USDA Natural Resources Conservation Service

Ecological site R102AY016SD
Very Shallow

Last updated: 6/27/2024
Accessed: 05/10/2025

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.

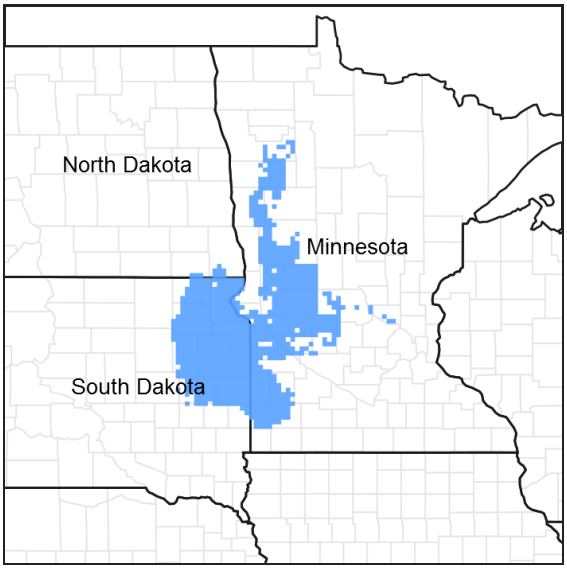


Figure 1. Mapped extent

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 Very Shallow ecological site occurs on the shoulder slopes in the upland areas. Soils are well to excessively drained and have root restricting layer, such as sand and gravel or bedrock within 10 inches of the soil surface. Along with the root restricting layer, precipitation tends to runoff, leaving less soil moisture for plant growth, production is lower, and species composition will tend towards more drought tolerant. In some areas the surface layer may consist of stony to extremely stony. Slopes can range from 0 to 40 percent. Vegetation in the Reference State includes needleandthread, blue grama, and threadleaf sedge. Forbs include dotted gayfeather, hairy goldaster, purple coneflower, and prairie clover. Non-native grasses such as Kentucky bluegrass and annual bromes 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 sand and gravel at a depth of greater than 20 inches below the soil surface. The central concept soil series is Estelline, Brandt, and Fordville, but other series are included.
R102AY014SD	**Shallow Gravel** These sites occur on upland areas. The soils are excessively drained and have sand and gravel within 10 to 20 inches of the soil surface. The central concept soil series is Arvilla and Renshaw, but other series are included.

Similar sites

R102AY014SD	**Shallow Gravel** The Shallow Gravel site occurs in a backslope landscape position and does not have a root restricting layer, such as sand and gravel within 10 inches of the soil surface. The Shallow Gravel site will have more bluestem and higher production than the Very Shallow site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Hesperostipa comata ssp. comata* (2) *Bouteloua gracilis*

Physiographic features

The Very Shallow ecological site occurs on the shoulder slopes in the upland areas.

Table 2. Representative physiographic features

Landforms	(1) Upland
Elevation	1,000–2,000 ft

Slope	0–40%
Water table depth	48–80 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) ARTICHOKE LAKE [USC00210287], Correll, MN
- (2) ARLINGTON 1 W [USC00390281], Arlington, SD
- (3) BENSON [USC00210667], Benson, MN
- (4) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (5) BROWNS VALLEY [USC00211063], Beardsley, MN
- (6) CASTLEWOOD [USC00391519], Castlewood, SD
- (7) CLARK [USC00391739], Clark, SD
- (8) CLEAR LAKE [USC00391777], Clear Lake, SD
- (9) FERGUS FALLS [USC00212768], Fergus Falls, MN
- (10) FOSSTON 1 E [USC00212916], Fosston, MN
- (11) GLENWOOD 2 WNW [USC00213174], Glenwood, MN
- (12) LAKE WILSON [USC00214534], Lake Wilson, MN
- (13) MAHNOMEN [USC00215012], Mahnomen, MN
- (14) MELROSE [USC00215325], Melrose, MN
- (15) MILAN 1 NW [USC00215400], Milan, MN

- (16) MILBANK 4 NW [USC00395536], Milbank, SD
- (17) MORRIS WC EXP STN [USC00215638], Hancock, MN
- (18) PIPESTONE [USC00216565], Pipestone, MN
- (19) ROY LAKE [USC00397326], Lake City, SD
- (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 Very Shallow ecological site occurs on the shoulder slopes in the upland areas. Soils are well to excessively drained and have root restricting layer, such as sand and gravel or bedrock within 10 inches of the soil surface. In some areas the surface layer may consist of stony to extremely stony. The central concept soil series is Sandberg and Sioux, but other series are included.

Table 4. Representative soil features

Surface texture	(1) Gravelly loam (2) Sandy loam
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained
Permeability class	Moderate to rapid
Soil depth	5–10 in
Surface fragment cover <=3"	6–26%
Surface fragment cover >3"	0–9%
Available water capacity (0-40in)	2–3 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	26–54%
Subsurface fragment volume >3" (Depth not specified)	2–19%

Ecological dynamics

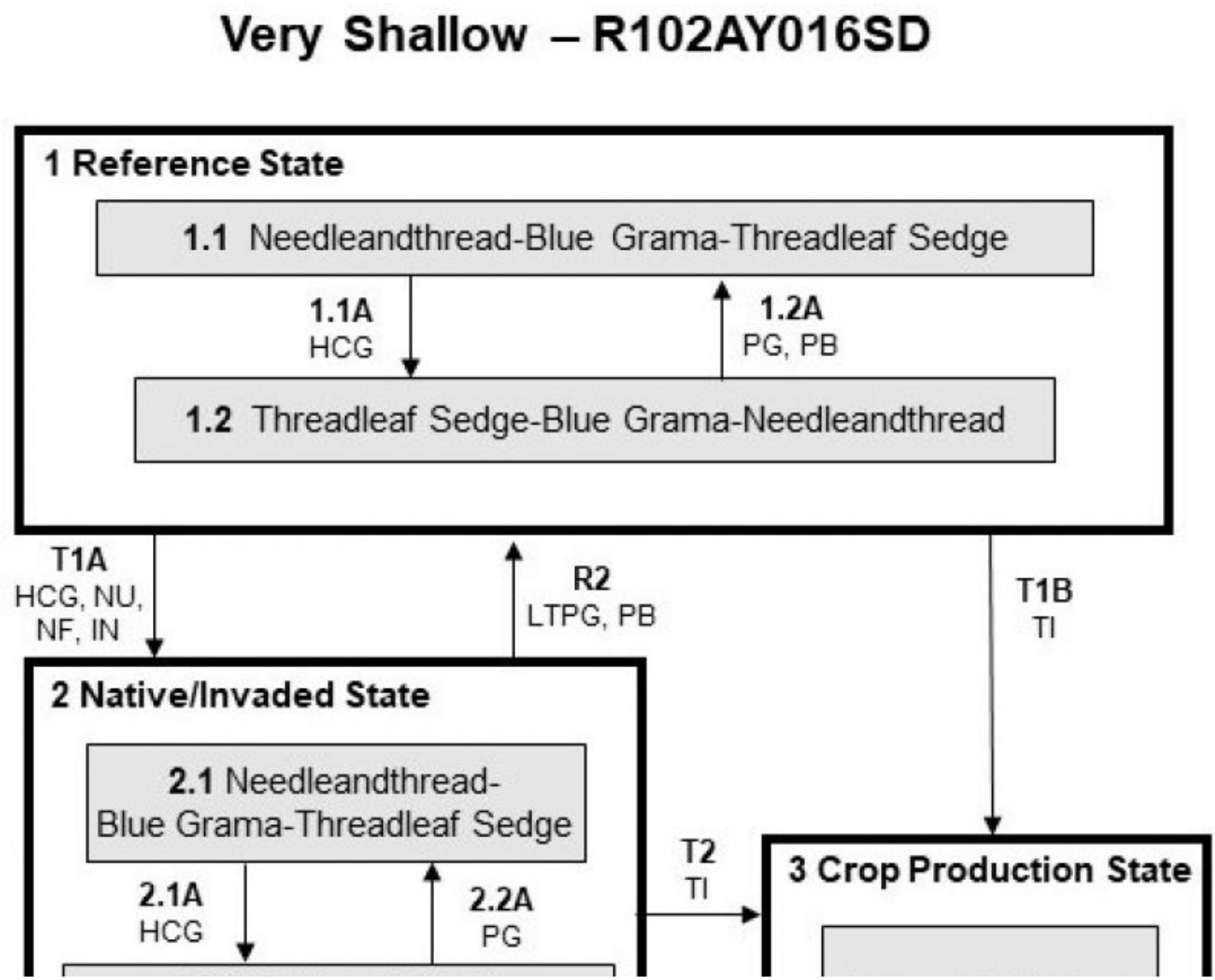
The site which is located in the Prairie Pothole Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse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

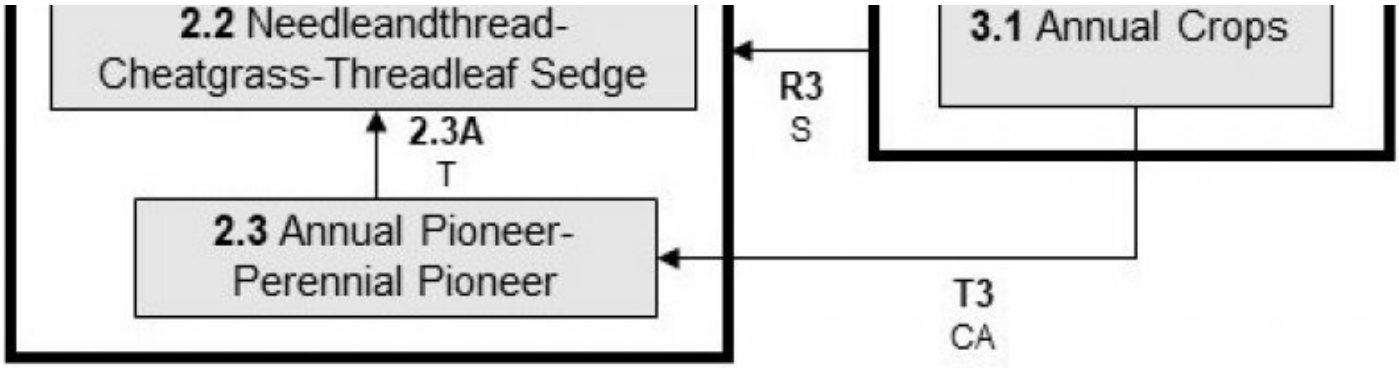
Grama-Threadleaf Sedge Plant Community Phase. This community phase and the Reference State have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered.

This ecological site (ES) has been grazed by domestic livestock since they have been introduced into the area. This ecological site is naturally resilient, and quite resistant to change. Also, due to the relatively steep slopes and naturally low fertility of the soils, this site generally avoids more intensive disturbances such as farming. However, 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 each grazing occurrence can cause this site to depart from the Needleandthread-Blue Grama-Threadleaf Sedge Plant Community Phase. Sedges and gramas can increase and eventually develop into a sod while many of the tall and mid-statured grasses will decrease [e.g., little bluestem (*Schizachyrium scoparium*), green needlegrass (*Nassella viridula*), needleandthread, porcupine grass (*Hesperostipa spartea*), and western wheatgrass, (*Pascopyrum smithii*)]. Even with these disturbances, many of the tall- and mid-statured grasses will remain in the community at reduced levels, allowing recovery to occur once the disturbances are removed.

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
Very Shallow– R102AY016SD

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, inundation, no fire
T1B	Tillage
T2	Tillage
T3	Abandonment of cropping
1.1A	Heavy continuous grazing
1.2A	Prescribed grazing with recovery periods, prescribed burning
2.1A	Heavy continuous grazing
2.2A	Prescribed grazing with recovery periods
2.3A	Time w/wo disturbance
R2	Long term prescribed grazing, prescribed burning
R3	Seeding

State 1
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ES. This state represents the natural range of variability that dominates the dynamics of this ecological site (ES). This state is 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 grazing by large herding ungulates and fluctuations in levels of precipitation. Grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, this 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. The dominant tall and mid-grass species can decline and a corresponding increase in short-statured species will occur.

Community 1.1
Needleandthread-Blue Grama-Threadleaf Sedge

Interpretations are based primarily on the 1.1 Needleandthread-Blue Grama-Threadleaf Sedge Plant Community

Phase (this is also considered to be climax). This plant community evolved with grazing by large herbivores, frequent surface fires, and periodic flooding events and is suited for grazing by domestic livestock. This plant community can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use and adequate recovery periods following each grazing event. The potential vegetation is about 75 percent grasses or grass-like plants, 15 percent forbs, and 10 percent shrubs. Cool-season grass and grass-like species dominate this plant community, with warm-season grasses being subdominant. The major grass or grass-like species include needleandthread, blue grama, threadleaf sedge, green needlegrass, porcupine grass, hairy grama (*Bouteloua hirsuta*), sideoats grama (*Bouteloua curtipendula*), and needleleaf sedge (*Carex duriuscula*). Other grasses occurring on the site include threeawn (Aristida), plains muhly (*Muhlenbergia cuspidata*), little bluestem (*Schizachyrium scoparium*), and prairie Junegrass (*Koeleria macrantha*). The significant forbs include dotted gayfeather (*Liatris punctata*), hairy goldaster (*Heterotheca villosa*), purple coneflower (Echinacea), and prairie clover (Dalea). Significant shrubs are fringed sagewort (*Artemisia frigida*), leadplant (*Amorpha canescens*), rose (Rosa), skunkbush sumac (*Rhus trilobata*), and snowberry (Symphoricarpos). 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. This plant community is stable and protected from excessive erosion.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1120	1567	1955
Forb	90	190	330
Shrub/Vine	90	143	215
Total	**1300**	**1900**	**2500**

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
Threadleaf Sedge-Blue Grama-Needleandthread

This plant community can develop from the adverse effects of heavy, continuous grazing in conjunction with extended periods of below average precipitation. Short grass and grass-like species increase to dominate the site and annual production decreases. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives blue grama and sedges a competitive advantage over cool- and warm-season mid-grasses. Threadleaf sedge, blue grama, and needleandthread are the dominant grass/grass-like species. Other grasses may include sideoats grama, prairie Junegrass, and threeawn. Significant forbs include green sagewort (*Artemisia campestris*), cutleaf ironplant (*Machaeranthera pinnatifida*), scurfpeas (Psoralidium), white prairie aster (*Symphyotrichum falcatum*), and woolly Indianwheat (*Plantago patagonica*). Common shrubs include fringed sagewort, cactus (Cactaceae), and snowberry. Nonnative species such as Kentucky bluegrass (*Poa pratensis*), cheatgrass (*Bromus tectorum*), and Japanese bromegrass (Bromus japonicas) may begin to invade this phase. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the 1.1 Needleandthread-Blue Grama-Threadleaf Sedge Plant Community Phase. Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	680	1072	1435
Forb	40	90	150
Shrub/Vine	40	68	95
Total	**760**	**1230**	**1680**

Figure 11. 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 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 Threadleaf Sedge-Blue Grama-Needleandthread Plant Community Phase.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed Grazing, and/or prescribed burning returned to normal disturbance regime levels and frequencies or periodic light to moderate grazing possibly including periodic rest would have converted this plant community to the 1.1 Needleandthread-Blue Grama-Threadleaf Sedge Plant Community Phase.

State 2
Native/Invaded State

This state represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire due to fire suppression. This state is dominated by 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. Nonnative species such as cheatgrass or Japanese bromegrass can become dominant at times and influence the biotic and hydrologic ecological processes of the State.

Community 2.1
Needleandthread-Blue Grama-Threadleaf Sedge

This plant community is the result of encroachment of nonnative species, often as a result of fluctuations in precipitation cycles, typically extended periods of below average precipitation followed by a mild winter and/or a cool, wet spring. The potential vegetation is about 75 percent grasses or grass-like plants, 15 percent forbs, and 10 percent shrubs. Cool-season grass and grass-like species dominate this plant community, with warm-season grasses being subdominant. The major grass or grass-like species include needlegrasses (needleandthread, green needlegrass, and/or porcupine grass), blue and/or hairy grama, threadleaf sedge, sideoats grama, and needleleaf sedge. Other grasses occurring on the site include threeawn, plains muhly, little bluestem, prairie Junegrass, and nonnative species such as Kentucky bluegrass, cheatgrass, and/or Japanese bromegrass. The significant forbs include dotted gayfeather, purple coneflower, prairie clover, and hairy goldaster. Significant shrubs are fringed sagewort, leadplant, rose, and snowberry. This plant community is very similar to the 1.1 Needleandthread-Blue Grama-Threadleaf Sedge Plant Community Phase. The main difference is that this plant community will have a minor amount on nonnative grasses, up to about 10 to 15 percent by weight. 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. This plant community is stable and protected from excessive erosion.

Figure 12. 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 2.2
Needleandthread-Cheatgrass-Threadleaf Sedge

This plant community can develop from the adverse effects of heavy, continuous grazing in conjunction with extended periods of below average precipitation. This plant community phase is further impacted by the invasion of nonnative species such as cheatgrass, Japanese bromegrass, and/or Kentucky bluegrass. Needlegrasses will be evident on the aspect of this phase but will be reduced in vigor and production. Annual bromegrass and sedge will make up a bulk of the composition on this plant community phase. The dominant grass and grass-like species will include needlegrass (needleandthread, green needlegrass, and/or porcupine grass), cheatgrass and/or Japanese bromegrass, and threadleaf sedge and/or needleleaf sedge. Other grasses present include blue grama, threeawn, Kentucky bluegrass, hairy grama, and prairie Junegrass. Significant forbs include green sagewort, cutleaf ironplant, scurfpeas, white prairie aster, and woolly Indianwheat. Common shrubs include cactus, snowberry, and fringed sagewort. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives sedges and annual bromegrass a competitive advantage over cool-and warm-season mid-grasses. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the 1.1 Needleandthread-Blue Grama-Threadleaf Sedge Plant Community Phase. Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	420	742	1055
Forb	40	90	150
Shrub/Vine	40	68	95
Total	**500**	**900**	**1300**

Figure 14. 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 2.3
Annual Pioneer-Perennial Pioneer

This plant community developed under continuous heavy grazing or other excessive disturbances (e.g., heavy use areas, defoliation by rodents, etc.). The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include nonnative invasive and/or early seral species. Plant diversity is low (plant richness may be high but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites. This community can be renovated to improve the production capability; however, if management changes are not made the

vegetation could revert back invasive or early seral species.

Pathway 2.1A
Community 2.1 to 2.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites and no surface fire for extended periods of time (typically for 10 years or more) causing litter levels to become high enough to reduce native grass vigor, diversity, and density will shift this community to the 2.2 Needleandthread-Cheatgrass-Threadleaf Sedge Plant Community Phase.

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 2.1 Needleandthread-Blue Grama-Threadleaf Sedge Plant Community Phase. This pathway could also occur with a return to more normal precipitation levels and frequencies.

Conservation practices

Prescribed Grazing

Pathway 2.3A
Community 2.3 to 2.2

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 2.2 Needleandthread-Cheatgrass-Threadleaf Sedge Plant Community Phase.

State 3
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 3.1
Annual Crops

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

Transition T1A
State 1 to 2

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, and/or heavy continuous grazing or invasion of non-native plant species will likely lead this state over a threshold resulting in the Native/Invaded State (State 2).

Transition T1B
State 1 to 3

Tillage will cause a shift over a threshold leading to the 3.1 Annual Crops within the Crop Production State (State 3).

Restoration pathway R2
State 2 to 1

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 Reference State (State 1).

Conservation practices

Prescribed Grazing

Transition T2
State 2 to 3

Tillage will cause a shift over a threshold leading to the 3.1 Annual Crops within the Crop Production State (State 3).

Restoration pathway R3
State 3 to 2

Seeding may lead this Crop Production State (State 3) over a threshold to the Native/Invaded State (State 2). Cropping followed by abandonment may lead this plant community phase over a threshold to the Native/Invaded State (State 3) and more specifically to the 2.3 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			380–855	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	190–570	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	95–380	–
	green needlegrass	NAVI4	*Nassella viridula*	0–152	–
2	**Short Warm-season Grasses**			190–475	
	blue grama	BOGR2	*Bouteloua gracilis*	95–380	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	38–190	–
	threeawn	ARIST	*Aristida*	19–57	–
3	**Mid Warm-season Grasses**			95–285	
	sideoats grama	BOCU	*Bouteloua curtipendula*	38–190	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	38–190	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–95	–
4	**Other Native Grasses**			19–95	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–76	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	19–57	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–38	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–38	–
5	**Grass-likes**			95–285	
	threadleaf sedge	CAFI	*Carex filifolia*	38–190	–

	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–95	–
	needleleaf sedge	CADU6	*Carex duriuscula*	19–95	–
Forb					
6	**Forbs**			95–285	
	Forb, native	2FN	*Forb, native*	19–57	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	19–57	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	19–57	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	19–57	–
	dotted blazing star	LIPU	*Liatris punctata*	19–38	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	19–38	–
	false boneset	BREU	*Brickellia eupatorioides*	0–38	–
	field sagewort	ARCA12	*Artemisia campestris*	19–38	–
	purple prairie clover	DAPU5	*Dalea purpurea*	19–38	–
	white heath aster	SYER	*Symphyotrichum ericoides*	19–38	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	19–38	–
	American vetch	VIAM	*Vicia americana*	19–38	–
	white prairie clover	DACA7	*Dalea candida*	0–19	–
	milkvetch	ASTRA	*Astragalus*	0–19	–
	pussytoes	ANTEN	*Antennaria*	0–19	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–19	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–19	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–19	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–19	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–19	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–19	–
Shrub/Vine					
7	**Shrubs**			95–190	
	leadplant	AMCA6	*Amorpha canescens*	19–57	–
	prairie sagewort	ARFR4	*Artemisia frigida*	19–57	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–38	–
	rose	ROSA5	*Rosa*	19–38	–
	snowberry	SYMPH	*Symphoricarpos*	19–38	–
	pricklypear	OPUNT	*Opuntia*	0–19	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–19	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			65–195	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–195	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–195	–
	green needlegrass	NAVI4	*Nassella viridula*	0–195	–
2	**Short Warm-season Grasses**			195–390	
	blue grama	BOGR2	*Bouteloua gracilis*	130–325	–

	blue grama	BOGR2	*Bouteloua gracilis*	130–325	
	hairy grama	BOHI2	*Bouteloua hirsuta*	39–195	–
	threeawn	ARIST	*Aristida*	26–104	–
3	**Mid Warm-season Grasses**			13–130	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	13–130	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–65	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–26	–
4	**Other Native Grasses**			13–52	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–39	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	13–26	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–13	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–13	–
5	**Grass-likes**			195–390	
	threadleaf sedge	CAFI	*Carex filifolia*	130–260	–
	needleleaf sedge	CADU6	*Carex duriuscula*	65–195	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–130	–
6	**Non-Native Grasses**			0–130	
	field brome	BRAR5	*Bromus arvensis*	0–130	–
	cheatgrass	BRTE	*Bromus tectorum*	0–130	–
	bluegrass	POA	*Poa*	0–130	–
	smooth brome	BRIN2	*Bromus inermis*	0–65	–
Forb					
7	**Forbs**			65–195	
	white sagebrush	ARLU	*Artemisia ludoviciana*	13–65	–
	Forb, introduced	2FI	*Forb, introduced*	0–52	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	13–52	–
	field sagewort	ARCA12	*Artemisia campestris*	13–52	–
	Forb, native	2FN	*Forb, native*	13–39	–
	white heath aster	SYER	*Symphyotrichum ericoides*	13–39	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–26	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	13–26	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–13	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–13	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–13	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–13	–
	dotted blazing star	LIPU	*Liatris punctata*	0–13	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–13	–
	pussytoes	ANTEN	*Antennaria*	0–13	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–13	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–13	–
	American vetch	VIAM	*Vicia americana*	0–13	–
Shrub/Vine					
8	**Shrubs**			65–130	

	prairie sagewort	ARFR4	*Artemisia frigida*	13–65	–
	pricklypear	OPUNT	*Opuntia*	0–26	–
	snowberry	SYMPH	*Symphoricarpos*	0–26	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–26	–
	leadplant	AMCA6	*Amorpha canescens*	0–13	–
	rose	ROSA5	*Rosa*	0–13	–

Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			45–180	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–180	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–180	–
	green needlegrass	NAVI4	*Nassella viridula*	0–180	–
2	**Short Warm-season Grasses**			45–135	
	threeawn	ARIST	*Aristida*	18–108	–
	blue grama	BOGR2	*Bouteloua gracilis*	18–90	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–63	–
3	**Mid Warm-season Grasses**			0–27	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–27	–
4	**Other Native Grasses**			0–27	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–27	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–18	–
5	**Grass-likes**			135–270	
	threadleaf sedge	CAFI	*Carex filifolia*	90–180	–
	needleleaf sedge	CADU6	*Carex duriuscula*	45–135	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–90	–
6	**Non-Native Grasses**			90–270	
	field brome	BRAR5	*Bromus arvensis*	45–180	–
	cheatgrass	BRTE	*Bromus tectorum*	45–180	–
	bluegrass	POA	*Poa*	0–90	–
	smooth brome	BRIN2	*Bromus inermis*	0–45	–
Forb					
7	**Forbs**			45–135	
	Forb, introduced	2FI	*Forb, introduced*	9–72	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–63	–
	field sagewort	ARCA12	*Artemisia campestris*	9–54	–
	white heath aster	SYER	*Symphyotrichum ericoides*	9–36	–
	Forb, native	2FN	*Forb, native*	0–18	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	9–18	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–9	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–9	–

	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–9	–
	pussytoes	ANTEN	*Antennaria*	0–9	–
Shrub/Vine					
8	**Shrubs**			45–90	
	prairie sagewort	ARFR4	*Artemisia frigida*	2–8	–
	pricklypear	OPUNT	*Opuntia*	0–4	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–3	–
	snowberry	SYMPH	*Symphoricarpos*	0–1	–

Animal community

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

Needlegrass/Grama/Sedge (1.1 & 2.1)
Average Annual Production (lbs./acre, air-dry): 1900
Stocking Rate* (AUM/acre):0.52

Sedge/Grama/Needlegrass (1.2)
Average Annual Production (lbs./acre, air-dry): 1300
Stocking Rate* (AUM/acre):0.36

Needlegrass/Annual Bromegrass/Sedge (2.2)
Average Annual Production (lbs./acre, air-dry): 900
Stocking Rate* (AUM/acre):0.25

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

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

Hydrological functions

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

Other references

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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:** Typically not observable.

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground 20-40%.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class usually 4-6. Moderately high root content. Soil surface is resistant to erosion, in large part due to high rock/gravel content.

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, 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: Mid cool-season bunch grass > short warm-season grass

    Sub-dominant: > short cool-season grass > mid warm-season rhizomatous grass > mid warm-season bunch grass = forb > shrub

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

14. **Average percent litter cover (%) and depth (in):** 20-40%, less than 0.5 inch thick. 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):** 1600 – 2200 lbs./acre air-dry weight, average 1,900 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

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