USDA Natural Resources
Conservation Service

Ecological site R102DY016SD
Very Shallow

Last updated: 8/14/2024
Accessed: 05/21/2025

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.

MLRA notes

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

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

Classification relationships

Fenneman (1916) Physiographic Regions
Division - Interior Plains
East:
Province - Central Lowland
Section - Western Lake / Dissected Till Plains (12b/12e)

USFS (2007) Ecoregions
Domain - Humid Temperate
Division - Prairie
Province - Prairie Parkland (Temperate)
Section - North-Central Glaciated Plains (251B)

EPA Ecoregions (Omernik 1997)
I - Great Plains (9)
II - Temperate Prairies (9.2)
III - Aspen Parkland/Northern Glaciated Plains (9.2.1)

Ecological site concept

The 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

R102DY010SD	**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.
R102DY014SD	**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.

Similar sites

R102DY014SD	**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

This site primarily occurs on outwash plains in upland areas.

Table 2. Representative physiographic features

Landforms	(1) Outwash plain
Runoff class	Low to high
Flooding frequency	None
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to occasional
Elevation	305–610 m
Slope	2–25%
Water table depth	0 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 22 to 28 inches. Half or more of the precipitation falls during the growing season. Rainfall typically occurs during high-intensity, convective thunderstorms in summer. In the western part of the MLRA, rainfall is less abundant and not always adequate for full maturation of crops. Precipitation in winter is typically snow. The average annual temperature is 42 to 45 degrees F. The freeze-free period averages 144 days and ranges from 137 to 151 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	118-129 days
Freeze-free period (characteristic range)	141-149 days
Precipitation total (characteristic range)	610-686 mm
Frost-free period (actual range)	113-131 days
Freeze-free period (actual range)	137-151 days
Precipitation total (actual range)	559-711 mm
Frost-free period (average)	123 days
Freeze-free period (average)	144 days
Precipitation total (average)	635 mm

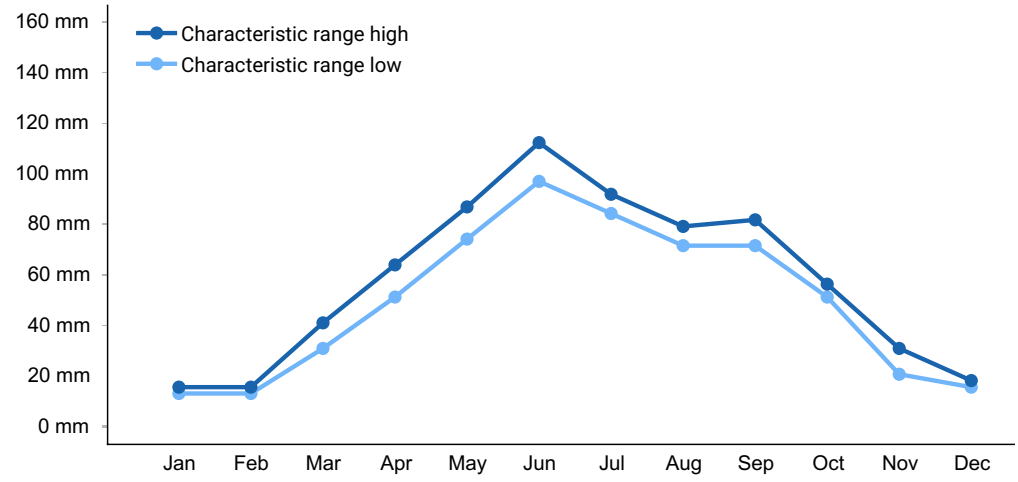


Figure 1. Monthly precipitation range

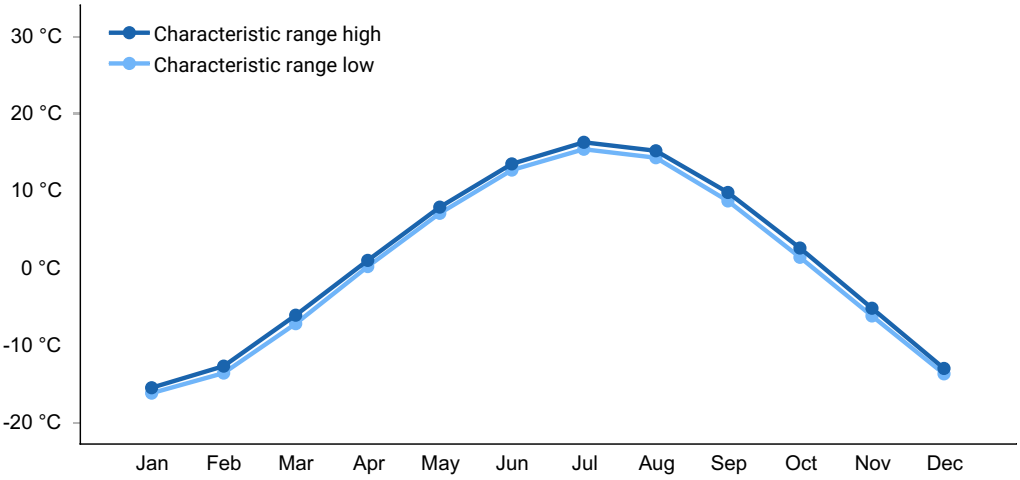


Figure 2. Monthly minimum temperature range

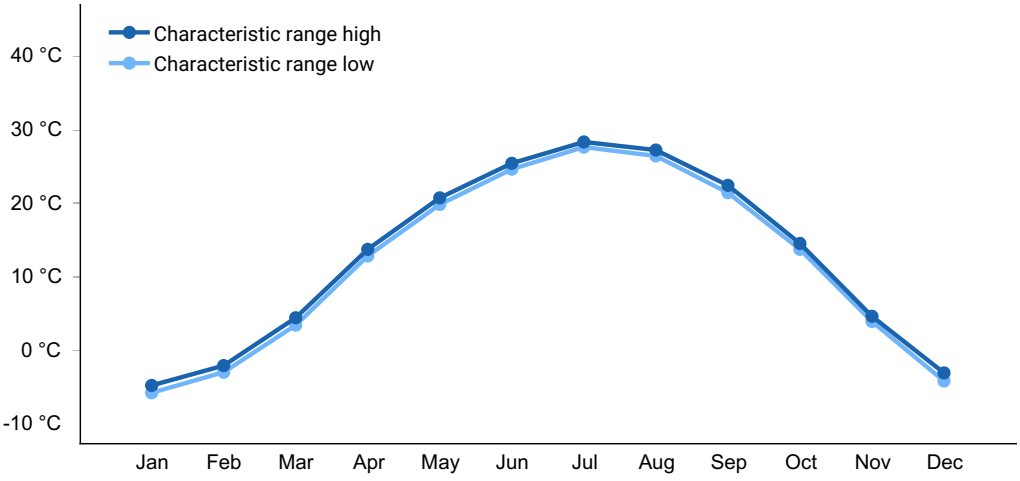


Figure 3. Monthly maximum temperature range

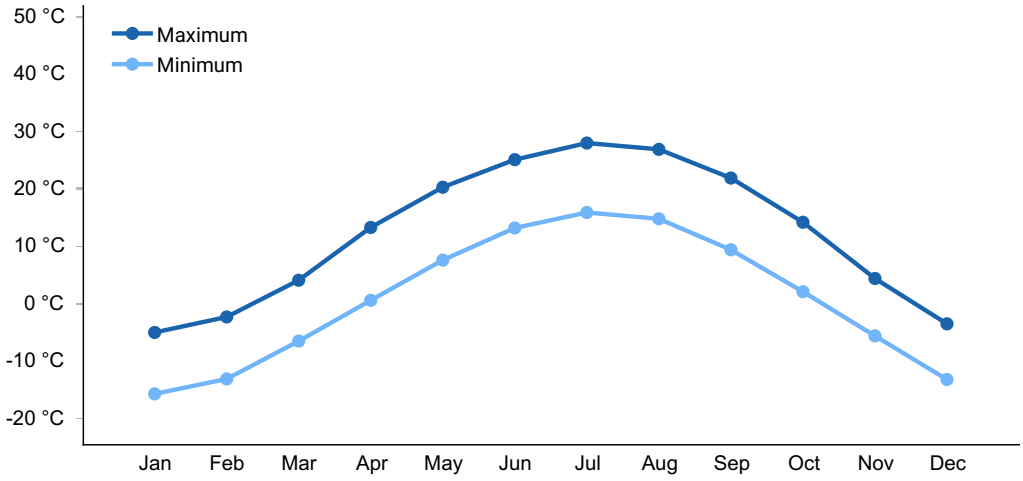


Figure 4. Monthly average minimum and maximum temperature

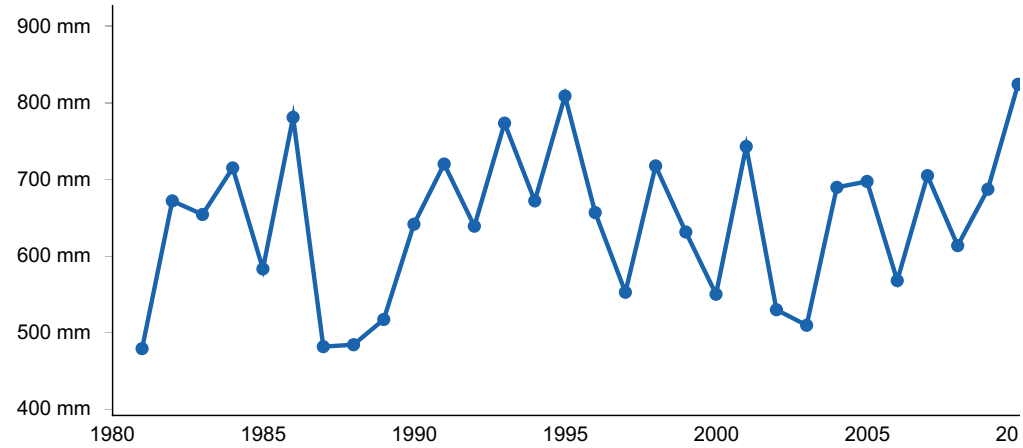


Figure 5. Annual precipitation pattern

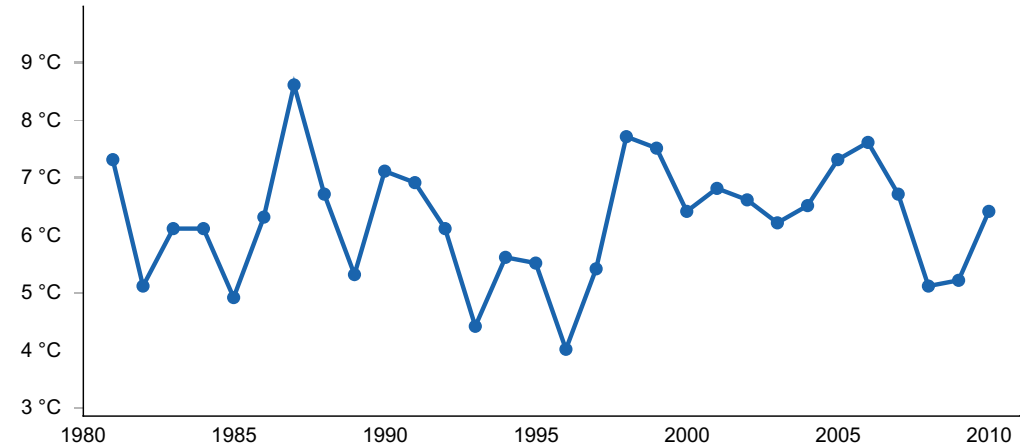


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ROY LAKE [USC00397326], Lake City, SD
- (2) WAUBAY NWR [USC00398980], Waubay, SD
- (3) WEBSTER [USC00399004], Webster, SD
- (4) WATERTOWN RGNL AP [USW00014946], Watertown, SD

- (5) WATERTOWN 1W [USC00398930], Watertown, SD
- (6) CLEAR LAKE [USC00391777], Clear Lake, SD
- (7) ARLINGTON 1 W [USC00390281], Arlington, SD
- (8) ASTORIA 4S [USC00390422], White, SD
- (9) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (10) TYLER [USC00218429], Tyler, MN

Influencing water features

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

Soil features

Soils are formed in outwash. Surface textures are primarily gravelly loam and sandy loam. Soils are somewhat excessively to excessively drained.

Table 4. Representative soil features

Parent material	(1) Outwash
Surface texture	(1) Gravelly loam (2) Sandy loam
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	15 cm
Soil depth	15–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	6.35–7.11 cm
Soil reaction (1:1 water) (0-25.4cm)	6.6–8.4
Subsurface fragment volume <=3" (0-152.4cm)	20–47%
Subsurface fragment volume >3" (0-152.4cm)	1–2%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	10–25 cm

Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-25.4cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	Not specified
Subsurface fragment volume >3" (0-152.4cm)	Not specified

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.

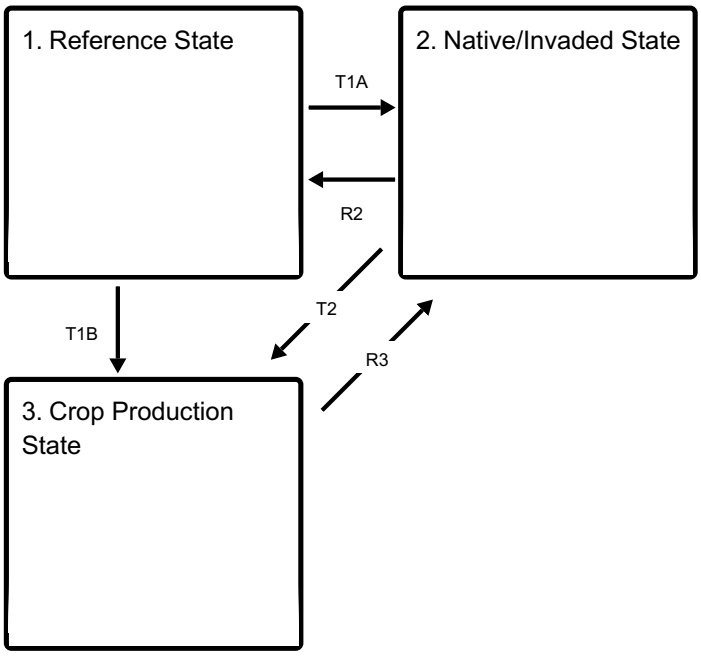
This ecological site (ES) has been grazed by domestic livestock since they have been introduced into the area. This ecological site is naturally resilient, and quite resistant to change. Also, due to the relatively steep slopes and naturally low fertility of the soils, this site generally avoids more 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

Ecosystem states



T1A - Heavy continuous grazing, inundation, no fire

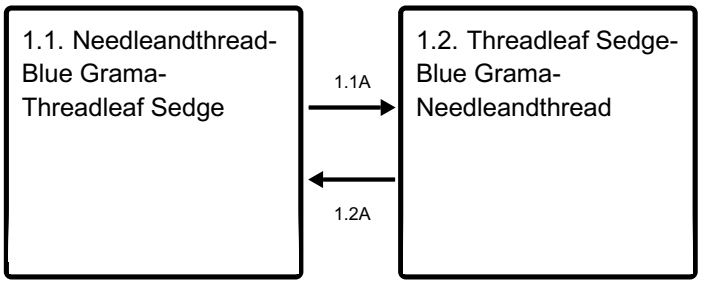
T1B - Tillage

R2 - Long-term prescribed grazing, prescribed burning

T2 - Tillage

R3 - Seeding, abandonment of cropping

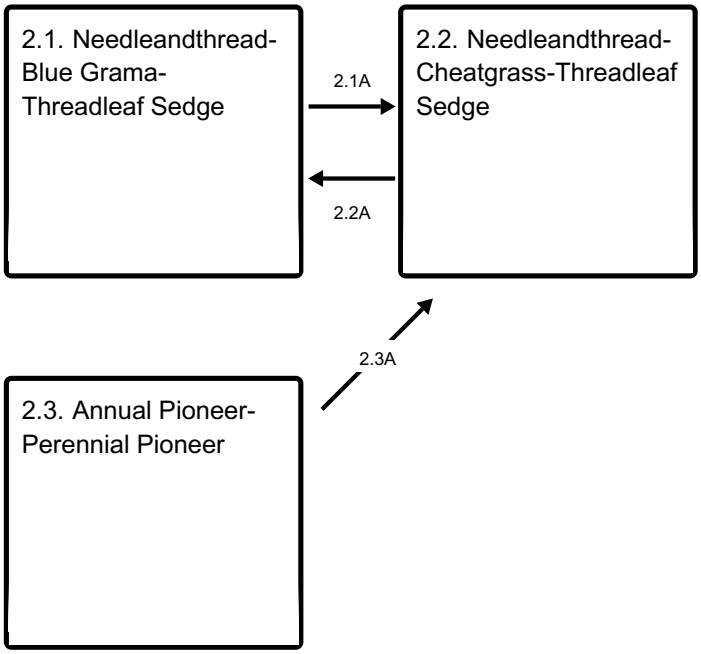
State 1 submodel, plant communities



1.1A - Heavy continuous grazing

1.2A - Prescribed grazing with recovery periods, prescribed burning

State 2 submodel, plant communities

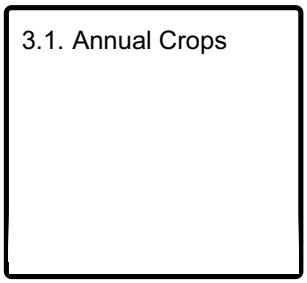


2.1A - Heavy continuous grazing

2.2A - Prescribed grazing with recovery periods

2.3A - Time without disturbance

State 3 submodel, plant communities



State 1
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ES. This state 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.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- rose (*Rosa*), shrub
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- blue grama (*Bouteloua gracilis*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- threadleaf sedge (*Carex filifolia*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- blacksamson echinacea (*Echinacea angustifolia*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous

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 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1255	1756	2191
Forb	101	213	370
Shrub/Vine	101	160	241
Total	**1457**	**2129**	**2802**

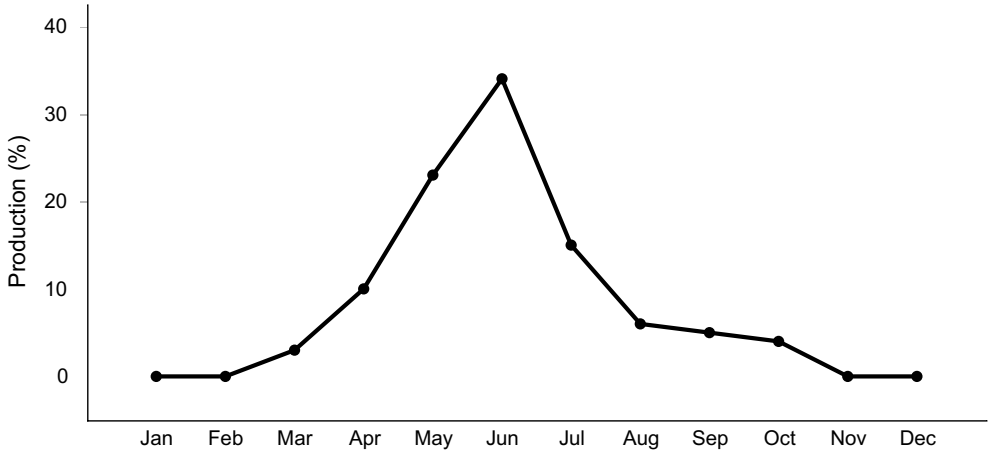


Figure 8. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

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 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	762	1202	1608
Forb	45	101	168
Shrub/Vine	45	76	106
Total	**852**	**1379**	**1882**

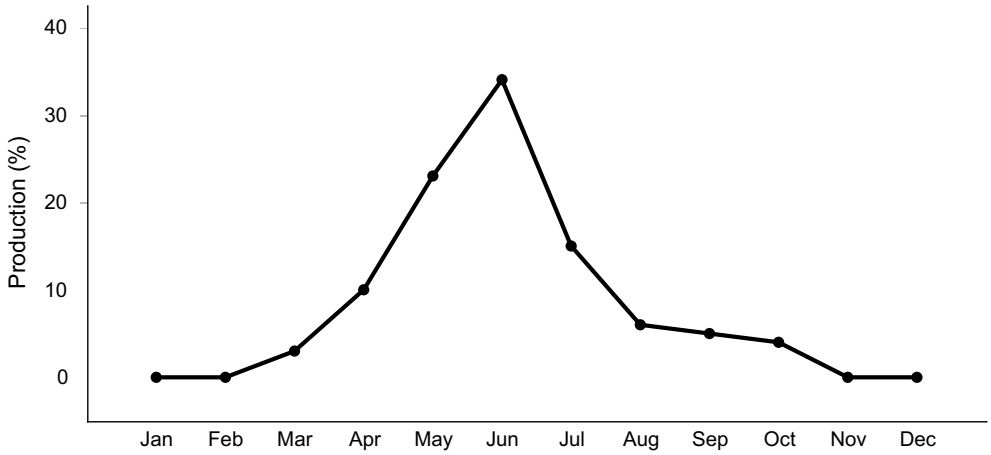


Figure 10. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Pathway 1.1A
Community 1.1 to 1.2

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

Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- pricklypear (*Opuntia*), shrub
- threadleaf sedge (*Carex filifolia*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- threeawn (*Aristida*), grass
- field brome (*Bromus arvensis*), grass
- cheatgrass (*Bromus tectorum*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- field sagewort (*Artemisia campestris*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous

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.

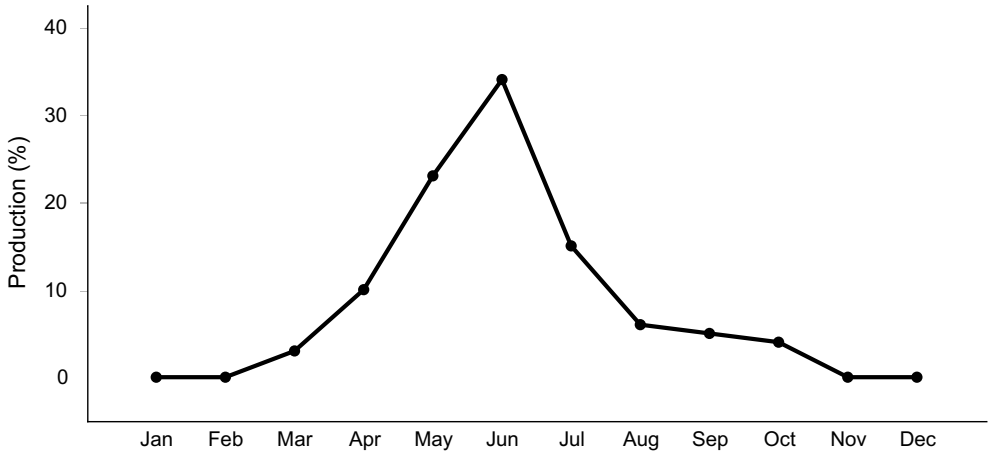


Figure 11. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

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 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	471	832	1182
Forb	45	101	168
Shrub/Vine	45	76	106
Total	**561**	**1009**	**1456**

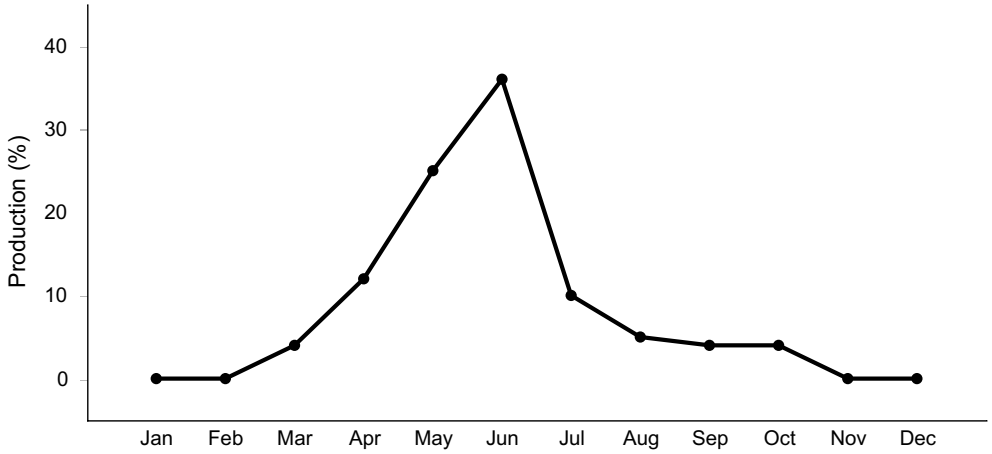


Figure 13. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

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.

Dominant plant species

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

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 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			426–958	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	213–639	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	106–426	–
	green needlegrass	NAVI4	*Nassella viridula*	0–170	–
2	**Short Warm-season Grasses**			213–532	
	blue grama	BOGR2	*Bouteloua gracilis*	106–426	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	43–213	–
	threeawn	ARIST	*Aristida*	21–64	–
3	**Mid Warm-season Grasses**			106–319	
	sideoats grama	BOCU	*Bouteloua curtipendula*	43–213	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	43–213	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–106	–
4	**Other Native Grasses**			21–106	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–85	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	21–64	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–43	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–43	–
5	**Grass-likes**			106–319	
	threadleaf sedge	CAFI	*Carex filifolia*	43–213	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–106	–
	needleleaf sedge	CADU6	*Carex duriuscula*	21–106	–
Forb					
6	**Forbs**			106–319	
	American vetch	VIAM	*Vicia americana*	21–429	–
	Forb, native	2FN	*Forb, native*	21–64	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	21–64	–
	blacksamson	ECAN2	*Echinacea angustifolia*	21–64	–

	echinacea				
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	21–64	–
	dotted blazing star	LIPU	*Liatris punctata*	21–43	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	21–43	–
	false boneset	BREU	*Brickellia eupatorioides*	0–43	–
	field sagewort	ARCA12	*Artemisia campestris*	21–43	–
	purple prairie clover	DAPU5	*Dalea purpurea*	21–43	–
	white heath aster	SYER	*Symphyotrichum ericoides*	21–43	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	21–43	–
	white prairie clover	DACA7	*Dalea candida*	0–21	–
	milkvetch	ASTRA	*Astragalus*	0–21	–
	pussytoes	ANTEN	*Antennaria*	0–21	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–21	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–21	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–21	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–21	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–21	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–21	–
Shrub/Vine					
7	**Shrubs**			106–213	
	leadplant	AMCA6	*Amorpha canescens*	21–64	–
	prairie sagewort	ARFR4	*Artemisia frigida*	21–64	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–43	–
	rose	ROSA5	*Rosa*	21–43	–
	snowberry	SYMPH	*Symphoricarpos*	21–43	–
	pricklypear	OPUNT	*Opuntia*	0–21	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–21	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)

Grass/Grasslike					
1	**Needlegrass**			73–219	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–219	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–219	–
	green needlegrass	NAVI4	*Nassella viridula*	0–219	–
2	**Short Warm-season Grasses**			219–437	
	blue grama	BOGR2	*Bouteloua gracilis*	146–364	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	44–219	–
	threeawn	ARIST	*Aristida*	29–117	–
3	**Mid Warm-season Grasses**			15–146	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	15–146	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–73	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–29	–
4	**Other Native Grasses**			15–58	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–44	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	15–29	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–15	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–15	–
5	**Grass-likes**			219–437	
	threadleaf sedge	CAFI	*Carex filifolia*	146–291	–
	needleleaf sedge	CADU6	*Carex duriuscula*	73–219	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–146	–
6	**Non-Native Grasses**			0–146	
	field brome	BRAR5	*Bromus arvensis*	0–146	–
	cheatgrass	BRTE	*Bromus tectorum*	0–146	–
	bluegrass	POA	*Poa*	0–146	–
	smooth brome	BRIN2	*Bromus inermis*	0–73	–
Forb					
7	**Forbs**			73–219	
	white sagebrush	ARLU	*Artemisia ludoviciana*	15–73	–
	Forb, introduced	2FI	*Forb, introduced*	0–58	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	15–58	–

	field sagewort	ARCA12	*Artemisia campestris*	15–58	–
	Forb, native	2FN	*Forb, native*	15–44	–
	white heath aster	SYER	*Symphyotrichum ericoides*	15–44	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–29	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	15–29	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–15	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	dotted blazing star	LIPU	*Liatris punctata*	0–15	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–15	–
	pussytoes	ANTEN	*Antennaria*	0–15	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–15	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–15	–
	American vetch	VIAM	*Vicia americana*	0–15	–
Shrub/Vine					
8	**Shrubs**			73–146	
	prairie sagewort	ARFR4	*Artemisia frigida*	15–73	–
	pricklypear	OPUNT	*Opuntia*	0–29	–
	snowberry	SYMPH	*Symphoricarpos*	0–29	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–29	–
	leadplant	AMCA6	*Amorpha canescens*	0–15	–
	rose	ROSA5	*Rosa*	0–15	–

Table 11. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			50–202	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–202	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–202	–

	green needlegrass	NAVI4	*Nassella viridula*	0–202	–
2	**Short Warm-season Grasses**			50–151	
	threeawn	ARIST	*Aristida*	20–121	–
	blue grama	BOGR2	*Bouteloua gracilis*	20–101	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–71	–
3	**Mid Warm-season Grasses**			0–30	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–30	–
4	**Other Native Grasses**			0–30	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–30	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–20	–
5	**Grass-likes**			151–303	
	threadleaf sedge	CAFI	*Carex filifolia*	101–202	–
	needleleaf sedge	CADU6	*Carex duriuscula*	50–151	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–101	–
6	**Non-Native Grasses**			101–303	
	field brome	BRAR5	*Bromus arvensis*	50–202	–
	cheatgrass	BRTE	*Bromus tectorum*	50–202	–
	bluegrass	POA	*Poa*	0–101	–
	smooth brome	BRIN2	*Bromus inermis*	0–50	–
Forb					
7	**Forbs**			50–151	
	Forb, introduced	2FI	*Forb, introduced*	10–81	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	10–71	–
	field sagewort	ARCA12	*Artemisia campestris*	10–61	–
	white heath aster	SYER	*Symphyotrichum ericoides*	10–40	–
	Forb, native	2FN	*Forb, native*	0–20	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	10–20	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–10	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–10	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–10	–

	pussytoes	ANTEN	*Antennaria*	0–10	–
Shrub/Vine					
8	**Shrubs**			50–101	
	prairie sagewort	ARFR4	*Artemisia frigida*	2–9	–
	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

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

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

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

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

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

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

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

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

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

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

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

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

Contributors

Megan Baxter
Stan Boltz
Lance Howe
Steve Winter

Approval

Suzanne Mayne-Kinney, 8/14/2024

Acknowledgments

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

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

Rangeland health reference sheet

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

Author(s)/participant(s)	David Schmidt, Tim Nordquist, Stan Boltz
Contact for lead author	
Date	12/04/2007
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

---

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.
