

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

Site Name: Clayey Overflow

Site ID: R102AY021SD

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

Physiographic Features

This site occurs in and adjacent to potholes.

Landform: pothole

Aspect: N/A

Elevation (feet):

Minimum

1,000

Maximum

2,000

Slope (percent):

0

1

Water Table Depth (inches):

12

60

Flooding:

Frequency:

Occasional

Occasional

Duration:

Long

Long

Ponding:

Depth (inches):

None

None

Frequency:

None

None

Duration:

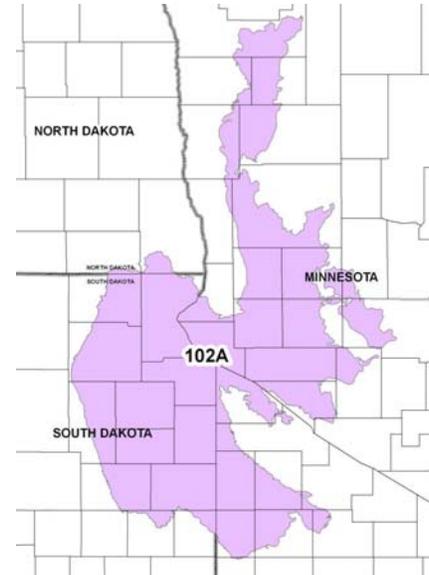
None

None

Runoff Class:

Negligible

Low



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 (Mahnomens 1 W, Minnesota (MN)), to about 14°F (Tracy, MN). July is the warmest month with temperatures averaging from about 69°F (Mahnomens 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.

	<u>Minimum</u>	<u>Maximum</u>
Frost-free period (days):	121	152
Freeze-free period (days):	145	174
Mean Annual Precipitation (inches):	21	27

Average Monthly Precipitation (inches) and Temperature (°F):

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.50	0.78	-5.9	23.1
February	0.50	0.76	1.1	27.8
March	0.86	1.46	15.0	39.4
April	2.00	2.52	30.5	56.5
May	2.93	3.14	42.5	70.0
June	3.67	4.14	52.0	79.4
July	3.17	3.66	56.3	84.7
August	2.64	3.60	54.2	82.3
September	1.98	2.83	44.6	73.6
October	1.52	2.14	34.1	60.8
November	0.74	1.23	18.4	41.9
December	0.45	0.76	2.8	27.9

Climate Stations		Period	
Station ID	Location or Name	From	To
SD0281	Arlington 1 W, SD	1928	2009
MN0667	Benson, MN	1952	2009
SD1739	Clark, SD	1893	2009
MN5012	Mahnomen 1 W, MN	1927	1998
MN8323	Tracy, MN	1912	2009
SD8980	Waubay National Wildlife Refuge, SD	1952	2009

For local climate stations that may be more representative, refer to <http://www.wcc.nrcs.usda.gov>.

Riparian and Wetland Features

Wetland Description:	<u>System</u>	<u>Subsystem</u>	<u>Class</u>	<u>Sub-class</u>
Cowardin, et al., 1979	Palustrine	N/A	Emergent Wetland	Persistent

Representative Soil Features

The soils in this site are poorly drained and formed in clayey alluvium. The silty clay loam surface layer is typically about nine inches thick but can be deeper on some soils. These soils have a very slow infiltration rate. When dry these soils crack. When the soils are wet, surface compaction can occur with heavy traffic. This site often occurs as slightly elevated, relatively flat areas within potholes. This site typically should show no evidence of rills, wind scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact. There are no root restrictive layers in these soils; however, the high shrink-swell potential can cause damage and/or inhibit root growth.

Access Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>) for specific local soils information.

Parent Material Kind: alluvium
Parent Material Origin:
Surface Texture: silty clay loam
Surface Texture Modifier: none
Subsurface Texture Group: clayey
Surface Fragments ≤3” (% Cover): 0-2
Surface Fragments >3” (%Cover): 0
Subsurface Fragments ≤3” (% Volume): 0-2
Subsurface Fragments >3” (% Volume): 0

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	poorly	poorly
Permeability Class:	very slow	very slow
Depth (inches):	80	80
Electrical Conductivity (mmhos/cm)*:	0	4
Sodium Absorption Ratio*:	0	5
Soil Reaction (1:1 Water)*:	6.6	8.4
Soil Reaction (0.1M CaCl₂)*:	NA	NA
Available Water Capacity (inches)*:	7	7
Calcium Carbonate Equivalent (percent)*:	0	10

*These attributes represent from 0-40 inches or to the first restrictive layer.

Plant Communities

Ecological Dynamics of the Site

This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances, such as periods of well below average precipitation, can cause significant shifts in plant communities and/or species composition.

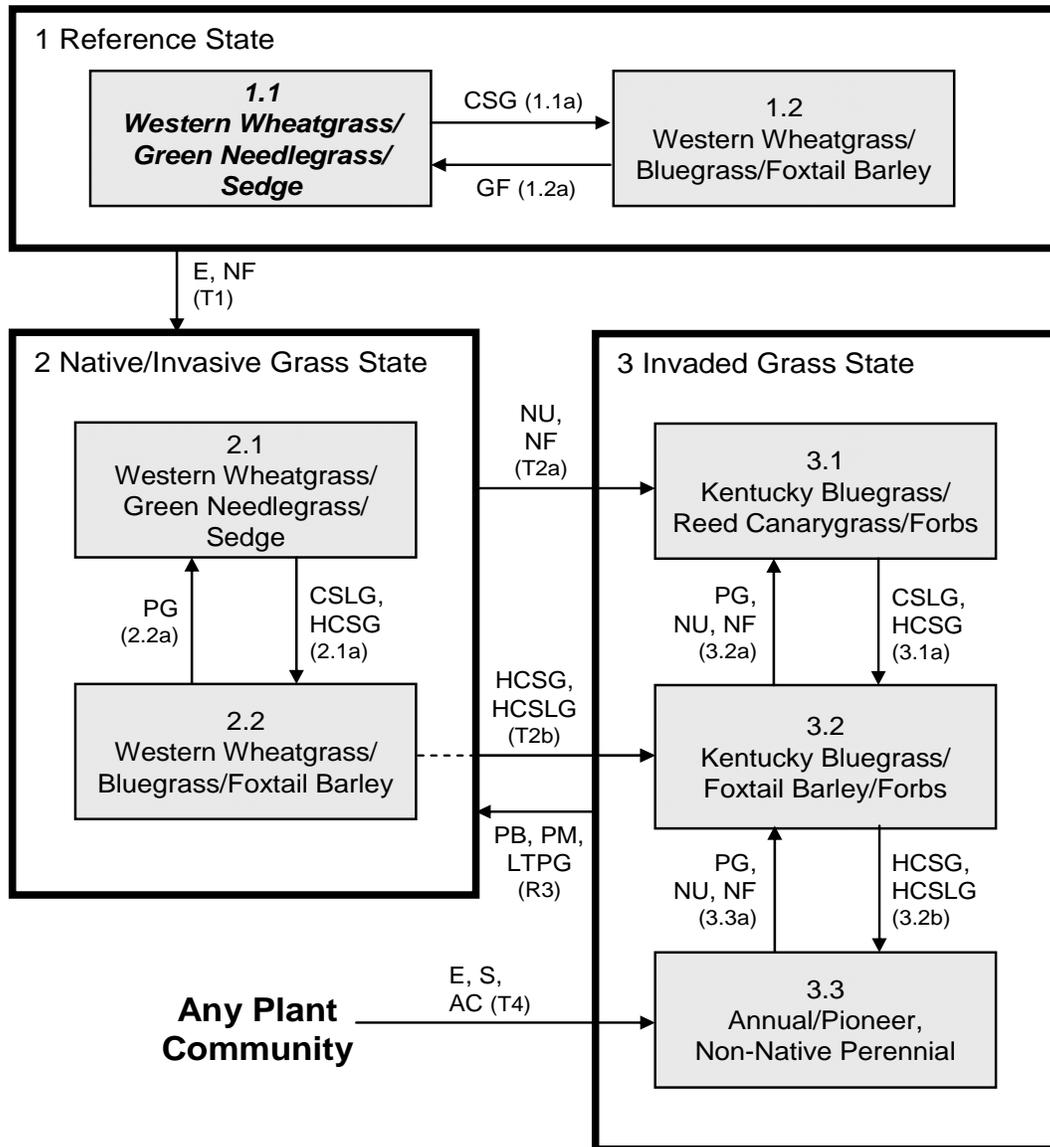
Fluctuations in the duration of ponding can temporarily shift this site to higher composition of grass-like species such as sedge, rush, and spikerush. Continuous season-long grazing (during the typical growing season of May through October) and/or heavy continuous seasonal grazing (i.e., grazing at the same time of year every year) without adequate recovery periods following each grazing occurrence causes this site to depart from the Western Wheatgrass/Green Needlegrass/Sedge Plant Community. Western wheatgrass increases initially and will eventually decrease with continuous grazing. Grass and grass-like species such as green needlegrass and the more palatable sedges will decrease in frequency and production. With continued disturbance, this site is susceptible to invasion of nonnative species such as Kentucky bluegrass. This species can become dominant and alter the ecological processes drastically.

Interpretations are primarily based on the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community. It has 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 used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

Plant Communities and Transitional Pathways



Refer to plant community phase narratives for details on pathways: **AC** – Abandonment of cropping; **CSG** – Continuous seasonal grazing; **CSLG** – Continuous season-long grazing; **E** – Encroachment of non-native species; **GF** – Grazing and fire returned to normal disturbance regimes; **HCSG** – Heavy continuous seasonal grazing; **HCSLG** – Heavy continuous season-long grazing; **LTPG** – Long-term prescribed grazing; **NF** – No fire; **NU** – Non-use; **PB** – Prescribed burning; **PG** – Prescribed grazing; **PM** – Pest management (herbicide); **S** – Seeding.

Plant Community Composition and Group Annual Production

			1.1 Western Wheatgrass/Green Needlegrass/Sedge		
COMMON/GROUP NAME	SCIENTIFIC NAME	SYMBOL	Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES				3570 - 3990	85 - 95
WHEATGRASS			1	630 - 2310	15 - 55
western wheatgrass	Pascopyrum smithii	PASM	1	630 - 2310	15 - 55
slender wheatgrass	Elymus trachycaulus	ELTR7	1	0 - 840	0 - 20
GRASS-LIKES			2	210 - 1260	5 - 30
clustered field sedge	Carex praegracilis	CAPR5	2	42 - 840	1 - 20
manyhead sedge	Carex sychnocephala	CASY	2	42 - 630	1 - 15
fox sedge	Carex vulpinoidea	CAVU2	2	0 - 630	0 - 15
Sartwell's sedge	Carex sartwellii	CASA8	2	0 - 420	0 - 10
woolly sedge	Carex pellita	CAPE42	2	0 - 168	0 - 4
rush	Juncus spp.	JUNCU	2	0 - 420	0 - 10
spikerush	Eleocharis spp.	ELEOC	2	0 - 336	0 - 8
other grass-likes		2GL	2	0 - 420	0 - 10
NATIVE COOL-SEASON GRASSES			3	630 - 1050	15 - 25
green needlegrass	Nassella viridula	NAVI4	3	420 - 840	10 - 20
plains bluegrass	Poa arida	POAR3	3	42 - 420	1 - 10
fowl bluegrass	Poa palustris	POPA2	3	42 - 420	1 - 10
foxtail barley	Hordeum jubatum	HOJU	3	0 - 126	0 - 3
Canada wildrye	Elymus canadensis	ELCA4	3	0 - 126	0 - 3
other grasses		2GRAM	3	0 - 210	0 - 5
WARM-SEASON GRASSES			4	0 - 210	0 - 5
switchgrass	Panicum virgatum	PAVI2	4	0 - 210	0 - 5
prairie cordgrass	Spartina pectinata	SPPE	4	0 - 126	0 - 3
FORBS			6	210 - 630	5 - 15
American licorice	Glycyrrhiza lepidota	GLLE3	6	42 - 126	1 - 3
American vetch	Vicia americana	VIAM	6	0 - 42	0 - 1
Carolina geranium	Geranium carolinianum var. carolinianum	GECAC4	6	0 - 42	0 - 1
cinquefoil	Potentilla spp.	POTEN	6	42 - 84	1 - 2
cudweed sagewort	Artemisia ludoviciana	ARLU	6	42 - 84	1 - 2
false boneset	Brickellia eupatorioides	BREU	6	0 - 42	0 - 1
Flodman's thistle	Cirsium flodmanii	CIFL	6	42 - 84	1 - 2
goldenrod	Solidago spp.	SOLID	6	42 - 84	1 - 2
heartleaf Alexanders	Zizia aptera	ZIAP	6	0 - 84	0 - 2
heath aster	Symphyotrichum ericoides	SYER	6	0 - 42	0 - 1
Indianhemp	Apocynum cannabinum	APCA	6	42 - 84	1 - 2
Macoun's buttercup	Ranunculus macounii	RAMA2	6	0 - 42	0 - 1
Maximilian sunflower	Helianthus maximiliani	HEMA2	6	42 - 84	1 - 2
meadow anemone	Anemone canadensis	ANCA8	6	42 - 84	1 - 2
mint	Mentha spp.	MENTH	6	0 - 42	0 - 1
northern bedstraw	Galium boreale	GABO2	6	0 - 42	0 - 1
Pennsylvania smartweed	Polygonum pensylvanicum	POPE2	6	0 - 84	0 - 2
prairie coneflower	Ratibida columnifera	RACO3	6	0 - 42	0 - 1
rough bugleweed	Lycopus asper	LYAS	6	0 - 84	0 - 2
Rydberg's sunflower	Helianthus nuttallii ssp. rydbergii	HENUR	6	0 - 42	0 - 1
scarlet gaura	Gaura coccinea	GACO5	6	0 - 42	0 - 1
scurfpea	Psoralegium spp.	PSORA2	6	42 - 84	1 - 2
swamp milkweed	Asclepias incarnata	ASIN	6	0 - 84	0 - 2
swamp smartweed	Polygonum hydropiperoides	POHY2	6	0 - 84	0 - 2
western dock	Rumex aquaticus	RUAQ	6	0 - 84	0 - 2
western ragweed	Ambrosia psilostachya	AMPS	6	0 - 42	0 - 1
western yarrow	Achillea millefolium var. occidentalis	ACMIO	6	42 - 84	1 - 2
white panicle aster	Symphyotrichum lanceolatum	SYLA6	6	0 - 84	0 - 2
wild bergamot	Monarda fistulosa	MOFI	6	0 - 42	0 - 1
native forbs		2FN	6	42 - 210	1 - 5

Annual Production lbs./acre		LOW	RV	HIGH
GRASSES & GRASS-LIKES		3215 -	3780	-4245
FORBS		185 -	420	-755
TOTAL		3400 -	4200	-5000

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative value.

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SYMBOL	1.1 Western Wheatgrass/ Green Needlegrass/Sedge			2.2 Western Wheatgrass/ Bluegrass/Foxtail Barley			3.1 Kentucky Bluegrass/ Reed Canarygrass/Forbs			3.2 Kentucky Bluegrass/ Foxtail Barley/Forbs		
		Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp
GRASSES & GRASS-LIKES			3570 - 3990	85 - 95		2970 - 3135	90 - 95		3040 - 3420	80 - 90		2000 - 2250	80 - 90
WHEATGRASS		1	630 - 2310	15 - 55	1	825 - 2145	25 - 65	1	76 - 570	2 - 15	1	0 - 125	0 - 5
western wheatgrass	PASM	1	630 - 2310	15 - 55	1	825 - 1980	25 - 60	1	76 - 570	2 - 15	1	0 - 125	0 - 5
slender wheatgrass	ELTR7	1	0 - 840	0 - 20	1	0 - 330	0 - 10	1	0 - 190	0 - 5			
GRASS-LIKES		2	210 - 1260	5 - 30	2	66 - 495	2 - 15	2	76 - 570	2 - 15	2	0 - 250	0 - 10
clustered field sedge	CAPR5	2	42 - 840	1 - 20	2	0 - 330	0 - 10	2	38 - 380	1 - 10	2	0 - 175	0 - 7
manyhead sedge	CASY	2	42 - 630	1 - 15	2	0 - 165	0 - 5	2	0 - 114	0 - 3			
fox sedge	CAVU2	2	0 - 630	0 - 15	2	0 - 66	0 - 2						
Sartwell's sedge	CASA8	2	0 - 420	0 - 10									
woolly sedge	CAPE42	2	0 - 168	0 - 4									
rush	JUNCU	2	0 - 420	0 - 10	2	0 - 264	0 - 8	2	0 - 190	0 - 5	2	0 - 175	0 - 7
spikerush	ELEOC	2	0 - 336	0 - 8	2	0 - 99	0 - 3	2	0 - 304	0 - 8	2	0 - 125	0 - 5
other grass-likes	2GL	2	0 - 420	0 - 10	2	0 - 165	0 - 5	2	0 - 114	0 - 3	2	0 - 75	0 - 3
NATIVE COOL-SEASON GRASSES		3	630 - 1050	15 - 25	3	330 - 990	10 - 30	3	190 - 1330	5 - 35	3	250 - 625	10 - 25
green needlegrass	NAV14	3	420 - 840	10 - 20	3	0 - 264	0 - 8	3	0 - 76	0 - 2			
plains bluegrass	POAR3	3	42 - 420	1 - 10	3	66 - 495	2 - 15	3	0 - 114	0 - 3			
fowl bluegrass	POPA2	3	42 - 420	1 - 10	3	66 - 495	2 - 15	3	0 - 114	0 - 3			
foxtail barley	HOJU	3	0 - 126	0 - 3	3	66 - 396	2 - 12	3	0 - 114	0 - 3	3	250 - 625	10 - 25
Canada wildrye	ELCA4	3	0 - 126	0 - 3				3	0 - 38	0 - 1			
reed canarygrass	PHAR3				3	0 - 99	0 - 3	3	76 - 1140	2 - 30	3	0 - 125	0 - 5
other grasses	2GRAM	3	0 - 210	0 - 5	3	0 - 99	0 - 3	3	0 - 114	0 - 3	3	0 - 75	0 - 3
WARM-SEASON GRASSES		4	0 - 210	0 - 5	4	0 - 99	0 - 3	4			4		
switchgrass	PAV12	4	0 - 210	0 - 5									
prairie cordgrass	SPPE	4	0 - 126	0 - 3	4	0 - 99	0 - 3						
NON-NATIVE GRASSES		5			5	33 - 330	1 - 10	5	570 - 1710	15 - 45	5	625 - 1750	25 - 70
Kentucky bluegrass	POPR				5	33 - 330	1 - 10	5	570 - 1710	15 - 45	5	625 - 1750	25 - 70
other grasses	2GRAM				5	0 - 132	0 - 4	5	0 - 190	0 - 5	5	0 - 125	0 - 5
FORBS		6	210 - 630	5 - 15	6	165 - 330	5 - 10	6	380 - 760	10 - 20	6	250 - 500	10 - 20
American licorice	GLLE3	6	42 - 126	1 - 3	6	33 - 66	1 - 2	6	38 - 152	1 - 4	6	0 - 50	0 - 2
American vetch	VIAM	6	0 - 42	0 - 1									
Carolina geranium	GECA4	6	0 - 42	0 - 1				6	0 - 76	0 - 2			
cinquefoil	POTEN	6	42 - 84	1 - 2	6	33 - 66	1 - 2	6	38 - 76	1 - 2	6	0 - 25	0 - 1
cutweed sagewort	ARLU	6	42 - 84	1 - 2	6	33 - 99	1 - 3	6	38 - 152	1 - 4	6	25 - 200	1 - 8
false bonaset	BREU	6	0 - 42	0 - 1									
Flodman's thistle	CIFL	6	42 - 84	1 - 2	6	0 - 33	0 - 1	6	38 - 114	1 - 3			
goldenrod	SOLID	6	42 - 84	1 - 2	6	33 - 66	1 - 2	6	38 - 114	1 - 3	6	25 - 200	1 - 8
heartleaf Alexanders	ZIAP	6	0 - 84	0 - 2				6	0 - 38	0 - 1			
heath aster	SYER	6	0 - 42	0 - 1				6	0 - 38	0 - 1	6	0 - 75	0 - 3
Indianhemp	APCA	6	42 - 84	1 - 2	6	0 - 33	0 - 1	6	38 - 114	1 - 3	6	0 - 25	0 - 1
Macoun's buttercup	RAMA2	6	0 - 42	0 - 1									
Maximilian sunflower	HEMA2	6	42 - 84	1 - 2	6	0 - 33	0 - 1	6	0 - 38	0 - 1			
meadow anemone	ANCA8	6	42 - 84	1 - 2	6	0 - 33	0 - 1						
mint	MENTH	6	0 - 42	0 - 1				6	0 - 76	0 - 2			
northern bedstraw	GABO2	6	0 - 42	0 - 1									
Pennsylvania smartweed	POPE2	6	0 - 84	0 - 2	6	0 - 33	0 - 1	6	0 - 114	0 - 3	6	0 - 25	0 - 1
prairie coneflower	RACO3	6	0 - 42	0 - 1									
rough bugleweed	LYAS	6	0 - 84	0 - 2				6	0 - 38	0 - 1			
Rydberg's sunflower	HENUR	6	0 - 42	0 - 1									
scarlet gaura	GACO5	6	0 - 42	0 - 1									
scurfpea	PSORA2	6	42 - 84	1 - 2	6	33 - 66	1 - 2	6	38 - 152	1 - 4	6	25 - 175	1 - 7
swamp milkweed	ASIN	6	0 - 84	0 - 2				6	0 - 38	0 - 1			
swamp smartweed	POHY2	6	0 - 84	0 - 2				6	0 - 38	0 - 1	6	0 - 25	0 - 1
western dock	RUAQ	6	0 - 84	0 - 2									
western ragweed	AMPS	6	0 - 42	0 - 1	6	0 - 66	0 - 2	6	0 - 114	0 - 3	6	25 - 100	1 - 4
western yarrow	ACMIO	6	42 - 84	1 - 2	6	33 - 99	1 - 3	6	38 - 114	1 - 3	6	25 - 125	1 - 5
white panicle aster	SYLA6	6	0 - 84	0 - 2	6	0 - 33	0 - 1	6	0 - 76	0 - 2			
wild bergamot	MOFI	6	0 - 42	0 - 1				6	0 - 38	0 - 1			
native forbs	2FN	6	42 - 210	1 - 5	6	33 - 99	1 - 3	6	38 - 114	1 - 3	6	0 - 125	0 - 5
introduced forbs	2FI				6	0 - 132	0 - 4	6	38 - 266	1 - 7	6	50 - 250	2 - 10
Annual Production lbs./acre			LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH
GRASSES & GRASS-LIKES			3215 - 3780 - 4245		2355 - 3053 - 3715		2490 - 3230 - 3690		1585 - 2125 - 2600				
FORBS			185 - 420 - 755		145 - 248 - 385		310 - 570 - 910		215 - 375 - 600				
TOTAL			3400 - 4200 - 5000		2500 - 3300 - 4100		2800 - 3800 - 4600		1800 - 2500 - 3200				

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative value. Refer to PLANTS database for scientific names and codes: <http://plants.usda.gov>

Plant Community and Vegetation State Narratives

Reference State (State 1)

This state represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state was dominated by cool-season grass and grass-like species. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included somewhat frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. A combination of disturbances such as fire followed by grazing during below average precipitation periods, or a severe single disturbance such as extended periods of below average precipitation, would have caused a decline in sedges and green needlegrass. This would have resulted in a simplification of the plant community with dominance by western wheatgrass.

1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase

Interpretations are based primarily on the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase (this is also considered to be climax). The potential vegetation was about 85 percent grasses or grass-like plants and 15 percent forbs. The community was dominated by cool-season grasses. The major grass and grass-like species included western wheatgrass, green needlegrass, and clustered field sedge. Other grasses included switchgrass, plains bluegrass, prairie cordgrass, fowl bluegrass, and slender wheatgrass. This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high drought tolerance. This was a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD0207

Growth curve name: Rolling Till Prairie, cool-season dominant, warm-season subdominant.

Growth curve description: Cool-season dominant, warm-season subdominant, lowland.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	5	13	20	25	18	11	5	3	0	0

Transitions or pathways leading to other plant communities were as follows:

- 1.1a – Continuous seasonal grazing which includes grazing at moderate to heavy stocking levels at the same time of year each year, or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing would have shifted this community to the *1.2 Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase*.

1.2 Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase

This plant community evolved under continuous seasonal grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 90 percent grasses and grass-like species and 10 percent forbs. The dominant grass was western wheatgrass. Grass and grass-like species of secondary importance included plains bluegrass, fowl bluegrass, foxtail barley, and sedge. Forbs commonly found in this plant community included cudweed sagewort, western yarrow, American licorice, goldenrod, and scurfp pea. This plant community will have similar plant composition to the 2.2 Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase (refer to the plant composition tables). The main difference is that nonnative species such as Kentucky bluegrass would not have been present in this plant community phase.

When compared to the Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase (1.1), green needlegrass and sedge decreased significantly. Production and litter cover would have decreased as well and bare ground would have increased. The site would have been the most susceptible to erosion and gully formation during this phase. However, once conditions became more favorable, this plant community phase would have readily shifted back to the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD0206

Growth curve name: Rolling Till Prairie, lowland cool-season dominant.

Growth curve description: Cool-season dominant, lowland.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	6	15	20	26	17	9	4	3	0	0

Transitions or pathways leading to other plant communities were as follows:

- 1.2a – Grazing and fire 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 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase*.
- T1 – Encroachment of non-native grasses such as Kentucky bluegrass, and disruption of natural disturbance regimes such as periodic fire followed by short-term high intensity grazing would have led this plant community phase over a threshold to the *Native/Invasive Grass State (State 2)*. This occurs as natural and/or management actions (altered grazing and/or fire regime) favored a decline in the composition of the native species and an increase in cool-season sod grasses. Chronic season-long or heavy continuous grazing facilitated this transition. Complete rest from grazing and no fire events could also have accelerated this transition.

Native/Invasive Grass State (State 2)

This state is similar to the reference state in terms dominant plant composition and production. However, the invasion of introduced cool-season sod grasses alters the natural range of variability for this ES. This state is still dominated by mid- and tall native cool-season grasses, but invasive introduced cool-season sod grasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include grazing by domestic livestock and infrequent fires. Timing and intensity of grazing events coupled with weather dictate the dynamics that occur within this state. The cool-season native grass can decline and an increase in introduced sod grasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season-long grazing.

This state represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire followed by short-term intensive grazing. This state is dominated by cool-season grasses, with warm-season grasses being subdominant. 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.

2.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase

This plant community phase is similar to the 1.1 Western Wheatgrass/Green Needlegrass/Sedge

Plant Community Phase, but it also contains minor amounts of nonnative invasive grass species such as Kentucky bluegrass (up to about 15 percent by air-dry weight). The potential vegetation is about 85 percent grasses or grass-like plants and 15 percent forbs. The community is dominated by cool-season grasses. The major grass and grass-like species include western wheatgrass, green needlegrass, and clustered field sedge. Other grasses include switchgrass, plains bluegrass, prairie cordgrass, fowl bluegrass, and slender wheatgrass. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity. Refer to the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase for details of the plant composition for this community phase.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD0207

Growth curve name: Rolling Till Prairie, cool-season dominant, warm-season subdominant.

Growth curve description: Cool-season dominant, warm-season subdominant, lowland.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	5	13	20	25	18	11	5	3	0	0

Transitions or pathways leading to other plant communities are as follows:

- 2.1a – Continuous season-long grazing (grazing at light to moderate stocking levels for a majority of or the entire growing season), heavy continuous seasonal grazing (grazing at moderate to heavy stocking levels for extended portions of the growing season at the same time each year), or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will shift this community to the 2.2 *Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase*.

2.2 Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase

This phase is characterized by a shift to mid-cool-season rhizomatous grasses with lesser amounts of tall cool-season bunchgrasses and sedges. The vegetation is about 90 percent grasses and grass-like plants and 10 percent forbs. The dominant grass is western wheatgrass. Grass and grass-like species of secondary importance include plains bluegrass, fowl bluegrass, foxtail barley, Kentucky bluegrass, and sedge. Forbs commonly found in this plant community include cudweed sagewort, western yarrow, American licorice, goldenrod, and scurfpea. Energy capture by this plant community phase has shifted somewhat from late spring and summer to early spring through early summer. 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.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD0206

Growth curve name: Rolling Till Prairie, lowland cool-season dominant.

Growth curve description: Cool-season dominant, lowland.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	6	15	20	26	17	9	4	3	0	0

Transitions or pathways leading to other plant communities are as follows:

- 2.2a – 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 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase*.

Transitions from the Native/Invasive Grass State (State 2) to the Invaded State (State 3)

- T2a – Non-use and no fire for extended periods of time (typically for 10 or more years) will likely lead this state over a threshold resulting in the *3.1 Kentucky Bluegrass/Reed Canarygrass/Forbs Plant Community Phase* within the *Invaded Grass State (State 3)*.
- T2b – Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year) or heavy continuous season-long grazing will convert this plant community to the *3.2 Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase* in the *Invaded Grass State (State 3)*.

Invaded State (State3)

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant introduced grass species. The nutrient cycle is also impaired and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant introduced grass species. Studies indicate that soil biological activity is altered and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition.

Once the state is well established, even drastic events such as high intensity fires driven by high fuel loads of litter and thatch will not result in more than a very short term reduction of Kentucky bluegrass. These events may reduce the dominance of Kentucky bluegrass but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish and dominate before Kentucky bluegrass rebounds and again dominates the system.

3.1 Kentucky Bluegrass/Reed Canarygrass/Forbs Plant Community Phase

This plant community phase is a result of extended periods of nonuse and no fire. It is characterized by a dominance of Kentucky bluegrass. At times, reed canarygrass can increase significantly and may potentially become codominant with Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. When dominated by smooth brome grass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD0206

Growth curve name: Rolling Till Prairie, lowland cool-season dominant.

Growth curve description: Cool-season dominant, lowland.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	6	15	20	26	17	9	4	3	0	0

Transitions or pathways leading to other plant communities are as follows:

- 3.1a – Continuous season-long grazing (grazing at light to moderate stocking levels for a majority of or the entire growing season), heavy continuous seasonal grazing (grazing at moderate to heavy stocking levels for extended portions of the growing season at the same time each year), or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will shift this community to the *3.2 Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase*.

3.2 Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase

This plant community phase is a result of continuous season-long grazing or heavy, continuous seasonal grazing. It is characterized by a dominance of Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. The period that palatability is high is relatively short as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during an average year:

Growth curve number: SD0206

Growth curve name: Rolling Till Prairie, lowland cool-season dominant.

Growth curve description: Cool-season dominant, lowland.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	6	15	20	26	17	9	4	3	0	0

Transitions or pathways leading to other plant communities are as follows:

- 3.2a – Prescribed grazing (alternating season of use and providing adequate recovery periods), extended periods of nonuse and no fire or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the *3.1 Kentucky Bluegrass/Reed Canarygrass/Forbs Plant Community Phase*.
- 3.2b – Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year) or heavy continuous season-long grazing will convert this plant community to the *3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase*.

3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase

This plant community evolved under heavy continuous season-long grazing, heavy continuous seasonal grazing, or from over utilization during extended drought periods. The potential plant community is made up of approximately 50 to 80 percent grasses and grass-like species and 20 to 50 percent forbs. The dominant species are highly variable in this phase, often consisting of invasive species such as Kentucky bluegrass and invasive forbs.

This plant community is susceptible to invasion of Canada thistle and other nonnative species because of the relatively high percent of bare ground. This plant community phase may also be made up of seeded species such as legumes and intermediate wheatgrass. Refer to the corresponding Forage Suitability Group (FSG) for production and species adaptation.

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

Transitions or pathways leading to other plant communities are as follows:

- 3.3a – Prescribed grazing (alternating season of use and providing adequate recovery periods), extended periods of nonuse and no fire, or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the *3.2 Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase*.

Transition from Any Plant Community to the Invaded Grass State (State 3)

- T4 – Encroachment of highly competitive non-native species (e.g., Canada thistle, diffuse knapweed, leafy spurge, etc.), seeding with improved native or non-native forage species, or abandonment after cropping will shift any plant community to the *3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase* within the *Invaded Grass State (State 3)*.

Restoration Pathway from the Invaded Grass State (State 3) to the Native/Invasive Grass State (State 2)

- R3 - 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 and/or pest management (herbicide) may lead this plant community phase over a threshold to the *Native/Invasive Grass State (State 2)*. This will likely take a long period of time, possibly up to 10 years or more, and recovery may not be attainable. Success depends on whether native reproductive propagules remain intact on the site.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phases (1.1 & 2.1):

Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phases (1.2 & 2.2):

Kentucky Bluegrass/Reed Canarygrass/Forbs Plant Community Phase (3.1):

Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase (3.2):

Annual/Pioneer, Non-native Perennial Plant Community Phase (3.3):

Animal Preferences (Quarterly – 1,2,3,4[†])

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
Grasses and Grass-likes							
Canada wildrye	U D U U	N U N N	U D U U	N U N N	N U N N	U D U U	U D U U
clustered field sedge	U D U U	U P N D	U D U U	U D U D	U D U D	U D U U	U D U U
fowl bluegrass	N U U N	N U U N	N U U N	N U U N	N U U N	N U U N	N U U N
fox sedge	U D U U	U P N D	U D U U	U D U D	U D U D	U D U U	U D U U
foxtail barley	U D N N	N P N N	U D N N	N P N N	N P N N	U D N N	U D N N
green needlegrass	U P U D	N P N P	U P U D	N P N P	N P N P	U P U D	U P U D
manyhead sedge	U D U U	U P N D	U D U U	U D U D	U D U D	U D U U	U D U U
plains bluegrass	U D U D	N D N U	U D U D	U P N D	U P N D	U D U D	U D U D
prairie cordgrass	U D D U	N N N N	U D D U	N N N N	N N N N	U D D U	U D D U
rush	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
Sartwell's sedge	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U
slender wheatgrass	U P U U	N D U N	U P U U	N D U N	N D U N	U P U U	U P U U
spikerush	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U
switchgrass	U D D U	U D U U	U D D U	N N N N	N N N N	U D D U	U D D U
western wheatgrass	U P D U	N D N N	U P D U	N D N N	N D N N	U P D U	U P D U
woolly sedge	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U
Forbs							
American licorice	U U D U	N U U N	U U D U	N U U N	N U U N	U U D U	N U U N
American vetch	U D P U	U P P U	U D P U	U P P U	U P P U	U D P U	U P P U
Carolina geranium	U U D U	U U U U	U U D U	U U U U	U U U U	U U D U	U U U U
cinquefoil	U U D U	U U U U	U U D U	U U U U	U U U U	U U D U	U U U U
cudweed sagewort	U U U U	U U D U	U U U U	U U D U	U U D U	U U U U	U U D U
false boneset	U U D U	N D U N	U U D U	N D U N	N D U N	U U D U	N D U N
Flodman's thistle	N U U N	N U U N	N U U N	N U U N	N U U N	N U U N	N U U N
goldenrod	U U D U	N U U N	U U D U	N U U N	N U U N	U U D U	N U U N
heartleaf Alexanders	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U
heath aster	U U D U	U U P U	U U D U	U U P U	U U P U	U U D U	U U P U
Indianhemp	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T
Macoun's buttercup	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
Maximilian sunflower	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U
meadow anemone	U U U U	U U D U	U U U U	U U D U	U U D U	U U U U	U U U U
mint	N N U N	N U U N	N N U N	N U U N	N U U N	N N U N	N N U N
northern bedstraw	N N N N	N U D N	N N N N	N U D N	N U D N	N N N N	N N N N
Pennsylvania smartweed	U U D U	N N N N	U U D U	N N N N	N N N N	U U D U	N N N N
prairie coneflower	U U D U	U P P U	U U D U	U P P U	U P P U	U U D U	U P P U
rough bugleweed	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
Rydberg's sunflower	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U
scarlet gaura	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
scurfpea	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
swamp milkweed	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T
swamp smartweed	U U D U	N N N N	U U D U	N N N N	N N N N	U U D U	N N N N
western dock	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
western ragweed	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
western yarrow	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
white panicle aster	U U D U	U U P U	U U D U	U U P U	U U P U	U U D U	U U P U
wild bergamot	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N

N = not used; **U** = undesirable; **D** = desirable; **P** = preferred; **T** = toxic

[†] Quarters: 1 – Jan., Feb., Mar.; 2 – Apr., May, Jun.; 3 – Jul., Aug., Sep.; 4 – Oct., Nov., Dec.

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.

Plant Community	Average Annual Production (lbs./acre, air-dry)	Stocking Rate* (AUM/acre)
Western Wheatgrass/Green Needlegrass/Sedge (1.1 & 2.1)	4,200	1.15
Western Wheatgrass/Bluegrass/Foxtail Barley (2.2)	3,300	0.90
Kentucky Bluegrass/Reed Canarygrass/Forbs (3.1)	3,800	1.04
Kentucky Bluegrass/Foxtail Barley/Forbs (3.2)	2,500	0.69
Annual/Pioneer, Non-Native Perennial (3.3)	1,200	0.33

*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.

Hydrology Functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic groups C and D. Infiltration is typically very slow and runoff potential for this site is normally negligible due to the concave feature of the landform.

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.

Supporting Information

Associated Sites

Wet Meadow (R102AY004SD), Shallow Marsh (R102AY001SD), Loamy Overflow (R102AY020SD)

Similar Sites

(R102AY011SD) – Clayey [more big bluestem, less needlegrass; lower production]

Inventory Data References

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS.

State Correlation

This site has been correlated in MN, North Dakota (ND), and South Dakota (SD) in MLRA 102A.

Field Offices/Counties

Ada, MN/Norman	Forman, ND/Sargent	Olivia, MN/Renville
Alexandria, MN/Douglas	Glenwood, MN/Pope	Ortonville, MN/Big Stone
Benson, MN/Swift	Hayti, SD/Hamlin	Pipestone, MN/Pipestone
Breckenridge, MN/Wilkin	Ivanhoe, MN/Lincoln	Redwood Falls, MN/Redwood
Britton, SD/Marshall	Long Prairie, MN/Todd	Sisseton, SD/Roberts
Brookings, SD/Brookings	Madison, MN/Lac Qui Parle	Slayton, MN/Murray
Clark, SD/Clark	Madison, SD/Lake	Wahpeton, ND/Richland
Clarkfield, MN/Yellow Medicine	Mahnomen, MN/Mahnomen	Waite Park, MN/Stearns
Clear Lake, SD/Deuel	Marshall, MN/Lyon	Watertown, SD/Codington
De Smet, SD/Kingsbury	McIntosh, MN/Polk	Webster, SD/Day
Detroit Lakes, MN/Becker	Milbank, SD/Grant	Wheaton, MN/Traverse
Elbow Lake, MN/Grant	Montevideo, MN/Chippewa	Willmar, MN/Kandiyohi
Fergus Falls, MN/Otter Tail	Moorhead, MN/Clay	Windom, MN/Cottonwood
Flandreau, SD/Moody	Morris, MN/Stevens	

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 46e – Tewaukon Dead Ice Moraine, 46k – Prairie Coteau, 46l – Prairie Coteau Escarpment, 46m – Big Sioux Basin, 46o – Minnesota River Prairie, 47b – Des Moines Lobe, 48d – Lake Agassiz Plain, 51j – Alexandria Moraines and Detroit Lakes Outwash Plain.

Other References

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (<http://www.hprcc.unl.edu/>)
USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (<http://www.wcc.nrcs.usda.gov>)
USDA, NRCS. National Range and Pasture Handbook, September 1997
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. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Site Description Approval

MN, State Grazing Lands Specialist

Date

ND, State Range Management Specialist

Date

SD, State Range Management Specialist

Date