surface texture	(1) Loam (2) Silt loam
Drainage class	Somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–2%
Available water capacity (0-101.6cm)	7.37–9.14 cm
Soil reaction (1:1 water) (0-25.4cm)	6.1–7.8
Subsurface fragment volume <=3" (0-152.4cm)	15–30%
Subsurface fragment volume >3" (0-152.4cm)	0–1%

## Ecological dynamics

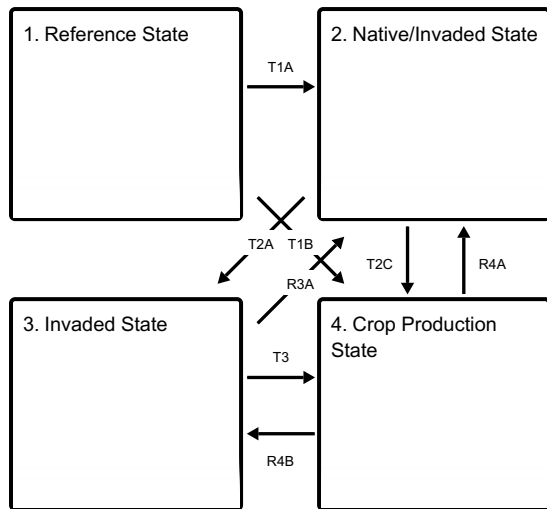
The site which is located in the Prairie Pothole Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Needleandthread-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 grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered.

This ecological site (ES) has been grazed by domestic livestock since they have been introduced into the area. 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 departure from the 2.1 Needleandthread-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. Needleandthread, porcupine grass (*Hesperostipa spartea*), sideoats grama (*Bouteloua curtipendula*), big bluestem (*Andropogon gerardii*), and little bluestem 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*) and smooth brome grass (*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 states/community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and/or states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

# State and transition model

## Ecosystem states



**T1A** - Heavy continuous grazing, non-use, no fire, invasion

**T1B** - Tillage

**T2A** - Non-use, no fire, heavy continuous grazing

**T2C** - Tillage

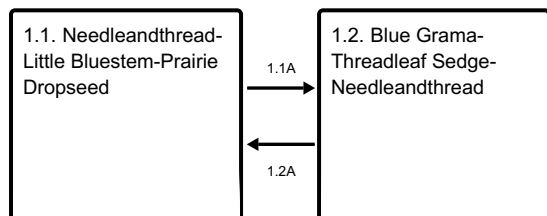
**R3A** - Long-term prescribed grazing, prescribed burning, seeding

**T3** - Tillage

**R4A** - Seeding

**R4B** - Seeding, abandonment of cropping

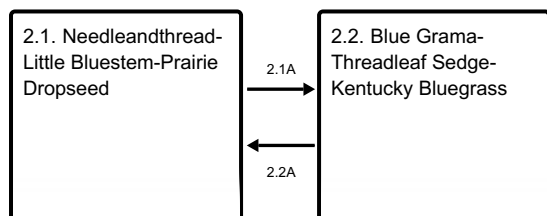
## State 1 submodel, plant communities



**1.1A** - Heavy continuous grazing

**1.2A** - Prescribed grazing with recovery periods, prescribed burning

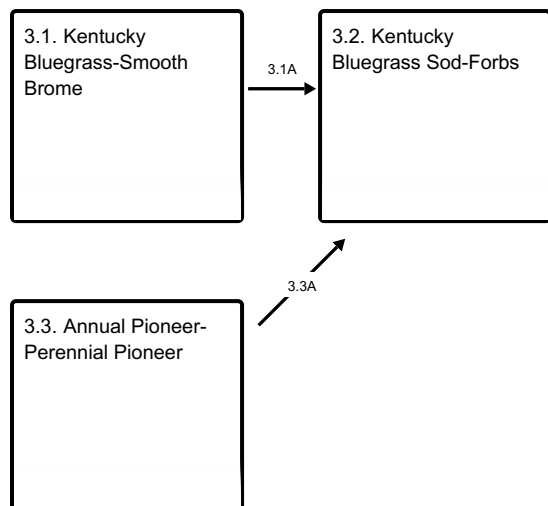
## State 2 submodel, plant communities



**2.1A** - Heavy continuous grazing

**2.2A** - Prescribed grazing with recovery periods

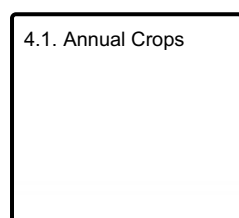
### State 3 submodel, plant communities



**3.1A** - Heavy continuous grazing

**3.3A** - Time without disturbances

### State 4 submodel, plant communities



## 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-stature grass species can decline and a corresponding increase in short-stature warm-season grasses and cool-season grass-like species will occur.

### Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- snowberry (*Symphoricarpos*), shrub
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- big bluestem (*Andropogon gerardii*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- blacksamson echinacea (*Echinacea angustifolia*), other herbaceous
- blazing star (*Liatris*), other herbaceous
- false boneset (*Brickellia eupatorioides*), other herbaceous

## Community 1.1

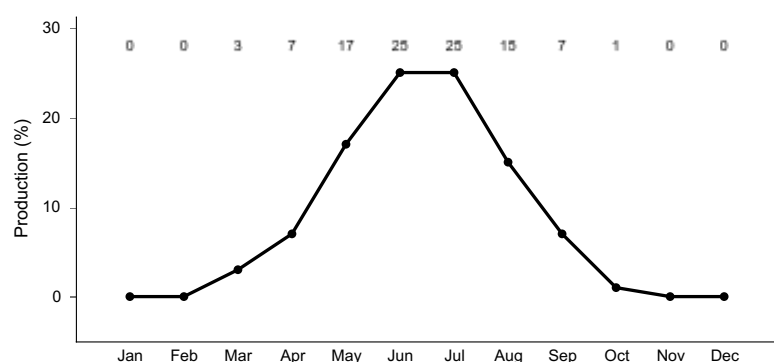
### Needleandthread-Little Bluestem-Prairie Dropseed

Interpretations are based primarily on the 1.1 Needleandthead-Little Bluestem-Prairie Dropseed Plant Community Phase (this is also considered to be climax). 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 needleandthread, little bluestem, prairie dropseed, and blue grama. Other grass and grass-likes species occurring include big bluestem, threadleaf sedge (*Carex filifolia*),

porcupine grass (*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 nonleguminous 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 drought tolerance. This was a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

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

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1625	2260	2808
Forb	118	269	471
Shrub/Vine	50	161	308
<b>Total</b>	<b>1793</b>	<b>2690</b>	<b>3587</b>

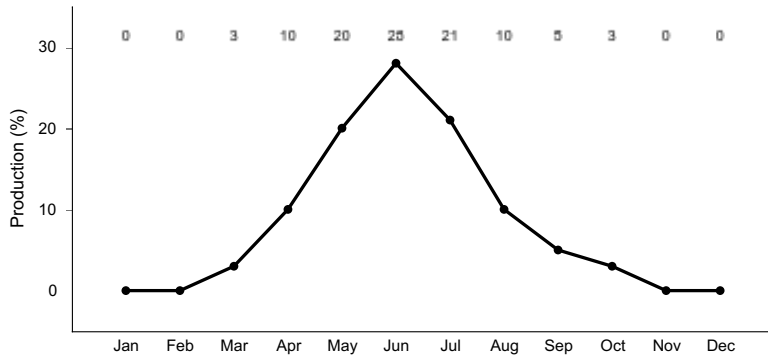


**Figure 8. Plant community growth curve (percent production by month). SD0204, Rolling Till Prairie, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..**

## Community 1.2 Blue Grama-Threadleaf Sedge-Needleandthread

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, Threadleaf sedge, needleandthread and sideoats grama. Grasses of secondary importance included porcupine grass, 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 western 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 nonnative invasive species such as Kentucky bluegrass and smooth brome grass. When compared to the 1.1 Needleandthread-Little Bluestem-Prairie Dropseed Plant Community Phase, 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 9. Plant community growth curve (percent production by month). SD0203, Rolling Till Prairie, cool-season/warm-season codominant.. Cool-season, warm-season codominant..**

## 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-Needleandthread Plant Community Phase.

## Pathway 1.2A Community 1.2 to 1.1

Prescribed grazing, and/or prescribed burning returned 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 Needleandthread-Little Bluestem-Prairie Dropseed Plant Community Phase.

## State 2 Native/Invaded State

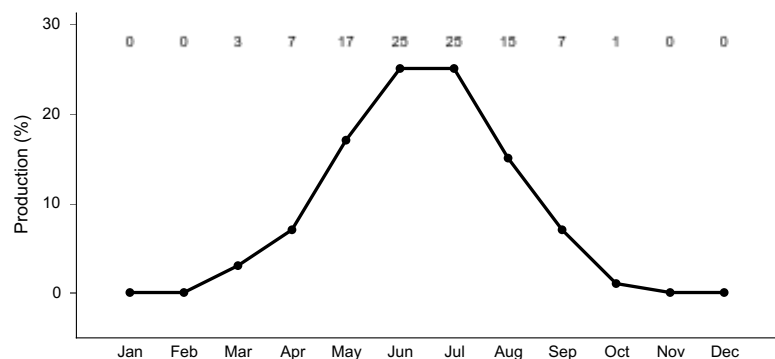
This state is very similar to the Reference State. The invasion of introduced cool-season sod grasses has altered the natural range of variability for this ecological site (ES). This state still has strong components of both warm- and cool-season grass species, but invasive introduced cool-season sod grasses 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 sod grasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season-long grazing.

### Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- pricklypear (*Opuntia*), shrub
- snowberry (*Symphoricarpos*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- needle and thread (*Hesperostipa comata* ssp. *comata*), grass
- threadleaf sedge (*Carex filifolia*), grass
- blue grama (*Bouteloua gracilis*), grass
- field sagewort (*Artemisia campestris*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- blazing star (*Liatris*), other herbaceous

## Community 2.1 Needleandthread-Little Bluestem-Prairie Dropseed

This community phase most closely resembles the Reference State in appearance and ecological functions (e.g., hydrologic, biotic, and soil/site stability). The warm- and cool-season codominated 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 Needleandthread-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 nonnative species may be a causative factor leading to the eventual dominance of cool-season introduced grasses in the Invaded State.



**Figure 10. Plant community growth curve (percent production by month). SD0204, Rolling Till Prairie, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..**

## Community 2.2

### Blue Grama-Threadleaf Sedge-Kentucky Bluegrass

Grazing pressure reduces the mid/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-like 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, 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, needleandthread, threeawn, and sand dropseed. Other grasses present include western wheatgrass, porcupine grass, and prairie Junegrass. The common forbs include cudweed sagewort, goldenrod (*Oligoneuron*), green sagewort (*Artemisia campestris*), heath aster (*Symphotrichum ericoides*), and scurfpea. Fringed sagewort (*Artemisia frigida*), cactus (Cactaceae), and rose (*Rosa*) 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 Needleandthread-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 towards 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1082	1685	2230
Forb	95	202	347
Shrub/Vine	56	131	224
<b>Total</b>	<b>1233</b>	<b>2018</b>	<b>2801</b>

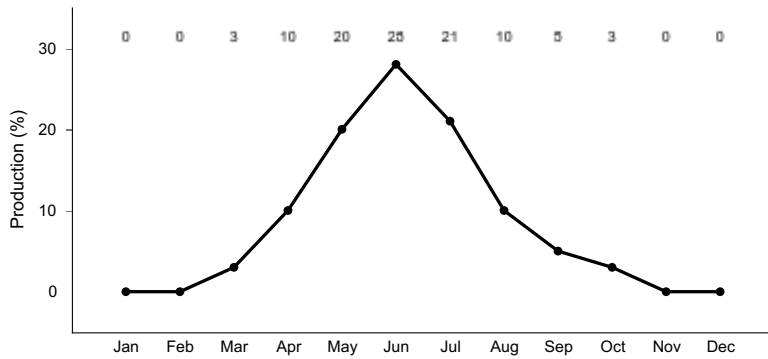


Figure 12. Plant community growth curve (percent production by month). SD0203, Rolling Till Prairie, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

### 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 Needleandthread-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 sod grasses. This state is characterized by the dominance of Kentucky bluegrass and/or 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 sod grasses, 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 sod grasses 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 would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition.

### Dominant plant species

- snowberry (*Symphoricarpos*), shrub
- rose (*Rosa*), shrub
- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- threadleaf sedge (*Carex filifolia*), grass
- blue grama (*Bouteloua gracilis*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- field sagewort (*Artemisia campestris*), other herbaceous

### Community 3.1 Kentucky Bluegrass-Smooth Brome

This plant community phase is a result of extended periods of non-use and no fire. It is characterized by a dominance of smooth brome 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 brome, 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1345	2034	2651
Forb	112	247	432
Shrub/Vine	112	185	280
<b>Total</b>	<b>1569</b>	<b>2466</b>	<b>3363</b>

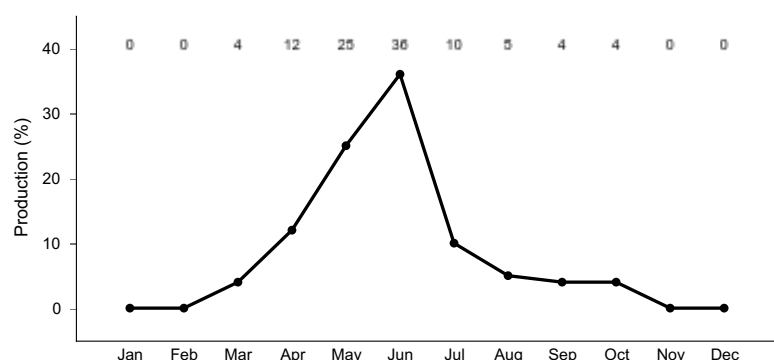


Figure 14. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

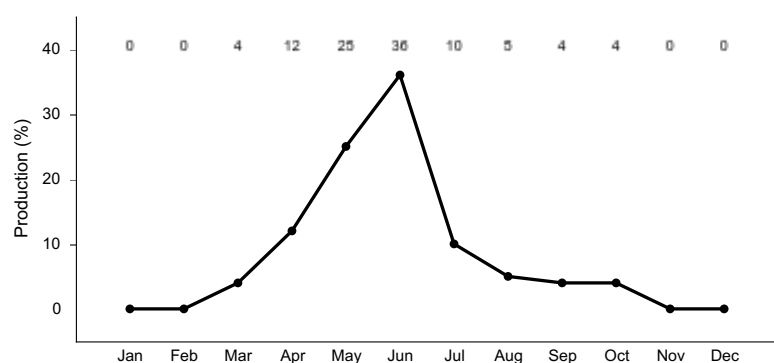
### Community 3.2 Kentucky Bluegrass Sod-Forbs

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 reduced significantly in this phase.

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

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	796	1216	1709
Forb	140	235	359
Shrub/Vine	73	118	174
<b>Total</b>	<b>1009</b>	<b>1569</b>	<b>2242</b>



**Figure 16. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..**

### 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 nonnative invasive and/or 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 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.

#### **Dominant plant species**

- corn (*Zea*), grass
- wheat (*Triticum*), grass
- soybean (*Glycine*), other herbaceous

## **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, sugar beet and a variety of other crops.

## **Transition T1A**

### **State 1 to 2**

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, 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 within the Crop Production State (State 4).

## **Transition T2A**

### **State 2 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, 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 within the Crop Production State (State 4).

## **Restoration pathway R3A**

### **State 3 to 2**

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) coupled with prescribed burning 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
Integrated Pest Management (IPM)

### Transition T3 State 3 to 4

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

### Restoration pathway R4A 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 R4B 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 (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Cool-season Bunchgrasses</b>			269–807	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	135–807	–
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	135–807	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–81	–
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	0–81	–
2	<b>Mid Warm-season Grasses</b>			269–807	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	135–538	–
	prairie dropseed	SPHE	<i>Sporobolus heterolepis</i>	54–404	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	27–135	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	27–135	–
3	<b>Tall Warm-season Grasses</b>			54–404	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	54–404	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–135	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0–135	–
4	<b>Short Warm-season Grasses</b>			54–269	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	27–269	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	27–269	–

	sand dropseed	SPOR	<i>Sporobolus cryptanarus</i>	0-81	-
	threeawn	ARIST	<i>Aristida</i>	0-54	-
5	<b>Grass-likes</b>			54-269	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	54-188	-
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0-135	-
6	<b>Wheatgrass</b>			0-135	
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0-135	-
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-135	-
7	<b>Other Native Grasses</b>			54-135	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0-81	-
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	27-81	-
	fall rosette grass	DIWI5	<i>Dichanthelium wilcoxianum</i>	27-54	-
<b>Forb</b>					
8	<b>Forbs</b>			135-404	
	Forb, native	2FN	<i>Forb, native</i>	27-135	-
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	27-81	-
	blazing star	LIATR	<i>Liatris</i>	27-81	-
	false boneset	BREU	<i>Brickellia eupatorioides</i>	0-54	-
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	27-54	-
	northern bedstraw	GABO2	<i>Galium boreale</i>	0-54	-
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	27-54	-
	stiff sunflower	HEPA19	<i>Helianthus pauciflorus</i>	27-54	-
	anemone	ANEMO	<i>Anemone</i>	0-54	-
	field sagewort	ARCA12	<i>Artemisia campestris</i>	27-54	-
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	27-54	-
	wild bergamot	MOFI	<i>Monarda fistulosa</i>	0-54	-
	scurfpea	PSORA2	<i>Psoralegium</i>	27-54	-
	cutleaf anemone	PUPAM	<i>Pulsatilla patens ssp. multifida</i>	0-54	-
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	27-54	-
	goldenrod	SOLID	<i>Solidago</i>	27-54	-
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	27-54	-
	aromatic aster	SYOB	<i>Symphyotrichum oblongifolium</i>	0-54	-
	hoary verbena	VEST	<i>Verbena stricta</i>	0-54	-
	American vetch	VIAM	<i>Vicia americana</i>	27-54	-
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0-27	-
	milkvetch	ASTRA	<i>Astragalus</i>	0-27	-
	pussytoes	ANTEN	<i>Antennaria</i>	0-27	-
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	0-27	-
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0-27	-
	lacy tansyaster	MAPI	<i>Machaeranthera pinnatifida</i>	0-27	-
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			54-269	
	leadplant	AMCA6	<i>Amorpha canescens</i>	27-135	-



	snowberry	SYMPH	<i>Symphoricarpos</i>	0–81	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–81	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–54	–
	pricklypear	OPUNT	<i>Opuntia</i>	0–54	–
	rose	ROSA5	<i>Rosa</i>	27–54	–

Table 10. Community 2.2 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>			40–303	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	40–303	–
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	0–101	–
2	<b>Mid Warm-season Grasses</b>			40–303	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	20–202	–
	prairie dropseed	SPHE	<i>Sporobolus heterolepis</i>	0–101	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–101	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	0–61	–
3	<b>Tall Warm-season Grasses</b>			0–61	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–40	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–40	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0–20	–
4	<b>Short Warm-season Grasses</b>			202–504	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	101–504	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	20–504	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–101	–
	threeawn	ARIST	<i>Aristida</i>	0–81	–
5	<b>Grass-likes</b>			101–404	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	101–363	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–141	–
6	<b>Wheatgrass</b>			0–40	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–40	–
7	<b>Other Native Grasses</b>			40–101	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–61	–
	fall rosette grass	DIWI5	<i>Dichanthelium wilcoxianum</i>	20–40	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	20–40	–
8	<b>Non-Native Grasses</b>			101–404	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	101–404	–
	smooth brome	BRIN2	<i>Bromus inermis</i>	0–101	–
<b>Forb</b>					
9	<b>Forbs</b>			101–303	
	Forb, native	2FN	<i>Forb, native</i>	0–81	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	20–81	–

	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	20–81	–
	blazing star	LIATR	<i>Liatris</i>	20–61	–
	scurfpea	PSORA2	<i>Psoraleidum</i>	20–61	–
	goldenrod	SOLID	<i>Solidago</i>	20–61	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	20–61	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	20–61	–
	hoary verbena	VEST	<i>Verbena stricta</i>	0–40	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	0–40	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–40	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–20	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–20	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–20	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–20	–
	stiff sunflower	HEPA19	<i>Helianthus pauciflorus</i>	0–20	–
	American vetch	VIAM	<i>Vicia americana</i>	0–20	–
	aromatic aster	SYOB	<i>Symphotrichum oblongifolium</i>	0–20	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–20	–
	wild bergamot	MOFI	<i>Monarda fistulosa</i>	0–20	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–20	–
<b>Shrub/Vine</b>					
10	<b>Shrubs</b>			61–202	
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	20–81	–
	pricklypear	OPUNT	<i>Opuntia</i>	20–61	–
	snowberry	SYMPH	<i>Symphoricarpos</i>	0–61	–
	rose	ROSA5	<i>Rosa</i>	20–40	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–40	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–40	–

Table 11. Community 3.1 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>			0–123	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–123	–
2	<b>Mid Warm-season Grasses</b>			0–74	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–74	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–49	–
3	<b>Short Warm-season Grasses</b>			25–247	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	25–173	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	0–99	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–99	–
	threeawn	ARIST	<i>Aristida</i>	0–25	–
4	<b>Grass-likes</b>			49–247	

	threadleaf sedge	CAFI	<i>Carex filifolia</i>	49–247	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–123	–
5	<b>Wheatgrass</b>			0–49	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–49	–
6	<b>Other Native Grasses</b>			25–123	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–74	–
	fall rosette grass	DIWI5	<i>Dichanthelium wilcoxianum</i>	25–49	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0–25	–
7	<b>Non-Native Grasses</b>			740–1726	
	smooth brome	BRIN2	<i>Bromus inermis</i>	370–1356	–
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	370–1356	–
<b>Forb</b>					
8	<b>Forbs</b>			123–247	
	Forb, introduced	2FI	<i>Forb, introduced</i>	25–74	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	25–74	–
	Forb, native	2FN	<i>Forb, native</i>	0–49	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	25–49	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	25–49	–
	blazing star	LIATR	<i>Liatris</i>	25–49	–
	wild bergamot	MOFI	<i>Monarda fistulosa</i>	25–49	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	25–49	–
	goldenrod	SOLID	<i>Solidago</i>	25–49	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	25–49	–
	aromatic aster	SYOB	<i>Symphotrichum oblongifolium</i>	0–25	–
	hoary verbena	VEST	<i>Verbena stricta</i>	0–25	–
	American vetch	VIAM	<i>Vicia americana</i>	0–25	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–25	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–25	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	0–25	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–25	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–25	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–25	–
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			123–370	
	snowberry	SYMPH	<i>Symphoricarpos</i>	25–247	–
	rose	ROSA5	<i>Rosa</i>	25–99	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–74	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–74	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	25–74	–
	pricklypear	OPUNT	<i>Opuntia</i>	0–49	–

Table 12. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Mid Warm-season Grasses</b>			0–78	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–78	–
2	<b>Short Warm-season Grasses</b>			16–235	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–235	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	0–126	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–94	–
	threeawn	ARIST	<i>Aristida</i>	16–78	–
3	<b>Grass-likes</b>			78–204	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	78–204	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–78	–
4	<b>Other Native Grasses</b>			0–31	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–31	–
	fall rosette grass	DIWI5	<i>Dichanthelium wilcoxianum</i>	0–16	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0–16	–
5	<b>Non-Native Grasses</b>			471–1098	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	471–1098	–
	smooth brome	BRIN2	<i>Bromus inermis</i>	0–157	–
<b>Forb</b>					
6	<b>Forbs</b>			157–314	
	Forb, introduced	2FI	<i>Forb, introduced</i>	16–110	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	16–78	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	16–78	–
	goldenrod	SOLID	<i>Solidago</i>	16–78	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	16–78	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	0–47	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	16–47	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	16–47	–
	blazing star	LIATR	<i>Liatris</i>	0–31	–
	hoary verbena	VEST	<i>Verbena stricta</i>	0–31	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–16	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–16	–
	Forb, native	2FN	<i>Forb, native</i>	0–16	–
<b>Shrub/Vine</b>					
7	<b>Shrubs</b>			78–157	
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	16–94	–
	pricklypear	OPUNT	<i>Opuntia</i>	16–78	–
	snowberry	SYMPH	<i>Symphoricarpos</i>	0–47	–
	rose	ROSA5	<i>Rosa</i>	16–31	–

## **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.

Needlegrass/Bluestem/Prairie Dropseed (1.1 & 2.1)  
Average Annual Production (lbs./acre, air-dry): 2400  
Stocking Rate\* (AUM/acre): 0.66

Grama/Sedge/Kentucky Bluegrass (2.2)  
Average Annual Production (lbs./acre, air-dry): 1800  
Stocking Rate\* (AUM/acre): 0.49

Kentucky Bluegrass/Smooth Bromegrass (3.1)  
Average Annual Production (lbs./acre, air-dry): 2200  
Stocking Rate\* (AUM/acre): 0.60

Kentucky Bluegrass Sod/Forbs (3.2)  
Average Annual Production (lbs./acre, air-dry): 1400  
Stocking Rate\* (AUM/acre): 0.38

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 is typically moderate and runoff potential for this site varies from negligible to medium 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, and/or smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

## **Recreational uses**

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

## Wood products

No appreciable wood products are typically present on this site.

## Other products

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

## Inventory data references

MLRA 102D was created in 2022 with Agricultural Handbook 296 updated. This area was MLRA 102A prior to this time. Information was copied from MLRA 102A ESDs to create the MLRA 102D ESDs.

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; and Bruce Kunze, Soil Scientist, NRCS.

Data Source Sample Period State County  
SCS-RANGE-417 (1008646037) 1986 SD Day  
SCS-RANGE-417 (1008746037) 1987 SD Day

## Other references

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Coterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC. 92 pps.

Gilbert, M. C., Whited, P. M., Clairain Jr, E. J., & Smith, R. D. (2006). A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes. Washington DC.

Samson, F. B., & Knopf, F. L. (1996). Prairie Conservation Preserving North America's Most Endangered Ecosystem. Washington D.C.: Island Press.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed March 2018.

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2003. National Range and Pasture Handbook, Revision 1. Grazing Lands Technology Institute. 214 pps.

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. 672pps.

United States Department of Agriculture, Natural Resources Conservation Service. 2022. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture, Agriculture Handbook 296.

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (<http://soils.usda.gov/technical/nasis/>)

USDA, NRCS. 2018. The PLANTS Database (<http://plants.usda.gov>, 27 March 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

U.S. Environmental Protection Agency [EPA]. 2013. Level III and Level IV Ecoregions of the Continental United States. Corvallis, OR, U.S. EPA, National Health and Environmental Effects Research Laboratory, map scale 1:3,000,000. Available at <http://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states>. (Accessed 1 March 2018).

## Contributors

Megan Baxter  
Stan Boltz  
Lance Howe  
Steve Winter

## Approval

Suzanne Mayne-Kinney, 8/14/2024

## Acknowledgments

Contact for Lead Authors: Natural Resources Conservation Service (USDA-NRCS), Redfield Soil Survey Office Redfield, SD; Lance Howe (Lance.Howe@usda.gov), Soil Survey Office Leader, USDA-NRCS, Redfield, SD; and Steve Winter (Steven.Winter@usda.gov), Soil Scientist, USDA-NRCS, Redfield, SD

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

## 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	12/04/2007
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:** Typically not observable.

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

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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 5-15%.

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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.
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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 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.
- 
12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant: Tall cool-season bunch grass >> mid warm-season bunch grass
- Sub-dominant: > tall warm-season bunch grass = short warm-season grass = short cool-season grass = forb = shrub
- Other:
- Additional:
- 
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):** 2100 – 2800 lbs./acre air-dry weight, average 2,400 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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