

Ecological site R102DY003SD Subirrigated

Last updated: 8/14/2024
Accessed: 09/27/2024

General information

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

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 Subirrigated ecological site typically occurs in drainageways which can receive moderate run off moisture from within the watershed. Soils are formed in alluvium and are somewhat poorly drained, which have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. Vegetation in the Reference State is dominated by warm season grasses including big bluestem, Indiangrass, and switchgrass. Grass-like species occurring on this site may include clustered field sedge. Forbs present may include goldenrod, cudweed sagewort, asters, and western yarrow. Non-native species such as Kentucky bluegrass and smooth brome may invade the site due to changes in disturbance regime.

Associated sites

R102DY004SD	Wet Meadow These sites occur in a basin or closed depression. Soils are poorly drained and the site ponds water for 4 to 8 weeks in the spring of the year or after a heavy rain.
R102DY006SD	Limy Subirrigated These sites occur along the edges of drainageways. Soils are somewhat poorly drained which have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. Soils will effervesce with acid at or near the surface.
R102DY020SD	Loamy Overflow These sites occur in upland swales. Soils are moderately well drained which have water flow into and over/through the site.
R102DY012SD	Thin Upland

Similar sites

R102DY006SD	Limy Subirrigated The Limy Subirrigated site occurs along the edges of drainageways. Soils are similar in drainage class and water table, but will effervesce with acid at or near the surface. A Limy subirrigated site will have less big bluestem, more little bluestem and lower production than a Subirrigated site.
-------------	---

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Andropogon gerardii</i> (2) <i>Sorghastrum nutans</i>

Physiographic features

This site occurs in nearly level drainageways, outwash plains, and floodplains.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Outwash plain (3) Flood plain
Runoff class	Negligible to low
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Frequent
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to occasional
Elevation	1,000–2,100 ft
Slope	0–3%
Water table depth	0–40 in
Aspect	W, NW, N, NE, E, SE, S, SW

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)	112-126 days
Freeze-free period (characteristic range)	134-149 days
Precipitation total (characteristic range)	24-27 in
Frost-free period (actual range)	101-131 days
Freeze-free period (actual range)	129-151 days
Precipitation total (actual range)	22-28 in
Frost-free period (average)	119 days
Freeze-free period (average)	141 days
Precipitation total (average)	25 in

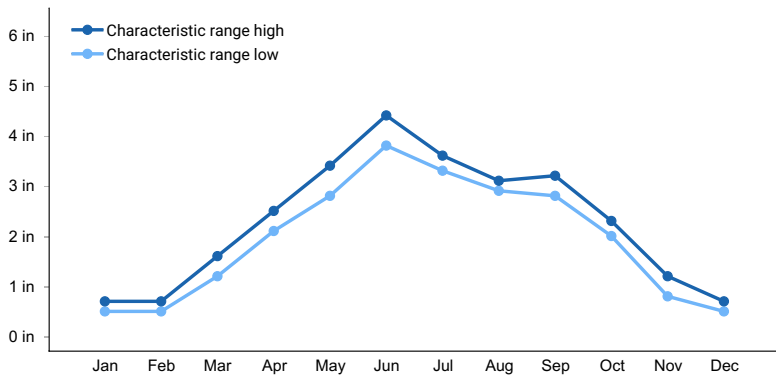


Figure 1. Monthly precipitation range

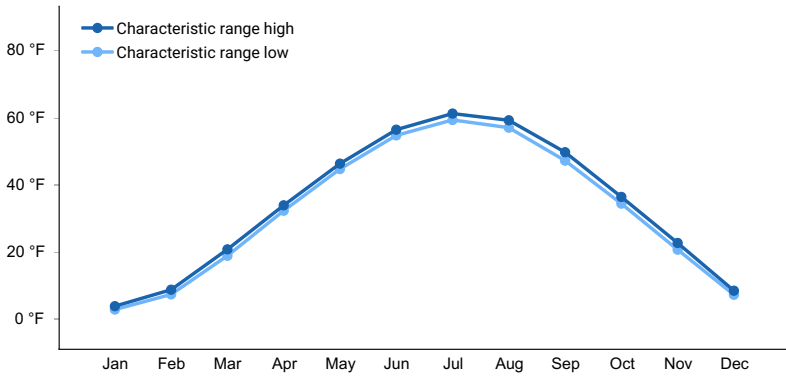


Figure 2. Monthly minimum temperature range

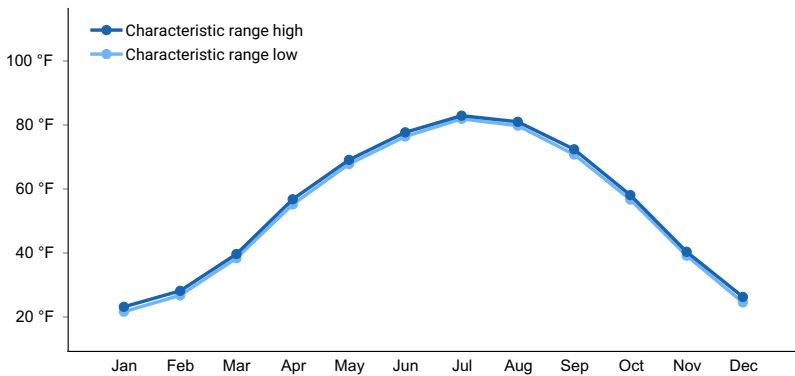


Figure 3. Monthly maximum temperature range

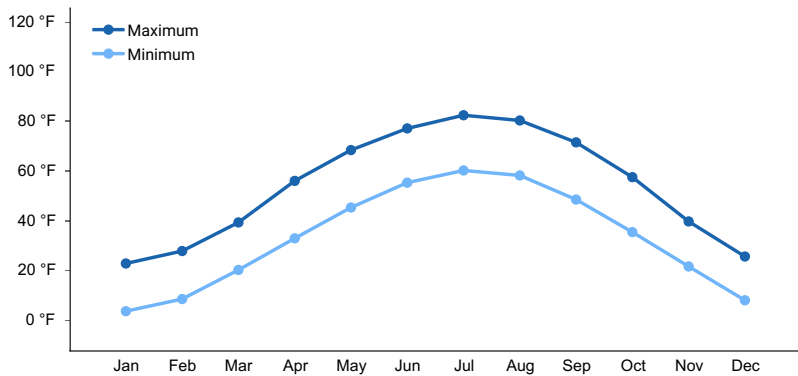


Figure 4. Monthly average minimum and maximum temperature

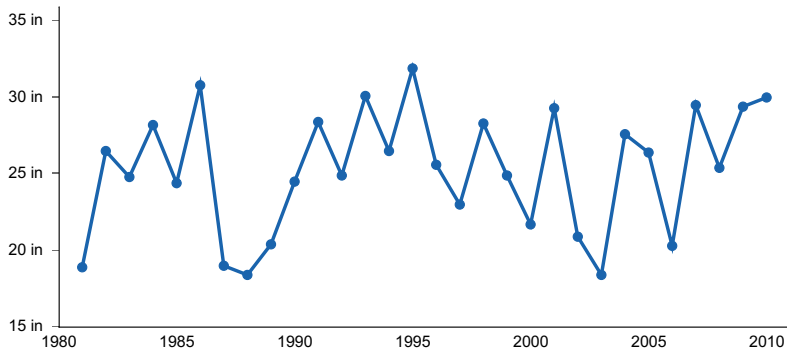


Figure 5. Annual precipitation pattern

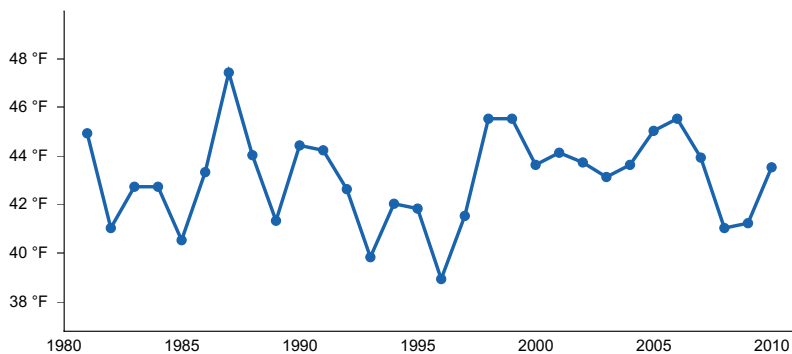


Figure 6. Annual average temperature pattern

Climate stations used

- (1) WAUBAY NWR [USC00398980], Waubay, SD
- (2) WEBSTER [USC00399004], Webster, SD
- (3) SUMMIT 1 W [USC00398116], Summit, SD
- (4) WATERTOWN RGNL AP [USW00014946], Watertown, SD
- (5) WATERTOWN 1W [USC00398930], Watertown, SD
- (6) CASTLEWOOD [USC00391519], Castlewood, SD
- (7) CLEAR LAKE [USC00391777], Clear Lake, SD
- (8) ASTORIA 4S [USC00390422], White, SD
- (9) ARLINGTON 1 W [USC00390281], Arlington, SD
- (10) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (11) TYLER [USC00218429], Tyler, MN

Influencing water features

Soils have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season, typically until August.

Soil features

Soils are formed in alluvium or alluvium over till. Surface textures are primarily silty clay loam and clay loam. Soils are poorly drained or somewhat poorly drained.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Till
Surface texture	(1) Silty clay loam (2) Clay loam
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Slow to moderately rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4.2–8.1 in
Soil reaction (1:1 water) (0-10in)	6.1–8.4
Subsurface fragment volume <=3" (0-60in)	0–4%
Subsurface fragment volume >3" (0-60in)	0%

Ecological dynamics

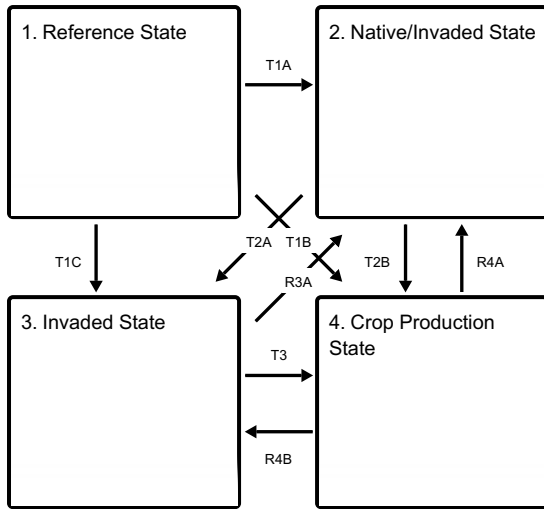
The site which is located in the Prairie Pothole Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse 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 Big Bluestem-Indiangrass-Switchgrass 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 causes Kentucky bluegrass (*Poa pratensis*) to invade and eventually develop into a sod condition. Extended periods of nonuse and no fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and smooth brome (*Bromus inermis*). In time, shrubs such as western snowberry (*Symphoricarpos occidentalis*) will also increase.

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 - Non-use, no fire, heavy continuous grazing, invasion

T1C - Non-native encroachment, seeding of introduced species

T1B - Tillage

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

T2B - Tillage

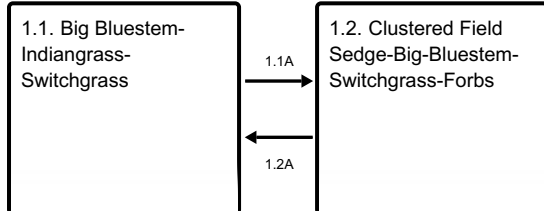
R3A - Long-term prescribed grazing, prescribed burning, seeding

T3 - Tillage

R4A - Seeding

R4B - Seeding, cropping followed by abandonment

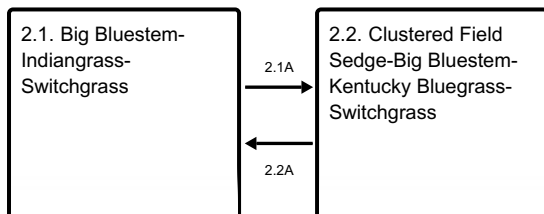
State 1 submodel, plant communities



1.1A - Heavy continuous grazing

1.2A - Prescribed grazing, prescribed burning

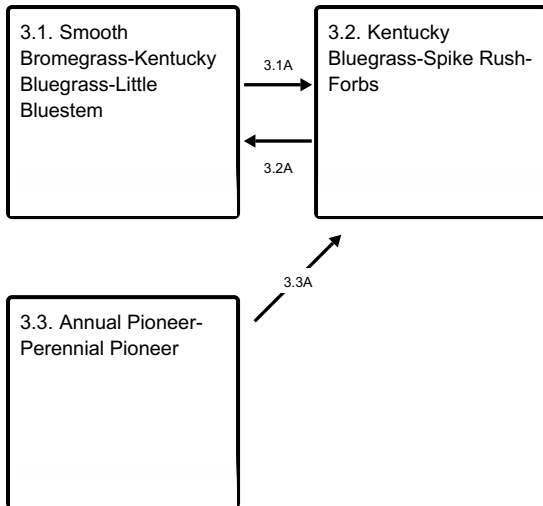
State 2 submodel, plant communities



2.1A - Heavy continuous grazing

2.2A - Prescribed grazing

State 3 submodel, plant communities

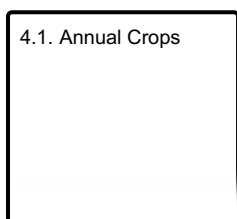


3.1A - Heavy continuous grazing

3.2A - Prescribed grazing

3.3A - Time without disturbance

State 4 submodel, plant communities



State 1

Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ES. This state is typically dominated by warm-season grass and grass-like species. Before European settlement, the primary disturbance mechanisms for this site in the reference condition included periodic fire, grazing by large herding ungulates, and fluctuations in the water table and ponding frequency and duration. Frequent surface fires (3 to 5 years) and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, the primary disturbance is from a lack of fire, concentrated livestock grazing, and weather fluctuations. Species that are desirable for livestock and wildlife can decline and a corresponding increase in less desirable species will occur.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- false indigo bush (*Amorpha fruticosa*), shrub
- rose (*Rosa*), shrub
- willow (*Salix*), shrub
- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- switchgrass (*Panicum virgatum*), grass
- clustered field sedge (*Carex praegracilis*), grass
- Maximilian sunflower (*Helianthus maximiliani*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous
- tall blazing star (*Liatris aspera*), other herbaceous
- Canadian anemone (*Anemone canadensis*), other herbaceous

Community 1.1

Big Bluestem-Indiangrass-Switchgrass

Interpretations are based primarily on the 1.1 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase (this is also considered to be climax). This plant community evolved with grazing by large herbivores, frequent surface fires, and periodic flooding events and is suited for grazing by domestic livestock. This plant community can be found on areas that are grazed and where the grazed plants receive adequate periods of rest during the growing season in order to recover. The potential vegetation was about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses. The major grasses included big bluestem, Indiangrass, and switchgrass. Other grass or grass-like species included little bluestem (*Schizachyrium scoparium*), prairie cordgrass (*Spartina pectinata*), Canada wildrye (*Elymus canadensis*), sideoats grama (*Bouteloua curtipendula*), prairie dropseed (*Sporobolus heterolepis*), slender wheatgrass (*Elymus trachycaulus*), and sedge (*Carex*). 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. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	4070	4671	5130
Forb	230	540	960
Shrub/Vine	100	189	310
Total	4400	5400	6400

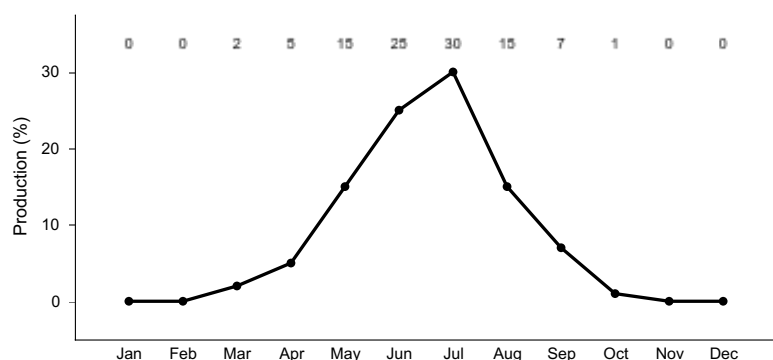


Figure 8. Plant community growth curve (percent production by month). SD0205, Rolling Till Prairie, warm-season dominant.. Warm-season dominant..

Community 1.2

Clustered Field Sedge-Big-Bluestem-Switchgrass-Forbs

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 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grass and grass-like species included clustered field sedge (*Carex praegracilis*), big bluestem, and switchgrass. Grass and grass-like species of secondary importance included Indiangrass, slender wheatgrass, plains bluegrass (*Poa arida*), little bluestem, rush (Juncaceae), and Canada wildrye. Forbs commonly found in this plant community included goldenrod (Solidago), cudweed sagewort (*Artemisia ludoviciana*), heath aster (*Symphotrichum ericoides*), Indian hemp (*Apocynum cannabinum*), and western yarrow (*Achillea millefolium*). This plant community had similar plant composition to the 2.2 Sedge-Bluestem-Kentucky Bluegrass-Switchgrass Plant Community Phase. The main difference is that this plant community phase did not have the presence of non-native invasive grass species. When compared to the 1.1 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase, sedges, plains bluegrass, and grass-like species increased. Production of tall warm-season grasses was 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. Most of the components of the ecological processes would have been functioning at

optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses would have been reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allowed for an increase in shorter-statured (and shallower rooted) species.

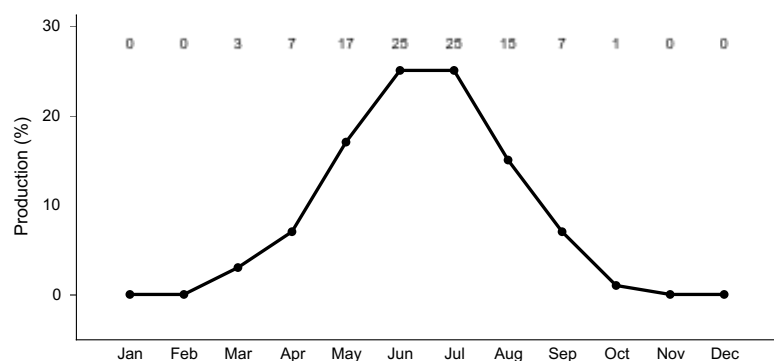


Figure 9. Plant community growth curve (percent production by month). SD0204, Rolling Till Prairie, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..

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 Clustered Field Sedge-Big Bluestem-Switchgrass-Forbs 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 would have converted this plant community to the 1.1 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase.

State 2 Native/Invaded State

This state represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire due to fire suppression. This state is dominated by warm-season grasses. It can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. Taller warm-season species can decline and a corresponding increase in short statured grass will occur.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub
- willow (*Salix*), shrub
- false indigo bush (*Amorpha fruticosa*), shrub
- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- timothy (*Phleum*), grass
- clustered field sedge (*Carex praegracilis*), grass
- Indianhemp (*Apocynum cannabinum*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- American licorice (*Glycyrrhiza lepidota*), other herbaceous

- smooth horsetail (*Equisetum laevigatum*), other herbaceous

Community 2.1

Big Bluestem-Indiangrass-Switchgrass

This plant community phase is similar to the 1.1 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase, but it also contains minor amounts of nonnative invasive grass species such as Kentucky bluegrass and smooth brome grass (up to about 10 percent by air-dry weight). The potential vegetation is about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community is dominated by warm-season grasses. The major grasses include big bluestem, Indiangrass, and switchgrass. Other grass or grass-like species include little bluestem, prairie cordgrass, Canada wildrye, sideoats grama, prairie dropseed, slender wheatgrass, and sedges. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

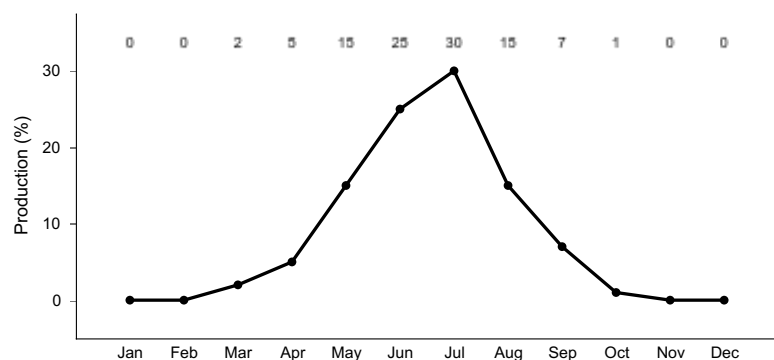


Figure 10. Plant community growth curve (percent production by month). SD0205, Rolling Till Prairie, warm-season dominant.. Warm-season dominant..

Community 2.2

Clustered Field Sedge-Big Bluestem-Kentucky Bluegrass-Switchgrass

This plant community is a result of heavy continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grass and grass-like species include clustered field sedge, big bluestem, Kentucky bluegrass, and switchgrass. Grass and grass-like species of secondary importance include Indiangrass, slender wheatgrass, plains bluegrass, little bluestem, rush, and Canada wildrye. Forbs commonly found in this plant community included goldenrod, cudweed sagewort, heath aster, Indian hemp, and western yarrow. When compared to the 1.1 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase, sedge, plains bluegrass, and grass-like species increased. Kentucky bluegrass has also invaded. Production of tall warm-season grasses was reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. Most of the components of the ecological processes are functioning at optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses are reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allows for an increase in shorter-statured (and shallower rooted) species. The introduction of nonnative invasive species such as Kentucky bluegrass and smooth brome grass (*Bromus inermis*) results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers and the structure will begin to be modified. These changes favor the shallow rooted species and hasten their eventual dominance if steps are not taken to reduce these species.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1975	3654	4205
Forb	185	420	755
Shrub/Vine	40	126	240
Total	2200	4200	5200

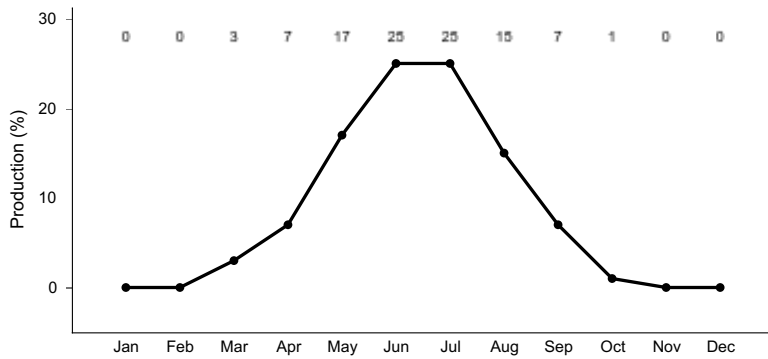


Figure 12. Plant community growth curve (percent production by month). SD0204, Rolling Till Prairie, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..

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 and no surface fire for extended periods of time (typically for 10 years or more) causing litter levels to become high enough to reduce native grass vigor, diversity, and density will shift this community to the 2.2 Clustered Field Sedge-Big Bluestem-Kentucky Bluegrass-Switchgrass Plant Community Phase.

Conservation practices

Prescribed Grazing

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 Big Bluestem-Indiangrass-Switchgrass Plant Community Phase.

State 3 Invaded State

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

Dominant plant species

- rose (*Rosa*), shrub
- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- slender wheatgrass (*Elymus trachycaulus*), grass
- big bluestem (*Andropogon gerardii*), grass
- creeping bentgrass (*Agrostis stolonifera*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- American licorice (*Glycyrrhiza lepidota*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- Canada thistle (*Cirsium arvense*), other herbaceous

Community 3.1

Smooth Bromegrass-Kentucky Bluegrass-Little Bluestem

This plant community phase is a result of extended periods of nonuse and no fire or occasionally light levels of grazing over several years. It is characterized by dominance of smooth bromegrass, Kentucky bluegrass, and little bluestem. 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 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. The dominance of these introduced species has been shown to alter the biotic component of the soil, as well as, organic matter levels and eventually the soil structure. These alterations perpetuate the dominance of Kentucky bluegrass and smooth bromegrass and tend to make establishment of native species extremely difficult.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3550	4296	4955
Forb	205	360	570
Shrub/Vine	45	144	275
Total	3800	4800	5800

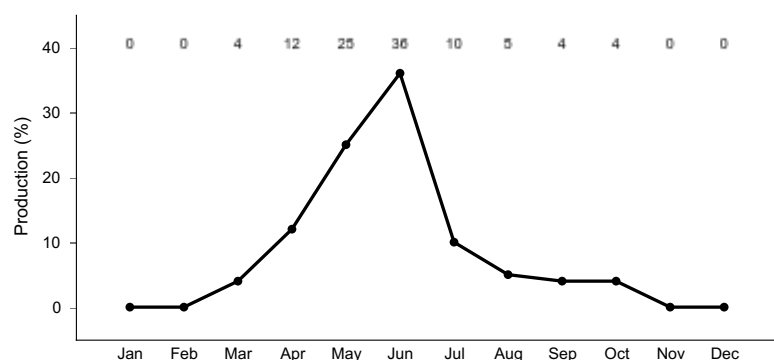


Figure 14. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

Community 3.2

Kentucky Bluegrass-Spike Rush-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, grass-like species, and forbs. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes

accumulate at or above the soil surface and eventually a thatch-mat layer may develop at the surface. 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2065	2595	3015
Forb	135	375	720
Shrub/Vine	0	30	65
Total	2200	3000	3800

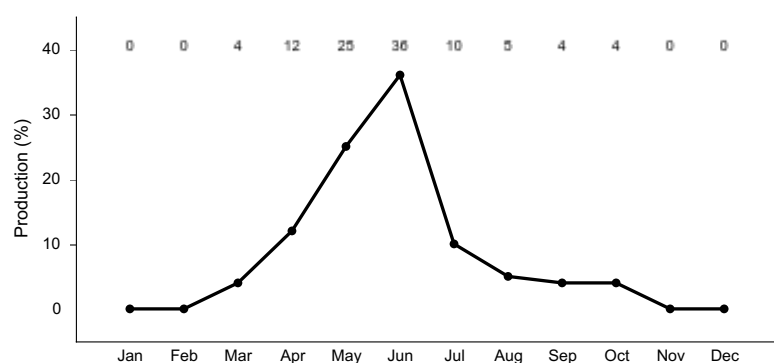


Figure 16. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

Community 3.3 Annual Pioneer-Perennial Pioneer

This plant community developed under continuous heavy grazing or other excessive disturbances. 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.

Pathway 3.1A Community 3.1 to 3.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites and no surface fire for extended periods of time (typically for 10 years or more) causing litter levels to become high enough to reduce native grass vigor, diversity, and density will shift this community to the 3.2 Kentucky Bluegrass-Spike Rush-Forbs Plant Community Phase.

Pathway 3.2A Community 3.2 to 3.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to

moderate grazing possibly including periodic rest may convert this plant community to the 3.1 Smooth Brome-grass-Kentucky Bluegrass-Little Bluestem Plant Community Phase.

Conservation practices

Prescribed Grazing

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-Spike Rush-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 T1C

State 1 to 3

Encroachment of non-native invasive/noxious species, abandonment of cropping, or seeding of introduced and/or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 3) and more specifically to the 3.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition T1B

State 1 to 4

Tillage will cause a shift over a threshold leading to the 3.1 Annual Crops Plant Community Phase 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 Smooth Bromegrass-Kentucky Bluegrass-Little Bluestem Plant 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-Spike Rush-Forbs Plant Community Phase within the Invaded State (State 3). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Transition T2B

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 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 this 3.1 Smooth Bromegrass-Kentucky Bluegrass-Little Bluestem Plant 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 T3

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 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 3.3 Annual Pioneer-Perennial Pioneer Plant Community Phase within the Invaded State (State 3).

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	Tall Warm season Grasses			1250-2240	

1	Tall Warm-season Grasses			1500–5240	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	540–2430	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	540–2430	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	108–1080	–
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	54–540	–
2	Cool-season Grasses			270–810	
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	54–540	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	54–270	–
	plains bluegrass	POAR3	<i>Poa arida</i>	54–162	–
	common rivergrass	SCFE	<i>Scolochloa festucacea</i>	54–162	–
	prairie wedgescale	SPOB	<i>Sphenopholis obtusata</i>	0–162	–
	northern reedgrass	CASTI3	<i>Calamagrostis stricta ssp. inexpansa</i>	54–162	–
3	Mid Warm-season Grasses			270–810	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	270–810	–
	prairie dropseed	SPHE	<i>Sporobolus heterolepis</i>	54–270	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	54–270	–
4	Grass-likes			270–810	
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	54–540	–
	Sartwell's sedge	CASA8	<i>Carex sartwellii</i>	54–540	–
	manyhead sedge	CASY	<i>Carex sychnocephala</i>	54–540	–
	rush	JUNCU	<i>Juncus</i>	54–270	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–162	–
5	Other Native Grasses			0–54	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–270	–
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthes var. scribnerianum</i>	0–54	–
	fall rosette grass	DIWI5	<i>Dichanthelium wilcoxianum</i>	0–54	–
Forb					
6	Forbs			270–810	
	Forb, native	2FN	<i>Forb, native</i>	54–162	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	54–162	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	54–108	–
	tall blazing star	LIAS	<i>Liatris aspera</i>	54–108	–
	Canadian anemone	ANCA8	<i>Anemone canadensis</i>	54–108	–
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	54–108	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	54–108	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	54–108	–
	goldenrod	SOLID	<i>Solidago</i>	54–108	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	54–108	–
	New England aster	SYNO2	<i>Symphyotrichum novae-angliae</i>	54–108	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	0–108	–
	prairie violet	VIPE2	<i>Viola pedatifida</i>	0–54	–
	meadow zizia	ZIAP	<i>Zizia aptera</i>	0–54	–

	smooth horsetail	EQLA	<i>Equisetum laevigatum</i>	0-54	-
	Virginia strawberry	FRVI	<i>Fragaria virginiana</i>	0-54	-
	closed bottle gentian	GEAN	<i>Gentiana andrewsii</i>	0-54	-
	downy gentian	GEPU5	<i>Gentiana puberulenta</i>	0-54	-
	milkweed	ASCLE	<i>Asclepias</i>	0-54	-
	bluebell bellflower	CARO2	<i>Campanula rotundifolia</i>	0-54	-
	palespike lobelia	LOSP	<i>Lobelia spicata</i>	0-54	-
	rough bugleweed	LYAS	<i>Lycopus asper</i>	0-54	-
	Norwegian cinquefoil	PONO3	<i>Potentilla norvegica</i>	0-54	-
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0-54	-
	blackeyed Susan	RUHI2	<i>Rudbeckia hirta</i>	0-54	-
	blue-eyed grass	SISYR	<i>Sisyrinchium</i>	0-54	-
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0-54	-
	common goldstar	HYHI2	<i>Hypoxis hirsuta</i>	0-54	-
Shrub/Vine					
7	Shrubs			108-270	
	leadplant	AMCA6	<i>Amorpha canescens</i>	54-162	-
	false indigo bush	AMFR	<i>Amorpha fruticosa</i>	0-108	-
	rose	ROSA5	<i>Rosa</i>	54-108	-
	willow	SALIX	<i>Salix</i>	0-108	-
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0-108	-

Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Tall Warm-season Grasses			420-1260	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	210-1050	-
	switchgrass	PAVI2	<i>Panicum virgatum</i>	210-840	-
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	0-420	-
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	0-210	-
2	Cool-season Grasses			84-420	
	plains bluegrass	POAR3	<i>Poa arida</i>	84-336	-
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0-294	-
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	0-210	-
	northern reedgrass	CASTI3	<i>Calamagrostis stricta ssp. inexpansa</i>	0-42	-
3	Mid Warm-season Grasses			0-420	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0-420	-
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0-126	-
4	Grass-likes			210-1260	
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	42-840	-
	Sartwell's sedge	CASA8	<i>Carex sartwellii</i>	42-840	-
	manyhead sedge	CASY	<i>Carex sychnocephala</i>	42-840	-
	rush	JUNCU	<i>Juncus</i>	42-336	-
	Grass-like (not a true	2GI	<i>Grass-like (not a true grass)</i>	0-126	-

	Grass-like (not a true grass)	2GL	Grass-like (not a true grass)	0-120	
5	Other Native Grasses			0-210	
	Graminoid (grass or grass-like)	2GRAM	Graminoid (grass or grass-like)	0-210	-
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i>	0-42	-
	fall rosette grass	DIWI5	<i>Dichanthelium wilcoxianum</i>	0-42	-
6	Non-Native Grasses			420-1050	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	210-840	-
	smooth brome	BRIN2	<i>Bromus inermis</i>	42-420	-
	timothy	PHLEU	<i>Phleum</i>	0-336	-
	creeping bentgrass	AGST2	<i>Agrostis stolonifera</i>	0-336	-
Forb					
7	Forbs			210-630	
	Forb, introduced	2FI	Forb, introduced	0-210	-
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	42-168	-
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	42-168	-
	goldenrod	SOLID	<i>Solidago</i>	42-168	-
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	42-168	-
	New England aster	SYNO2	<i>Symphyotrichum novae-angliae</i>	42-126	-
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	0-126	-
	Forb, native	2FN	Forb, native	42-126	-
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	42-126	-
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	42-126	-
	milkweed	ASCLE	<i>Asclepias</i>	0-84	-
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	42-84	-
	smooth horsetail	EQLA	<i>Equisetum laevigatum</i>	0-84	-
	tall blazing star	LIAS	<i>Liatris aspera</i>	0-84	-
	Norwegian cinquefoil	PONO3	<i>Potentilla norvegica</i>	0-42	-
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0-42	-
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	0-42	-
	Canadian anemone	ANCA8	<i>Anemone canadensis</i>	0-42	-
Shrub/Vine					
8	Shrubs			42-210	
	Shrub (>.5m)	2SHRUB	Shrub (>.5m)	0-84	-
	leadplant	AMCA6	<i>Amorpha canescens</i>	0-84	-
	rose	ROSA5	<i>Rosa</i>	42-84	-
	willow	SALIX	<i>Salix</i>	0-42	-
	false indigo bush	AMFR	<i>Amorpha fruticosa</i>	0-42	-

Table 11. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Tall Warm-season Grasses			0-480	

	big bluestem	ANGE	<i>Andropogon gerardii</i>	0-480	-
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0-240	-
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	0-240	-
2	Cool-season Grasses			48-720	
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0-480	-
	plains bluegrass	POAR3	<i>Poa arida</i>	48-480	-
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	0-96	-
3	Mid Warm-season Grasses			0-480	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0-384	-
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0-144	-
4	Grass-likes			240-960	
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	0-720	-
	Sartwell's sedge	CASA8	<i>Carex sartwellii</i>	0-720	-
	manyhead sedge	CASY	<i>Carex sychnocephala</i>	0-720	-
	rush	JUNCU	<i>Juncus</i>	0-336	-
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0-240	-
5	Other Native Grasses			0-240	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0-240	-
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthes var. scribnerianum</i>	0-48	-
	fall rosette grass	DIWI5	<i>Dichanthelium wilcoxianum</i>	0-48	-
6	Non-Native Grasses			960-2640	
	smooth brome	BRIN2	<i>Bromus inermis</i>	720-2400	-
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	240-1200	-
	creeping bentgrass	AGST2	<i>Agrostis stolonifera</i>	0-480	-
	timothy	PHLEU	<i>Phleum</i>	0-480	-
Forb					
7	Forbs			240-480	
	Forb, introduced	2FI	<i>Forb, introduced</i>	48-192	-
	Forb, native	2FN	<i>Forb, native</i>	0-144	-
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	48-144	-
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	48-144	-
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	48-144	-
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	0-144	-
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	48-96	-
	goldenrod	SOLID	<i>Solidago</i>	48-96	-
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	48-96	-
	New England aster	SYNO2	<i>Symphyotrichum novae-angliae</i>	48-96	-
	tall blazing star	LIAS	<i>Liatris aspera</i>	0-48	-
	rough bugleweed	LYAS	<i>Lycopus asper</i>	0-48	-
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0-48	-
	milkweed	ASCLE	<i>Asclepias</i>	0-48	-
	bluebell bellflower	CARO2	<i>Campanula rotundifolia</i>	0-48	-

	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–48	–
	smooth horsetail	EQLA	<i>Equisetum laevigatum</i>	0–48	–
Shrub/Vine					
8	Shrubs			48–240	
	willow	SALIX	<i>Salix</i>	0–144	–
	rose	ROSA5	<i>Rosa</i>	0–96	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–96	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–48	–
	false indigo bush	AMFR	<i>Amorpha fruticosa</i>	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	Tall Warm-season Grasses			0–90	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–90	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0–90	–
2	Cool-season Grasses			0–210	
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–150	–
	plains bluegrass	POAR3	<i>Poa arida</i>	0–150	–
3	Mid Warm-season Grasses			0–90	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–90	–
4	Grass-likes			150–600	
	rush	JUNCU	<i>Juncus</i>	60–450	–
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	0–150	–
	Sartwell's sedge	CASA8	<i>Carex sartwellii</i>	0–150	–
	manyhead sedge	CASY	<i>Carex sychnocephala</i>	0–150	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–90	–
5	Other Native Grasses			0–150	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–150	–
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthes var. scribnerianum</i>	0–30	–
	fall rosette grass	DIWI5	<i>Dichanthelium wilcoxianum</i>	0–30	–
6	Non-Native Grasses			600–2100	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	300–1800	–
	timothy	PHLEU	<i>Phleum</i>	0–450	–
	creeping bentgrass	AGST2	<i>Agrostis stolonifera</i>	0–450	–
	smooth brome	BRIN2	<i>Bromus inermis</i>	0–240	–
Forb					
7	Forbs			150–600	
	Forb, introduced	2FI	<i>Forb, introduced</i>	30–300	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	30–240	–
	goldenrod	SOLID	<i>Solidago</i>	30–240	–

	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	30–210	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	30–210	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	30–150	–
	New England aster	SYNO2	<i>Symphyotrichum novae-angliae</i>	30–150	–
	Forb, native	2FN	<i>Forb, native</i>	0–60	–
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	0–30	–
	smooth horsetail	EQLA	<i>Equisetum laevigatum</i>	0–30	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	0–30	–
Shrub/Vine					
8	Shrubs			0–60	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–60	–
	rose	ROSA5	<i>Rosa</i>	0–60	–

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.

Big Bluestem/Indiangrass/Switchgrass (1.1 & 2.1)

Average Annual Production (lbs./acre, air-dry):5400

Stocking Rate* (AUM/acre): 1.48

Sedge/Bluestem/Kentucky Bluegrass/Switchgrass (2.2)

Average Annual Production (lbs./acre, air-dry):4200

Stocking Rate* (AUM/acre): 1.15

Smooth Bromegrass/Kentucky Bluegrass/Bluestem (3.1)

Average Annual Production (lbs./acre, air-dry):4800

Stocking Rate* (AUM/acre): 1.32

Kentucky Bluegrass/Rush/Forbs (3.2)

Average Annual Production (lbs./acre, air-dry):3000

Stocking Rate* (AUM/acre): 0.82

Annual/Pioneer, Non-Native Perennial (3.3)

Average Annual Production (lbs./acre, air-dry):1600

Stocking Rate* (AUM/acre): 0.44

*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 groups B, C and D. Infiltration is typically moderate to moderately slow and runoff potential for this site varies from negligible to low 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. 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 (0018546011) 1985 SD Brookings
SCS-RANGE-417 (5018546025) 1985 SD Clark

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
Steven 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.

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than 5% and less than 2 inches in diameter.

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. Plant litter remains in place and is not moved by erosional forces.

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

Sub-dominant: > tall cool-season bunch grass > short cool-season grass > forb

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.
-
14. **Average percent litter cover (%) and depth (in):** 85-90%, roughly 0.5 inch thick or less. Litter cover is in contact with soil surface.
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 4800 – 6000 lbs./acre air-dry weight, average 5,400 lbs./acre air-dry weight
-
16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Refer to State and Local Noxious Weed List, also Kentucky bluegrass, smooth brome grass
-
17. **Perennial plant reproductive capability:** All species are capable of reproducing.
-