USDA Natural Resources Conservation Service

Ecological site R102AY009SD
Sandy

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General information

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

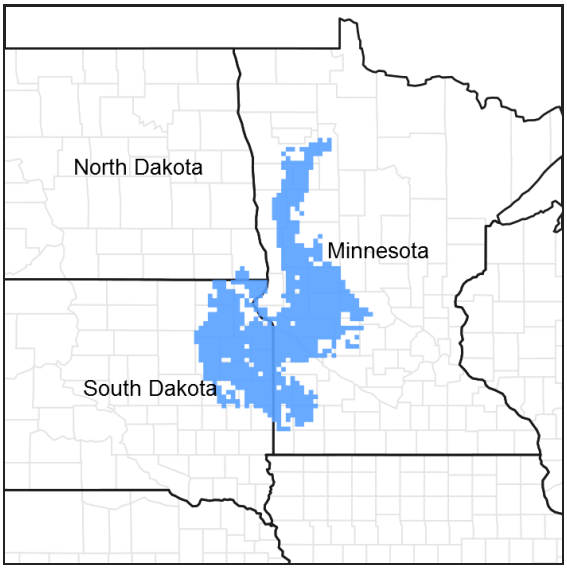


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 102A–Rolling Till Prairie

The Rolling Till Prairie (102A) is located within the Central Feed Grains and Livestock Land Resource Region. It spans 3 states (Minnesota 58 percent, South Dakota 42 percent, and small part in North Dakota), encompassing over 16,000 square miles (Figure 1). The elevation ranges from approximately over 2,000 feet above sea level (ASL) on the Prairie Coteau in Northeastern South Dakota to about 1,000 feet ASL on lowlands. The dominate landform in this area are stagnation moraines, end moraines, glacial outwash plains, terraces, and flood plains. The area is dominated by till covered moraines. The stagnation moraines are gently undulating to steep and have many depressions and poorly defined drainages. Small outwash areas are adjacent to the watercourses. The Cretaceous Pierre Shale underlies the till in the most of the area. Precambrian rocks also occur at depth. Granite is quarried near Milbank, South Dakota and outcrops of Sioux Quartzite are common. (USDA-NRCS 2006).

The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a frigid soil temperature regime, an aquic or udic soil moisture regime, and mixed mineralogy. They generally are very deep, well drained to very poorly drained. This area supports true prairie vegetation characterized by big bluestem (Andropogon gerardii), little bluestem (*Schizachyrium scoparium*), porcupinegrass (*Hesperostipa spartea*), and green needlegrass (Nassella viridula). Prairie cordgrass (Spartina pectinata) commonly grows in wet areas. (USDA-NRCS 2006).

Classification relationships

Major Land Resource Area (MLRA): Rolling Till Prairie (102A) (USDA-NRCS 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Upper Minnesota River-Des Moines Lobe Subsection (251Ba); Outer Coteau des Prairies Subsection (251Bb); Northwest Iowa Plains Subsection (251Bd); Minnesota and Northeast Iowa Morainal-Oak Savannah Section (222M); Alexandria Moraine-Hardwood Hills Subsection (222Ma) (Cleland et al. 2007).

US EPA Level IV Ecoregion: Tewaukon/Big Stone Stagnation Moraine (46e), Prairie Coteau (46k), Prairie Coteau Escarpment (46l), Big Sioux Basin (46m), Minnesota River Prairie (46o), Des Moines Lobe (47b) , Lake Agassiz Plains (48d), Alexandria Moraines and Detroit Lakes Outwash Plain (51j) (USEPA 2013)

Ecological site concept

The Sandy ecological site typically occurs in an upland area. Soils vary from moderately well drained to somewhat excessively drained. The surface and subsoil textures are sandy loam, fine sandy loam, loamy very fine sand. Slopes can range from 0 to 40 percent. Vegetation in the Reference State is dominated by warm season grasses including big bluestem, switchgrass and cool-season needlegrasses. Forbs include cudweed sagewort, prairie coneflower, and western yarrow. Non-native grasses such as Kentucky bluegrass and smooth bromegrass may invade with shifts in disturbance regime.

Associated sites

R102AY010SD	**Loamy** These sites occur on upland areas. Soils are well drained. The surface and subsoil textures are loam, silt loam, silty clay loam, clay loam, sandy clay loam, and very fine sandy loam. The central concept soil series is Barnes, Forman, and Poinsett, but other series are included.
R102AY012SD	**Thin Upland** These sites occur on uplands. Soils are well drained and will effervesce with acid at or near the surface. The central concept soil series is Buse, Langhei, and Zell, but other series are included.
R102AY020SD	**Loamy Overflow** These sites occur in upland swales. Soils are moderately well drained. The surface and subsoil textures are loam, silt loam, silty clay loam, clay loam, sandy clay loam, and very fine sandy loam. The central concept soil series is Aastad, Svea, and Waubay, but other series are included.

Similar sites

R102AY020SD	**Loamy Overflow** The Loamy Overflow site may occur similar in landscape position, but the surface and subsoil textures are silt loam, silty clay loam, sandy clay loam, and very fine sandy loam. A Loamy Overflow site will have more big bluestem and higher production than a Sandy site.
R102AY010SD	**Loamy** The Loamy site may occur similar in landscape position, but the surface and subsoil textures are silt loam, silty clay loam, sandy clay loam, and very fine sandy loam. A Loamy site will have more green needlegrass and western wheatgrass and less needleandthread than a Sandy site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Hesperostipa comata*

Physiographic features

The Sandy ecological site typically occurs in an upland area.

Table 2. Representative physiographic features

Landforms	(1) Upland
Elevation	1,000–2,000 ft
Slope	0–40%
Water table depth	39–80 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 102A is considered to have a continental climate – cold winters and relatively hot summers, low to moderate humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 21 to 27 inches per year. The average annual temperature is about 43°F. January is the coldest month with average temperatures ranging from about 5°F (Mahnomen 1 W, Minnesota (MN)), to about 14°F (Tracy, MN). July is the warmest month with temperatures averaging from about 69°F (Mahnomen 1 W, MN), to about 73°F (Tracy, MN). The range of normal average monthly temperatures between the coldest and warmest months is about 62°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Greenup of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	112-127 days
Freeze-free period (characteristic range)	137-151 days
Precipitation total (characteristic range)	25-28 in
Frost-free period (actual range)	99-131 days
Freeze-free period (actual range)	130-153 days
Precipitation total (actual range)	24-28 in
Frost-free period (average)	120 days
Freeze-free period (average)	143 days
Precipitation total (average)	26 in

Climate stations used

- (1) CLARK [USC00391739], Clark, SD
- (2) ROY LAKE [USC00397326], Lake City, SD
- (3) CLEAR LAKE [USC00391777], Clear Lake, SD
- (4) CASTLEWOOD [USC00391519], Castlewood, SD
- (5) MORRIS WC EXP STN [USC00215638], Hancock, MN
- (6) BENSON [USC00210667], Benson, MN
- (7) GLENWOOD 2 WNW [USC00213174], Glenwood, MN
- (8) ARLINGTON 1 W [USC00390281], Arlington, SD
- (9) ARTICHOKE LAKE [USC00210287], Correll, MN
- (10) BROOKINGS 2 NE [USC00391076], Brookings, SD

- (11) BROWNS VALLEY [USC00211063], Beardsley, MN
- (12) FERGUS FALLS [USC00212768], Fergus Falls, MN
- (13) FOSSTON 1 E [USC00212916], Fosston, MN
- (14) LAKE WILSON [USC00214534], Lake Wilson, MN
- (15) MAHNOMEN [USC00215012], Mahnomen, MN
- (16) MELROSE [USC00215325], Melrose, MN
- (17) MILAN 1 NW [USC00215400], Milan, MN
- (18) MILBANK 4 NW [USC00395536], Milbank, SD
- (19) PIPESTONE [USC00216565], Pipestone, MN
- (20) SISSETON [USC00397742], Sisseton, SD
- (21) SUMMIT 1 W [USC00398116], Summit, SD
- (22) TRACY [USC00218323], Tracy, MN
- (23) TYLER [USC00218429], Tyler, MN
- (24) WATERTOWN 1W [USC00398930], Watertown, SD
- (25) WEBSTER [USC00399004], Webster, SD

Influencing water features

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

Soil features

The Sandy ecological site typically occurs in an upland area. Soils vary from moderately well drained to somewhat excessively drained. The surface and subsoil textures are sandy loam, fine sandy loam, loamy very fine sand. The central concept soil series is Egeland, Embden, and Swenoda, but others are included.

Table 4. Representative soil features

Surface texture	(1) Sandy loam (2) Fine sandy loam (3) Loamy very fine sand
Family particle size	(1) Sandy
Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Moderate to moderately rapid
Soil depth	80 in
Surface fragment cover <=3"	0–2%
Available water capacity (0-40in)	4–6 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–7%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

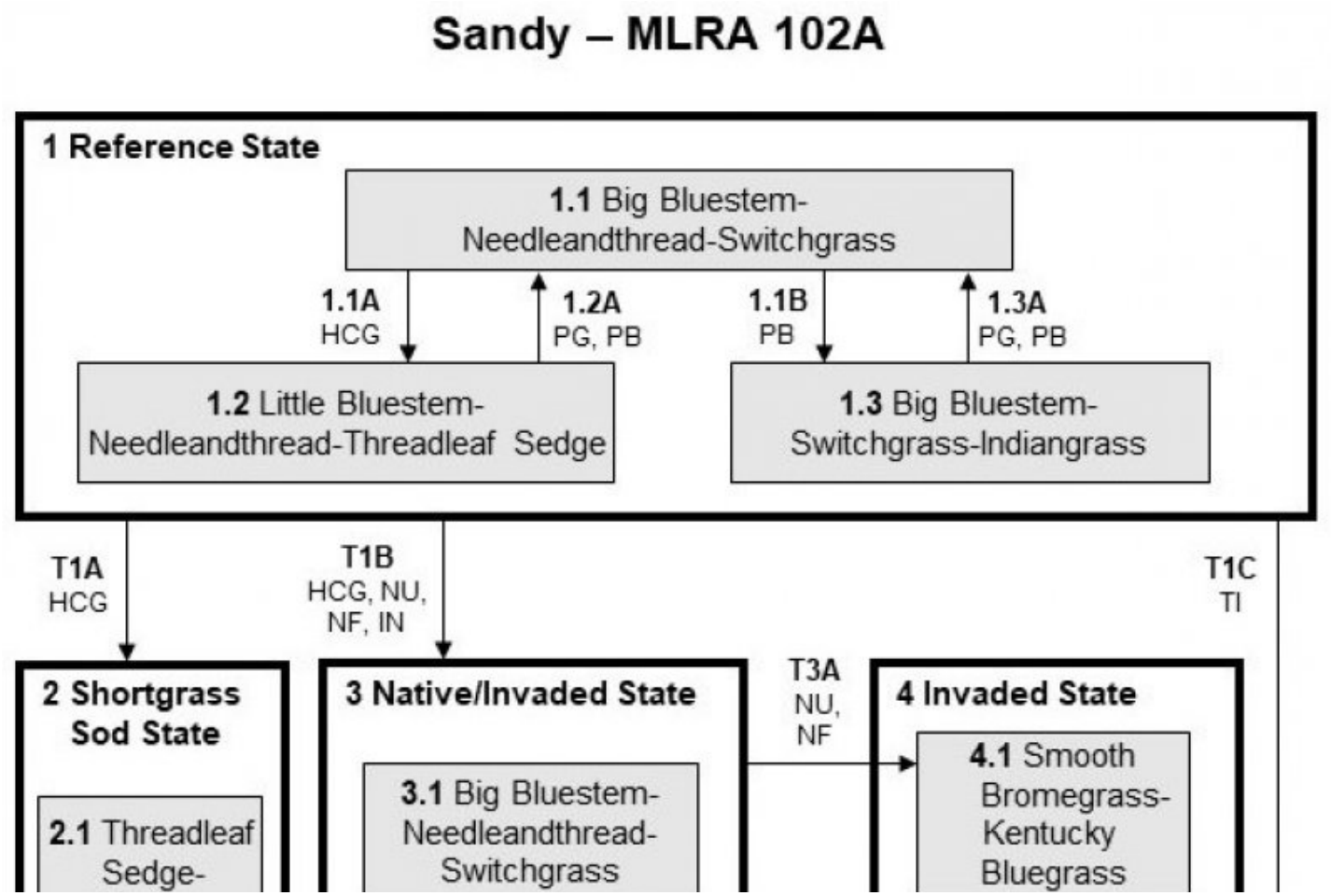
The site which is located in the Prairie Pothole Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant

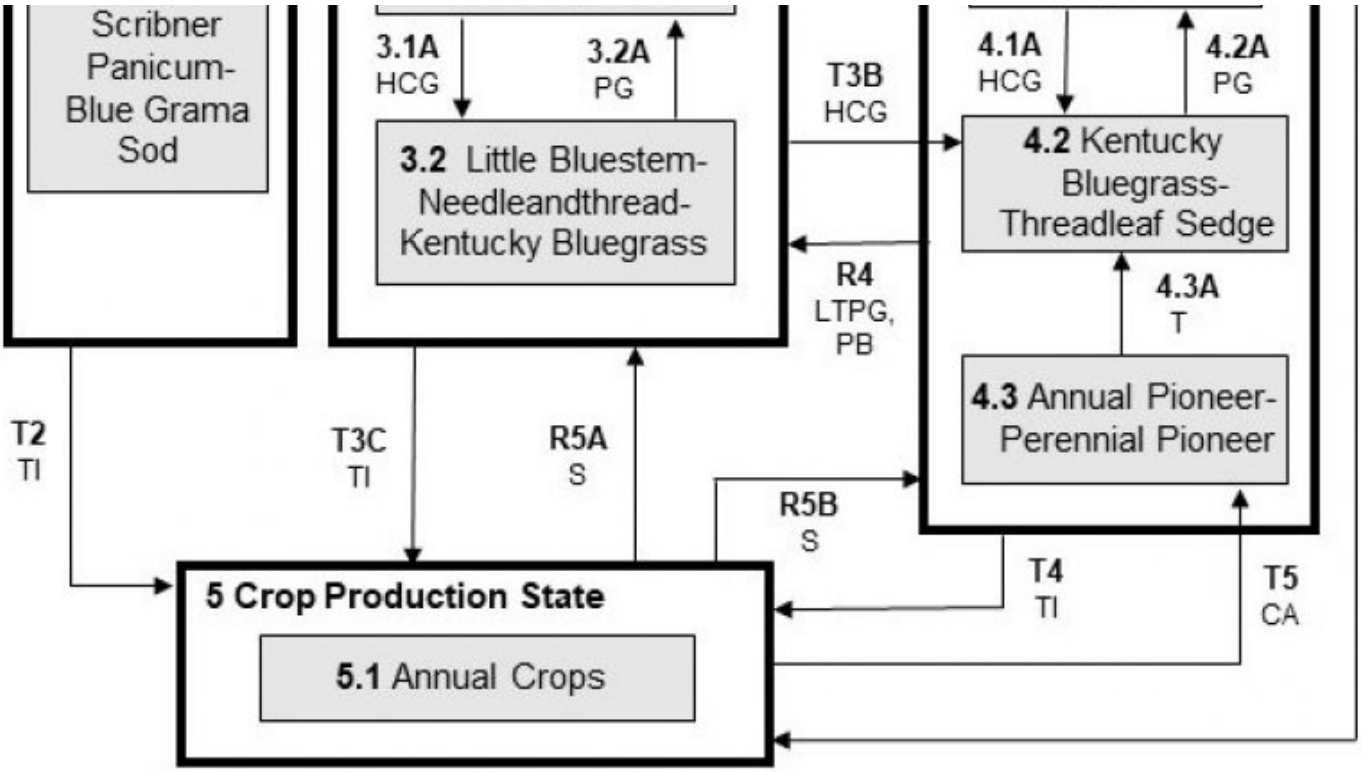
communities due to weather fluctuations and/or management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Big Bluestem-Needleandthread-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. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

This ecological site (ES) has been grazed by domestic livestock since they 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 1.1Big Bluestem-Needleandthread-Switchgrass Plant Community Phase. Sedge (Cyperaceae), Scribner's panicum (*Dichanthelium oligosanthes*), and blue grama (*Bouteloua gracilis*) will increase and eventually develop into a sod. Little bluestem (*Schizachyrium scoparium*) will increase initially and then begin to decrease. Needleandthread, porcupine grass (*Hesperostipa spartea*), sideoats grama (*Bouteloua curtipendula*), big bluestem 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 bromegrass (*Bromus inermis*).

Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable 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





LEGEND
Sandy – R102AY009SD

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

Code	Process
T1A	Heavy continuous grazing
T1B	Heavy continuous grazing, no use, no fire, invasion
T1C	Tillage
T2	Tillage
T3A	No use, no fire
T3B	Heavy continuous grazing
T3C	Tillage
T4	Tillage
T5	Abandonment of cropping
1.1A	Heavy continuous grazing
1.1B	Prescribed burning
1.2A	Prescribed grazing with recovery periods, prescribed burning
1.3A	Prescribed grazing with recovery periods, prescribed burning
3.1A	Heavy continuous grazing
3.2A	Prescribed grazing with recovery periods
4.1A	Heavy continuous grazing
4.2A	Prescribed grazing with recovery periods
4.3A	Time w/wo disturbances
R4	Long term prescribed grazing, prescribed burning
R5A	Seeding
R5B	Seeding

State 1
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ecological site (ES). This state was dominated by warm-season grasses with cool-season grasses being subdominant. 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. Cool-season and taller warm-season grasses would have declined and a corresponding increase in short, warm-season grasses would have occurred. Today, a similar state can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest.

Community 1.1
Big Bluestem-Needleandthread-Switchgrass

Interpretations are based primarily on the 1.1 Big Bluestem-Needleandthread-Switchgrass Plant Community Phase (this is also considered to be climax). The potential vegetation was about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses, with cool-season grasses subdominant. The major grasses included big bluestem, needleandthread, switchgrass, sand bluestem (*Andropogon hallii*), prairie sandreed (Calamovifa longifolia), little bluestem, and porcupine grass. Other grass or grass-like species included sideoats grama, blue grama, threadleaf sedge (*Carex filifolia*), and Indiangrass (*Sorghastrum nutans*). 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2190	2936	3630
Forb	145	248	385
Shrub/Vine	65	116	185
Total	**2400**	**3300**	**4200**

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..

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

Community 1.2
Little Bluestem-Needleandthread-Threadleaf Sedge

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 grasses included little bluestem, needleandthread, threadleaf sedge, prairie sandreed, and blue grama. Grasses of secondary importance included sideoats grama, porcupine grass, big bluestem, and sand dropseed (*Sporobolus cryptandrus*). Forbs commonly found in this plant community included cudweed sagewort (*Artemisia ludoviciana*), prairie coneflower (*Ratibida columnifera*), and western yarrow (*Achillea millefolium*). This plant community had similar plant composition to the 3.2 Little Bluestem-Needleandthread-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 bromegrass. When compared to the 1.1 Big Bluestem-Needleandthread-Switchgrass Plant Community Phase, needleandthread, threadleaf sedge, and blue grama increased. Big bluestem and porcupine grass 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 10. Plant community growth curve (percent production by month). SD0203, Rolling Till Prairie, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

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

Community 1.3
Big Bluestem-Switchgrass-Indiangrass

This plant community was a result of fire occurring at relatively frequent intervals (3 to 5 years). This phase could have also resulted from a combination of grazing events immediately following early season fire (i.e., large ungulates attracted to highly nutritious vegetative growth following a fire). These events would have caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would have increased in vigor and production leading to a temporary shift to this phase. Needlegrasses would have decreased most significantly amongst the cool-season grasses. The potential vegetation was about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses. The major grasses included big bluestem, little bluestem, Indiangrass, switchgrass, prairie sandreed, and sideoats grama. Other grass or grass-like species included porcupine grass, needleandthread, blue grama, and threadleaf sedge. This plant community was not resistant to change and would have readily shifted back to the 1.1 Big Bluestem-Needleandthread-Switchgrass Plant Community Phase with a return of more normal fire return intervals.

Figure 11. Plant community growth curve (percent production by month). SD0205, Rolling Till Prairie, warm-season dominant.. Warm-season dominant..

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

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 Little Bluestem-Needleandthread-Threadleaf Sedge Plant Community Phase.

Pathway 1.1B
Community 1.1 to 1.3

Prescribed Burning occurring at relatively frequent intervals (3 to 5 years), and occasional grazing events immediately following early season fire caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire, which would increase in vigor and production leading to a temporary shift to the 1.3 Big Bluestem-Switchgrass-Indiangrass 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 Big Bluestem-Needleandthread-Switchgrass Plant Community Phase.

Pathway 1.3A

Community 1.3 to 1.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest and/or prescribed burning with late season fire or at infrequent intervals (greater than 5 years) will convert this plant community to the 1.1 Big Bluestem-Needleandthread-Switchgrass Plant Community Phase.

State 2
Shortgrass Sod State

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

Community 2.1
Threadleaf Sedge-Scribner Panicum-Blue Grama Sod

This plant community evolved under heavy continuous season grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses typically included threadleaf sedge, Scribner's panicum, and blue grama. Grasses of secondary importance included little bluestem and needleandthread. Forbs commonly found in this plant community included cudweed sagewort, green sagewort (*Artemisia campestris*), and western yarrow. This vegetation state was very resistant to change. The herbaceous species present were well adapted to grazing. This plant community was less productive than other phases. The thick sod prevented other species from getting established due to decreased infiltration and increased runoff.

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

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

State 3
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 cool- and warm-season grasses. It can be found on areas that are properly managed with grazing and/or prescribed burning and sometimes on areas receiving occasional short periods of rest. Taller cool-season species can decline and a corresponding increase in short statured grass will occur.

Community 3.1
Big Bluestem-Needleandthread-Switchgrass

This plant community phase is similar to the 1.1 Big Bluestem-Needleandthread-Switchgrass Plant Community Phase, but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 15 percent by air-dry weight). The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community is dominated by warm-season grasses, with cool-season grasses subdominant. The major grasses include big bluestem, needleandthread, switchgrass, porcupine grass, little bluestem, and prairie sandreed. Other grass or grass-like species include sideoats grama, blue grama, threadleaf sedge, Indiangrass, prairie dropseed, and Kentucky bluegrass. 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 13. Plant community growth curve (percent production by month).

SD0204, Rolling Till Prairie, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..

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

Community 3.2
Little Bluestem-Needleandthread-Kentucky Bluegrass

This plant community is a result of heavy continuous grazing, continuous season-long grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grasses include little bluestem, needleandthread, prairie sandreed, threadleaf sedge, blue grama and Kentucky bluegrass. Grasses of secondary importance include sideoats grama, porcupine grass, and sand dropseed. Forbs commonly found in this plant community include cudweed sagewort, prairie coneflower, and western yarrow. When compared to the 1.1 Big Bluestem-Needleandthread-Switchgrass Plant Community Phase, threadleaf sedge, needleandthread, and blue grama have increased. Big bluestem, switchgrass, and porcupine grass have decreased, and production of mid- and tall warm-season grasses has also been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1550	2076	2550
Forb	105	240	420
Shrub/Vine	45	84	130
Total	**1700**	**2400**	**3100**

Figure 15. Plant community growth curve (percent production by month). SD0203, Rolling Till Prairie, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

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

Pathway 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 Little Bluestem-Needleandthread-Kentucky Bluegrass Plant Community Phase.

Pathway 3.2A
Community 3.2 to 3.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 3.1 Big Bluestem-Needleandthread-Switchgrass Plant Community Phase.

Conservation practices

Prescribed Grazing

State 4
Invaded State

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass and smooth bromegrass, and an increasing thatch layer that effectively blocks introduction of other plants into the system. 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 the invasive grass 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. Once the state is well established, even drastic events such as high intensity fires driven by high fuel loads of litter and thatch will not result in more than a very short term reduction of Kentucky bluegrass. These events may reduce the dominance of Kentucky bluegrass, but due to the large amount of rhizomes in the soil, there is no opportunity for the native species to establish and dominate before Kentucky bluegrass rebounds and again dominates the system.

Community 4.1
Smooth Bromegrass-Kentucky Bluegrass

This plant community phase is a result of extended periods of nonuse and no fire. It is characterized by a dominance of smooth bromegrass and Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface and eventually a thatch-mat layer may develop at the surface. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. When dominated by smooth bromegrass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2010	2670	3290
Forb	135	225	345
Shrub/Vine	55	105	165
Total	**2200**	**3000**	**3800**

Figure 17. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

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

Community 4.2
Kentucky Bluegrass-Threadleaf Sedge

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, threadleaf 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	995	1653	2270
Forb	90	190	330
Shrub/Vine	15	57	100
Total	**1100**	**1900**	**2700**

Figure 19. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

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

Community 4.3
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.

Pathway 4.1A
Community 4.1 to 4.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 4.2 Kentucky Bluegrass-Threadleaf Sedge Plant Community Phase.

Pathway 4.2A
Community 4.2 to 4.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 4.1 Smooth Bromegrass-Kentucky Bluegrass Plant Community Phase.

Conservation practices

Prescribed Grazing

Pathway 4.3A
Community 4.3 to 4.2

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 4.2 Kentucky Bluegrass-Threadleaf Sedge Plant Community Phase.

State 5
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. Cropping on this site is enabled during years with drier than normal precipitation or with artificial drainage (surface or subsurface).

Community 5.1
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

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year, typically beginning early in the season) will convert this plant community to the 2.1 Threadleaf Sedge-Scribner Panicum-Blue Grama Sod Plant Community Phase within the Shortgrass Sod State.

Transition T1B
State 1 to 3

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, 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 3).

Transition T1C
State 1 to 5

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

Transition T5
State 2 to 4

Encroachment of non-native invasive/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 4) and more specifically to the 4.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition T2
State 2 to 5

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

Transition T3A
State 3 to 4

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, will likely lead this state over a threshold

leading to the 4.1 Smooth Bromegrass-Kentucky Bluegrass Community Phase within the Invaded State (State 4). Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year), will likely lead this state over a threshold leading to the 4.2 Kentucky Bluegrass-Threadleaf Sedge Plant Community Phase within the Invaded State (State 4). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Transition T3C
State 3 to 5

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

Restoration pathway R4
State 4 to 3

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) coupled with prescribed burning may lead this plant community phase over a threshold to the Native/Invaded State (State 3).

Conservation practices

Prescribed Grazing
Integrated Pest Management (IPM)

Transition T4
State 4 to 5

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

Restoration pathway R5A
State 5 to 3

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

Restoration pathway R5B
State 5 to 4

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

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-season Grasses**			660–1815	
	big bluestem	ANGE	*Andropogon gerardii*	330–1155	–
	sand bluestem	ANHA	*Andropogon hallii*	0–660	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	99–495	–
	switchgrass	PAVI2	*Panicum virgatum*	165–495	–
	Indiangrass	SONU2	*Sorghastrum nutans*	33–330	–

2	**Mid Warm-season Grasses**			330–660	
	little bluestem	SCSC	*Schizachyrium scoparium*	165–660	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–165	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	33–165	–
3	**Cool-season Bunchgrasses**			165–495	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	66–495	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	66–495	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–99	–
4	**Short Warm-season Grasses**			66–165	
	blue grama	BOGR2	*Bouteloua gracilis*	33–165	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–99	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	33–66	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–33	–
	threeawn	ARIST	*Aristida*	0–33	–
5	**Other Native Grasses**			33–165	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–165	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–99	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–99	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	33–99	–
6	**Grass-likes**			33–165	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–165	–
	threadleaf sedge	CAFI	*Carex filifolia*	33–165	–
Forb					
7	**Forbs**			165–330	
	Forb, native	2FN	*Forb, native*	33–132	–
	field sagewort	ARCA12	*Artemisia campestris*	0–66	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	33–66	–
	purple prairie clover	DAPU5	*Dalea purpurea*	33–66	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	33–66	–
	blazing star	LIATR	*Liatris*	33–66	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	33–66	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–66	–
	scurfpea	PSORA2	*Psoralidium*	33–66	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	33–66	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–66	–
	goldenrod	SOLID	*Solidago*	33–66	–
	white heath aster	SYER	*Symphyotrichum ericoides*	33–66	–
	American vetch	VIAM	*Vicia americana*	33–66	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–33	–
	beardtongue	PENST	*Penstemon*	0–33	–
	ticktrefoil	DESMO	*Desmodium*	0–33	–

	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–33	–
	prairie fleabane	ERST3	*Erigeron strigosus*	0–33	–
	sand milkweed	ASAR	*Asclepias arenaria*	0–33	–
	milkvetch	ASTRA	*Astragalus*	0–33	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–33	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–33	–
	ragweed	AMBRO	*Ambrosia*	0–33	–
Shrub/Vine					
8	**Shrubs**			66–165	
	leadplant	AMCA6	*Amorpha canescens*	33–132	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–99	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–66	–
	rose	ROSA5	*Rosa*	33–66	–
	snowberry	SYMPH	*Symphoricarpos*	0–66	–

Table 10. 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**			48–360	
	big bluestem	ANGE	*Andropogon gerardii*	0–240	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–192	–
	sand bluestem	ANHA	*Andropogon hallii*	0–72	–
	switchgrass	PAVI2	*Panicum virgatum*	0–48	–
2	**Mid Warm-season Grasses**			120–600	
	little bluestem	SCSC	*Schizachyrium scoparium*	120–600	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–48	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–24	–
3	**Cool-season Bunchgrasses**			120–480	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	120–480	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–120	–
4	**Short Warm-season Grasses**			72–240	
	blue grama	BOGR2	*Bouteloua gracilis*	48–240	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–120	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	24–96	–
	threeawn	ARIST	*Aristida*	0–96	–
5	**Other Native Grasses**			24–120	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–120	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–96	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–96	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	24–48	–
6	**Grass-likes**			48–240	
	threadleaf sedge	CAFI	*Carex filifolia*	48–192	–

	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–120	–
7	**Non-Native Grasses**			120–360	
	Kentucky bluegrass	POPR	*Poa pratensis*	120–360	–
	smooth brome	BRIN2	*Bromus inermis*	0–144	–
Forb					
8	**Forbs**			120–360	
	field sagewort	ARCA12	*Artemisia campestris*	24–120	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–96	–
	goldenrod	SOLID	*Solidago*	24–96	–
	white heath aster	SYER	*Symphyotrichum ericoides*	24–96	–
	Forb, introduced	2FI	*Forb, introduced*	24–96	–
	Forb, native	2FN	*Forb, native*	0–72	–
	scurfpea	PSORA2	*Psoralidium*	24–72	–
	ragweed	AMBRO	*Ambrosia*	24–72	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	24–48	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–24	–
	American vetch	VIAM	*Vicia americana*	0–24	–
	milkvetch	ASTRA	*Astragalus*	0–24	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–24	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–24	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–24	–
	blazing star	LIATR	*Liatris*	0–24	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–24	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–24	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–24	–
Shrub/Vine					
9	**Shrubs**			48–120	
	prairie sagewort	ARFR4	*Artemisia frigida*	24–96	–
	snowberry	SYMPH	*Symphoricarpos*	0–72	–
	rose	ROSA5	*Rosa*	24–48	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–48	–
	leadplant	AMCA6	*Amorpha canescens*	0–24	–

Table 11. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid Warm-season Grasses**			0–150	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–150	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–30	–
2	**Cool-season Bunchgrasses**			0–300	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–300	–
3	**Short Warm-season Grasses**			30–150	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	30–150	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–120	–
	threeawn	ARIST	*Aristida*	0–90	–
4	**Other Native Grasses**			0–150	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–120	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–60	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–60	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–60	–
5	**Grass-likes**			0–150	
	threadleaf sedge	CAFI	*Carex filifolia*	0–150	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–90	–
6	**Non-Native Grasses**			900–2250	
	smooth brome	BRIN2	*Bromus inermis*	300–1800	–
	Kentucky bluegrass	POPR	*Poa pratensis*	300–1500	–
Forb					
7	**Forbs**			150–300	
	Forb, introduced	2FI	*Forb, introduced*	30–180	–
	ragweed	AMBRO	*Ambrosia*	30–120	–
	field sagewort	ARCA12	*Artemisia campestris*	0–90	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	30–90	–
	goldenrod	SOLID	*Solidago*	30–90	–
	white heath aster	SYER	*Symphyotrichum ericoides*	30–90	–
	Forb, native	2FN	*Forb, native*	0–60	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–60	–
	scurfpea	PSORA2	*Psoralidium*	0–60	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–30	–
Shrub/Vine					
8	**Shrubs**			60–150	
	snowberry	SYMPH	*Symphoricarpos*	30–150	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–60	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–60	–
	rose	ROSA5	*Rosa*	30–60	–

Table 12. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid Warm-season Grasses**			0–57	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–57	–
2	**Cool-season Bunchgrasses**			0–95	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–95	–
3	**Short Warm-season Grasses**			95–285	
	blue grama	BOGR2	*Bouteloua gracilis*	38–285	–
	threeawn	ARIST	*Aristida*	0–95	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	19–95	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–57	–
4	**Other Native Grasses**			38–133	
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	19–133	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–133	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–95	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–19	–
5	**Grass-likes**			95–380	
	threadleaf sedge	CAFI	*Carex filifolia*	95–380	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–152	–
6	**Non-Native Grasses**			380–950	
	Kentucky bluegrass	POPR	*Poa pratensis*	285–950	–
	smooth brome	BRIN2	*Bromus inermis*	0–152	–
Forb					
7	**Forbs**			95–285	
	Forb, introduced	2FI	*Forb, introduced*	19–152	–
	field sagewort	ARCA12	*Artemisia campestris*	19–133	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	19–95	–
	goldenrod	SOLID	*Solidago*	19–95	–
	ragweed	AMBRO	*Ambrosia*	19–95	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	19–57	–
	white heath aster	SYER	*Symphyotrichum ericoides*	19–57	–
	Forb, native	2FN	*Forb, native*	0–38	–
	scurfpea	PSORA2	*Psoralidium*	0–19	–
Shrub/Vine					
8	**Shrubs**			19–95	
	prairie sagewort	ARFR4	*Artemisia frigida*	19–95	–
	snowberry	SYMPH	*Symphoricarpos*	0–38	–
	rose	ROSA5	*Rosa*	0–19	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–19	–

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.

Bluestem/Needlegrass/Switchgrass (1.1 & 3.1)
Average Annual Production (lbs./ac, air-dry):3300
Stocking Rate* (AUM/ac): 0.91

Little Bluestem/Needleandthread/Kentucky Bluegrass (3.2)
Average Annual Production (lbs./ac, air-dry):2400
Stocking Rate* (AUM/ac): 0.66

Smooth Bromegrass/Kentucky Bluegrass (4.1)
Average Annual Production (lbs./ac, air-dry):3000
Stocking Rate* (AUM/ac): 0.82

Kentucky Bluegrass/Sedge (4.2)
Average Annual Production (lbs./ac, air-dry):1900
Stocking Rate* (AUM/ac): 0.52

Annual/Pioneer, Non-Native Perennial (4.3)
Average Annual Production (lbs./ac, air-dry):1000
Stocking Rate* (AUM/ac): 0.27

*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 with localized areas in hydrologic group A. Infiltration is typically moderate to moderately rapid and runoff potential for this site varies from very low 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

There is no NRCS clipping data and other inventory currently available for this site. Information presented here has been derived using field observations from range-trained personnel. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; and Bruce Kunze, Soil Scientist, NRCS.

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Rangeland health reference sheet

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

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Date	12/07/2004
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground 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 5-6. Typically high root content. 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: > mid/tall cool-season bunch grass > mid warm-season rhizomatous grass > forb > short cool-season grass/grass-likes = short warm-season grass = shrubs

    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):** 70-80%, 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):** 2800 – 3700 lbs./acre air-dry weight, average 3,300 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 bromegrass

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