USDA Natural Resources Conservation Service

Ecological site R102AY013SD
Claypan

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General information

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

Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 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 Claypan ecological site typically occurs on nearly level slopes in the upland areas. Soils are moderately well drained and has a claypan (columnar structure) within 16 inches of the soil surface due to the sodium affected subsoil. The natric horizon in the subsoil typically has a Sodium Absorption Ratio (SAR) greater than 13 and/or an Exchangeable Sodium Percentage (ESP) greater than 15. The root restriction of the Natric horizon limits plant growth, production is lower, and species composition will tend towards shallow rooted and more tolerant of the higher sodium levels. Slopes can range from 0 to 3 percent. Vegetation in the Reference State includes western wheatgrass, green needlegrass, and big bluestem. Non-native grasses such as Kentucky bluegrass, smooth brome may invade the site due to changes in disturbance regime.

Associated sites

R102AY010SD	**Loamy** These sites occur on upland areas. The soils are well drained and have less than 40 percent clay in the surface and subsoil. The central concept soil series is Forman, but other series are included.
R102AY011SD	**Clayey** These sites occur on upland areas. The soils are well drained and have greater than 40 percent clay in the surface and subsoil. The central concept soil series is Peever, but other series are included.

Similar sites

R102AY011SD	**Clayey** The Clayey site occurs in a similar landscape position and does not have a claypan (columnar structure) within 16 inches of the soil surface. The Clayey site will have more green needlegrass, less blue grama, and higher production than a Claypan site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

The Claypan site ecological typically occurs on nearly level slopes in the upland areas.

Table 2. Representative physiographic features

Landforms	(1) Upland
Elevation	1,000–2,000 ft
Slope	0–3%

Water table depth	40–80 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)	120-126 days
Freeze-free period (characteristic range)	141-148 days
Precipitation total (characteristic range)	24-25 in
Frost-free period (actual range)	115-127 days
Freeze-free period (actual range)	141-151 days
Precipitation total (actual range)	24-25 in
Frost-free period (average)	123 days
Freeze-free period (average)	145 days
Precipitation total (average)	24 in

Climate stations used

- (1) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (2) CLARK [USC00391739], Clark, SD
- (3) MILBANK 4 NW [USC00395536], Milbank, SD
- (4) SISSETON [USC00397742], Sisseton, SD
- (5) WATERTOWN 1W [USC00398930], Watertown, SD

Influencing water features

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

Soil features

The Claypan site ecological typically occurs on nearly level slopes in the upland areas. Soils are moderately well drained and has a claypan (columnar structure) within 16 inches of the soil surface. The central concept soil series is Cavour.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Clay loam (3) Silt loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained
Permeability class	Very slow to slow
Soil depth	80 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5–6 in
Calcium carbonate equivalent (0-40in)	0–25%
Electrical conductivity (0-40in)	2–16 mmhos/cm
Sodium adsorption ratio (0-40in)	3–21
Soil reaction (1:1 water) (0-40in)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

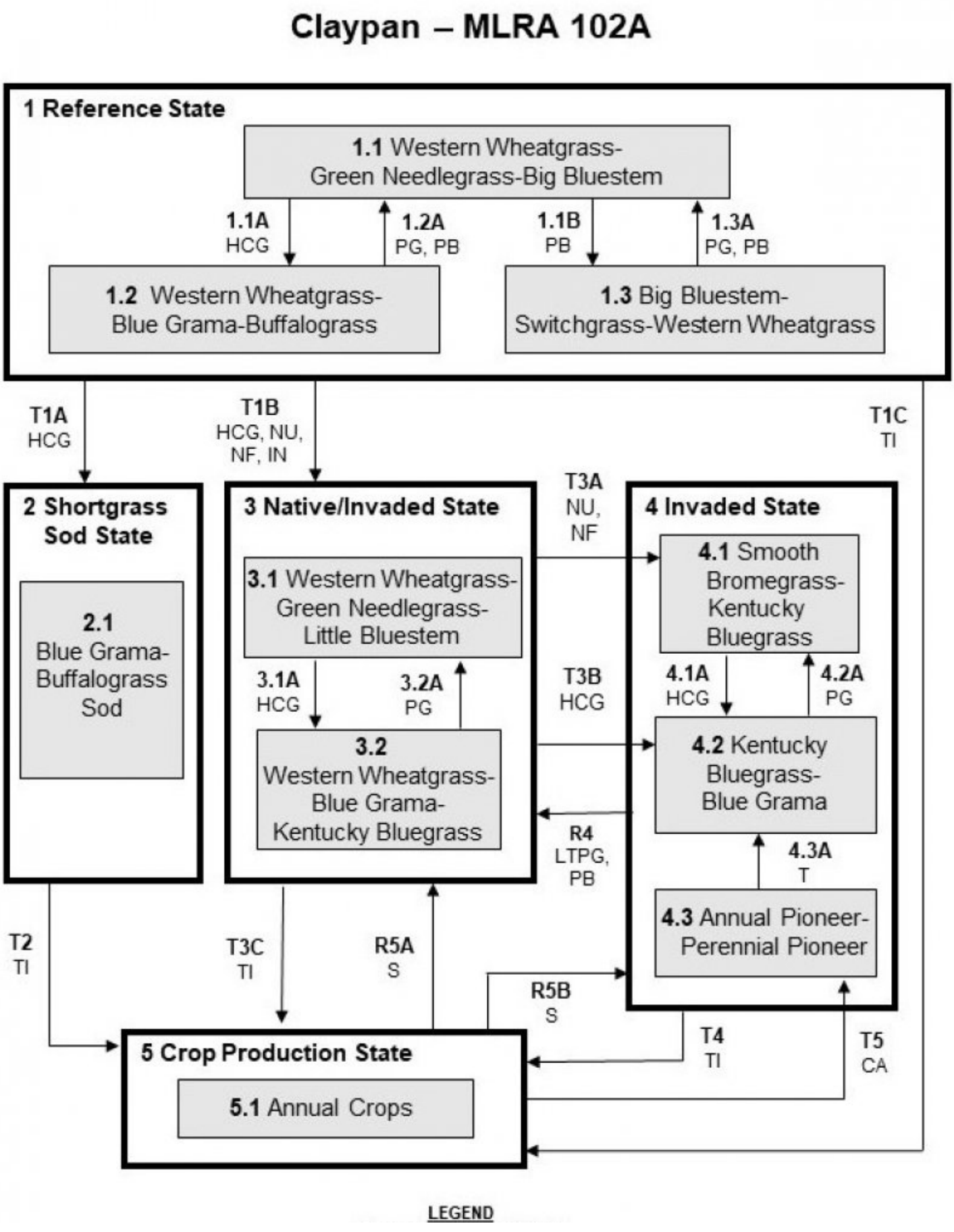
The site which is located in the Prairie Pothole Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse 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 Western Wheatgrass-Green Needlegrass-Big Blustem 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. Continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following grazing events causes departure from the 3.1 Western Wheatgrass-Green Needlegrass-Little Bluestem Plant Community Phase. Blue grama (*Bouteloua gracilis*) will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, needleandthread (*Hesperostipa comata*), porcupine grass (*Hesperostipa spartea*), sideoats grama (*Bouteloua curtipendula*), big bluestem, and little bluestem (*Schizachyrium scoparium*) will decrease in frequency and production. Extended periods of nonuse and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as Kentucky bluegrass (*Poa pratensis*), smooth bromegrass (*Bromus inermis*), green needlegrass, and cheatgrass (*Bromus tectorum*).

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



Claypan – R102AY013SD

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 dominated the dynamics of this ecological site (ES). This state was dominated by cool-season grasses, with warm-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and/or above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. Cool-season and taller warm-season grasses would have declined and a corresponding increase in short, warm-season grasses would have occurred. Today, a similar state, the Native/Invaded State (State 3) can be found on areas that are properly managed with grazing and/or prescribed burning and sometimes on areas receiving occasional short periods of rest.

Community 1.1
Western Wheatgrass-Green Needlegrass-Big Bluestem

Interpretations are based primarily on the 1.1 Western Wheatgrass-Green Needlegrass-Big Bluestem Plant Community Phase (this is also considered to be climax). The potential vegetation was about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community was dominated by cool-season grasses. The major grasses included western wheatgrass, green needlegrass, porcupine grass, and big bluestem. Other grass or grass-like species included needleandthread (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), switchgrass (*Panicum virgatum*), little bluestem, sideoats grama, slender wheatgrass (*Elymus trachycaulus*), and

needleleaf sedge (*Carex duriuscula*). 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	1735	2249	2710
Forb	115	195	295
Shrub/Vine	50	156	295
Total	**1900**	**2600**	**3300**

Figure 9. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 1.2
Western Wheatgrass-Blue Grama-Buffalograss

This plant community evolved under heavy continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses included western wheatgrass, blue grama, buffalograss, green needlegrass, sideoats grama, and needleandthread. Grasses of secondary importance included little bluestem, porcupine grass, big bluestem, and sedge (Carex). Forbs commonly found in this plant community included cudweed sagewort (*Artemisia ludoviciana*), prairie coneflower (*Ratibida columnifera*), and western yarrow (*Achillea millefolium*). This plant community had similar plant composition to the 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass Plant Community Phase. The main difference is that this plant community phase did not have the presence of nonnative invasive species such as Kentucky bluegrass and smooth bromegrass. When compared to the 1.1 Western Wheatgrass-Green Needlegrass-Big Bluestem Plant Community Phase, blue grama and buffalograss increased. Green needlegrass 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-Western Wheatgrass

This plant community was a result of fire occurring at relatively frequent intervals. This phase could have also resulted from a combination of grazing events immediately following early season fire (i.e., large ungulates attracted to highly nutritious vegetative growth following a fire). These events would have caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would have increased in vigor and production leading to a temporary shift to this phase. Needlegrasses would have decreased most significantly amongst the cool-season grasses. The potential vegetation was about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses. The major grasses included little bluestem, big bluestem, switchgrass, Indiangrass (Sorhgastrum nutans), sideoats grama, and western wheatgrass. Other grass or grass-like species

included green needlegrass, porcupine grass, needleandthread, blue grama, slender wheatgrass, tall dropseed (*Sporobolus compositus*), and sedges. This plant community was not resistant to change and would have readily shifted back to the 1.1 Western Wheatgrass-Green Needlegrass-Big Bluestem Plant Community Phase with a return of more normal fire return intervals.

Figure 11. 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

Pathway 1.1A
Community 1.1 to 1.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 1.2 Western Wheatgrass-Blue Grama-Buffalograss Plant Community Phase.

Pathway 1.1B
Community 1.1 to 1.3

Prescribed Burning occurring at relatively frequent intervals (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, and would increase in vigor and production leading to a temporary shift to the 1.3 Big Bluestem-Switchgrass-Western Wheatgrass 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 Western Wheatgrass-Green Needlegrass-Big Bluestem 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 Western Wheatgrass-Green Needlegrass-Big Bluestem 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
Blue Grama-Buffalograss 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 blue grama and buffalograss. Grasses of secondary importance included sedge and western wheatgrass. Forbs commonly found in this plant community included cudweed sagewort, scurfpea, and western yarrow. When compared to the 1.1 Western Wheatgrass-Green Needlegrass-Big Bluestem Plant Community Phase, blue grama and buffalograss (*Bouteloua dactyloides*) were dominant on this plant community. Cool-season grasses decreased significantly. This vegetation state was very resistant to change. The herbaceous species present were well adapted to grazing. This plant community was less productive than other phases. The thick sod prevented other species from getting established.

Figure 12. 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

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

Community 3.1
Western Wheatgrass-Green Needlegrass-Big Bluestem

This plant community phase is similar to the 1.1 Western Wheatgrass-Green Needlegrass-Big Bluestem Plant Community Phase but it also contains minor amounts of nonnative invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 15 percent by air-dry weight). The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community is dominated by cool-season grasses, with warm-season grasses being subdominant. The major grasses include western wheatgrass, green needlegrass, porcupine grass, and big bluestem. Other grass or grass-like species include needleandthread, blue grama, switchgrass, little bluestem, sideoats grama, slender wheatgrass, and needleleaf sedge. 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). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 3.2
Western Wheatgrass/Blue Grama/Kentucky Bluegrass Plant Community Phase

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

term.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1105	1521	1920
Forb	80	128	190
Shrub/Vine	15	51	90
Total	**1200**	**1700**	**2200**

Figure 15. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Pathway 3.1A
Community 3.1 to 3.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass Plant Community Phase.

Pathway 3.2A
Community 3.2 to 3.1

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

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	1550	2506	2925
Forb	125	210	320
Shrub/Vine	25	84	155
Total	**1700**	**2800**	**3400**

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-Blue Grama

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass and blue grama. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface and 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	735	1044	1335
Forb	55	120	200
Shrub/Vine	10	36	65
Total	**800**	**1200**	**1600**

Figure 19. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 4.3
Annual Pioneer-Perennial Pioneer

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 non-native

invasive and/or early seral species. Plant diversity is low (plant richness may be high, but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites. This community can be renovated to improve the production capability; however, if management changes are not made the vegetation could revert back to early seral species.

Pathway 4.1A
Community 4.1 to 4.2

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

Pathway 4.2A
Community 4.2 to 4.1

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

Conservation practices

Prescribed Grazing

Pathway 4.3A
Community 4.3 to 4.2

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

Conservation practices

Integrated Pest Management (IPM)

State 5
Crop Production State

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

Community 5.1
Annual Crops

This plant community developed with the use of a variety of tillage 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 Blue Grama-Buffalograss 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 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 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-Blue Grama Community Phase within the Invaded State (State 4). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Transition T3C
State 3 to 5

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops 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).

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	**Cool-season Bunchgrasses**			260–780	
	green needlegrass	NAVI4	*Nassella viridula*	130–650	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	130–520	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–260	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–130	–
2	**Wheatgrass**			260–780	
	western wheatgrass	PASM	*Pascopyrum smithii*	130–780	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	130–520	–
3	**Tall Warm-season Grasses**			260–520	
	big bluestem	ANGE	*Andropogon gerardii*	130–390	–
	switchgrass	PAVI2	*Panicum virgatum*	26–260	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–130	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–130	–
4	**Short Warm-season Grasses**			52–260	
	blue grama	BOGR2	*Bouteloua gracilis*	52–260	–
	saltgrass	DISP	*Distichlis spicata*	0–130	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–130	–
	threeawn	ARIST	*Aristida*	0–52	–
5	**Mid Warm-season Grasses**			52–260	
	sideoats grama	BOCU	*Bouteloua curtipendula*	52–260	–
	little bluestem	SCSC	*Schizachyrium scoparium*	52–260	–
6	**Other Native Grasses**			26–130	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–130	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	26–78	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–52	–

7	**Grass-likes**			26–130	
	needleleaf sedge	CADU6	*Carex duriuscula*	26–130	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–78	–
Forb					
8	**Forbs**			130–260	
	Forb, native	2FN	*Forb, native*	26–78	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	26–78	–
	milkweed	ASCLE	*Asclepias*	26–52	–
	false boneset	BREU	*Brickellia eupatorioides*	26–52	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	26–52	–
	purple prairie clover	DAPU5	*Dalea purpurea*	26–52	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	26–52	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–52	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	26–52	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	26–52	–
	goldenrod	SOLID	*Solidago*	26–52	–
	white heath aster	SYER	*Symphyotrichum ericoides*	26–52	–
	American vetch	VIAM	*Vicia americana*	26–52	–
	Nuttall's violet	VINU2	*Viola nuttallii*	0–26	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–26	–
	cutleaf anemone	PUPAM	*Pulsatilla patens ssp. multifida*	0–26	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–26	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–26	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–26	–
	mouse-ear chickweed	CERAS	*Cerastium*	0–26	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–26	–
	textile onion	ALTE	*Allium textile*	0–26	–
	pussytoes	ANTEN	*Antennaria*	0–26	–
	field sagewort	ARCA12	*Artemisia campestris*	0–26	–
Shrub/Vine					
9	**Shrubs**			52–260	
	leadplant	AMCA6	*Amorpha canescens*	26–130	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–78	–
	snowberry	SYMPH	*Symphoricarpos*	0–78	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–78	–
	rose	ROSA5	*Rosa*	26–52	–

Table 10. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			85–255	
	green needlegrass	NAVI4	*Nassella viridula*	34–255	–

	porcupinegrass	HESP11	*Hesperostipa spartea*	17–136	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–85	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–51	–
2	**Wheatgrass**			255–510	
	western wheatgrass	PASM	*Pascopyrum smithii*	255–510	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–170	–
3	**Tall Warm-season Grasses**			0–85	
	big bluestem	ANGE	*Andropogon gerardii*	0–85	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–51	–
	switchgrass	PAVI2	*Panicum virgatum*	0–51	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–51	–
4	**Short Warm-season Grasses**			255–425	
	blue grama	BOGR2	*Bouteloua gracilis*	170–425	–
	buffalograss	BODA2	*Bouteloua dactyloides*	34–204	–
	saltgrass	DISP	*Distichlis spicata*	0–85	–
	threeawn	ARIST	*Aristida*	0–51	–
5	**Mid Warm-season Grasses**			0–85	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–85	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–85	–
6	**Other Native Grasses**			17–85	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–85	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–34	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	17–34	–
7	**Grass-likes**			17–170	
	needleleaf sedge	CADU6	*Carex duriuscula*	17–170	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–51	–
8	**Non-Native Grasses**			85–425	
	Kentucky bluegrass	POPR	*Poa pratensis*	51–425	–
	brome	BROMU	*Bromus*	17–170	–
	quackgrass	ELRE4	*Elymus repens*	0–85	–
	smooth brome	BRIN2	*Bromus inermis*	0–85	–
Forb					
9	**Forbs**			85–170	
	Forb, introduced	2FI	*Forb, introduced*	0–68	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	17–68	–
	Forb, native	2FN	*Forb, native*	17–51	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	17–51	–
	goldenrod	SOLID	*Solidago*	17–51	–
	white heath aster	SYER	*Symphyotrichum ericoides*	17–51	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	17–34	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–34	–

	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	17–34	–
	field sagewort	ARCA12	*Artemisia campestris*	0–34	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–17	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–17	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–17	–
	American vetch	VIAM	*Vicia americana*	0–17	–
	pussytoes	ANTEN	*Antennaria*	0–17	–
	false boneset	BREU	*Brickellia eupatorioides*	0–17	–
	mouse-ear chickweed	CERAS	*Cerastium*	0–17	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–17	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–17	–
Shrub/Vine					
10	**Shrubs**			17–85	
	snowberry	SYMPH	*Symphoricarpos*	17–51	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–51	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	–
	leadplant	AMCA6	*Amorpha canescens*	0–17	–
	rose	ROSA5	*Rosa*	0–17	–

Table 11. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			0–224	
	green needlegrass	NAVI4	*Nassella viridula*	0–196	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–84	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–28	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–28	–
2	**Wheatgrass**			0–280	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–280	–
3	**Short Warm-season Grasses**			0–196	
	blue grama	BOGR2	*Bouteloua gracilis*	0–140	–
	saltgrass	DISP	*Distichlis spicata*	0–84	–
	threeawn	ARIST	*Aristida*	0–56	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–56	–
4	**Other Native Grasses**			0–140	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–140	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–28	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–28	–
5	**Grass-likes**			0–140	
	needleleaf sedge	CADU6	*Carex duriuscula*	0–140	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–84	–
6	**Non-Native Grasses**			840–1960	

	smooth brome	BRIN2	*Bromus inermis*	560–1820	–
	Kentucky bluegrass	POPR	*Poa pratensis*	140–700	–
	brome	BROMU	*Bromus*	28–420	–
	quackgrass	ELRE4	*Elymus repens*	0–224	–
Forb					
7	**Forbs**			140–280	
	Forb, introduced	2FI	*Forb, introduced*	0–168	–
	Forb, native	2FN	*Forb, native*	0–84	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–84	–
	goldenrod	SOLID	*Solidago*	28–84	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	28–84	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–56	–
	white heath aster	SYER	*Symphyotrichum ericoides*	28–56	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–56	–
	pussytoes	ANTEN	*Antennaria*	0–28	–
	field sagewort	ARCA12	*Artemisia campestris*	0–28	–
	mouse-ear chickweed	CERAS	*Cerastium*	0–28	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–28	–
Shrub/Vine					
8	**Shrubs**			28–140	
	snowberry	SYMPH	*Symphoricarpos*	28–112	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–56	–
	rose	ROSA5	*Rosa*	28–56	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–28	–

Table 12. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			0–60	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–36	–
	green needlegrass	NAVI4	*Nassella viridula*	0–36	–
2	**Wheatgrass**			0–60	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–60	–
3	**Short Warm-season Grasses**			120–300	
	blue grama	BOGR2	*Bouteloua gracilis*	60–300	–
	buffalograss	BODA2	*Bouteloua dactyloides*	12–120	–
	saltgrass	DISP	*Distichlis spicata*	0–96	–
	threeawn	ARIST	*Aristida*	0–36	–
4	**Other Native Grasses**			12–60	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–60	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	12–24	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–12	–

5	**Grass-likes**			36–180	
	needleleaf sedge	CADU6	*Carex duriuscula*	36–180	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–24	–
6	**Non-Native Grasses**			300–600	
	Kentucky bluegrass	POPR	*Poa pratensis*	120–540	–
	brome	BROMU	*Bromus*	24–240	–
	quackgrass	ELRE4	*Elymus repens*	24–144	–
	smooth brome	BRIN2	*Bromus inermis*	0–96	–
Forb					
7	**Forbs**			60–180	
	Forb, introduced	2FI	*Forb, introduced*	12–96	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	12–60	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	12–48	–
	goldenrod	SOLID	*Solidago*	12–48	–
	field sagewort	ARCA12	*Artemisia campestris*	0–36	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	12–36	–
	Forb, native	2FN	*Forb, native*	0–24	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	12–24	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–24	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–12	–
	pussytoes	ANTEN	*Antennaria*	0–12	–
Shrub/Vine					
8	**Shrubs**			12–60	
	prairie sagewort	ARFR4	*Artemisia frigida*	12–36	–
	snowberry	SYMPH	*Symphoricarpos*	0–36	–
	rose	ROSA5	*Rosa*	0–12	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–12	–

Animal community

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

Wheatgrass/Needlegrass/Bluestem (1.1 & 3.1)
Average Annual Production (lbs./acre, air-dry): 2600
Stocking Rate* (AUM/acre): 0.71

Western Wheatgrass/Blue Grama/Kentucky Bluegrass (3.2)
Average Annual Production (lbs./acre, air-dry): 1700
Stocking Rate* (AUM/acre): 0.47

Smooth Bromegrass/Kentucky Bluegrass (4.1)

Average Annual Production (lbs./acre, air-dry): 2800
Stocking Rate* (AUM/acre): 0.77

Kentucky Bluegrass/Blue grama (4.2)
Average Annual Production (lbs./acre, air-dry): 1200
Stocking Rate* (AUM/acre): 0.33

Annual/Pioneer, Non-Native Perennial (4.3)
Average Annual Production (lbs./acre, air-dry): 800
Stocking Rate* (AUM/acre): 0.22

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

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

Hydrological functions

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

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 15% 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 roughly 3-5. Relatively high root content. Soil surface is resistant to erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth and color of A-horizon.

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

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident. At less than 8 inches, an extremely dense clay B horizon with round-topped columnar or prismatic structure exists.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Mid cool-season rhizomatous grass > tall cool-season bunch grass

    Sub-dominant: > tall warm-season rhizomatous grass = short warm-season grass = short cool-season grass = forbs > 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):** 60-70%, 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):** 2200 – 3000 lbs./acre air-dry weight, average 2,600 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.