

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

Site Type: Rangeland

Site Name: Limy Subirrigated

Site ID: R102AY006SD

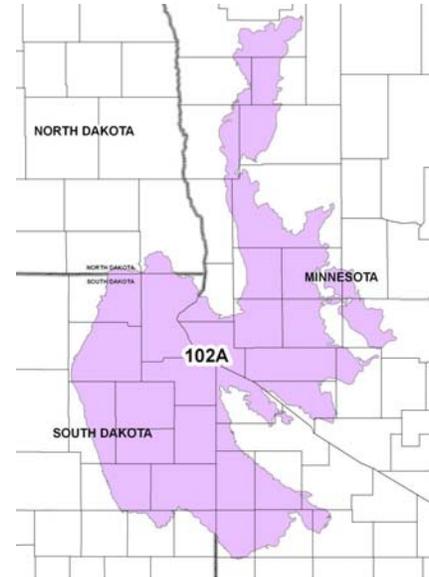
Major Land Resource Area (MLRA): 102A – Rolling Till Prairie

Physiographic Features

This site occurs on nearly level flood plains or swales.

Landform: swale, flood plain, pothole rim

Aspect: N/A



	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	1,000	2,000
Slope (percent):	1	2
Water Table Depth (inches):	30	80
Flooding:		
Frequency:	None	Occasional
Duration:	None	Brief
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 (Mahnomen 1 W, Minnesota (MN)), to about 14°F (Tracy, MN). July is the warmest month with temperatures averaging from about 69°F (Mahnomen 1 W, MN), to about 73°F (Tracy, MN). The range of normal average monthly temperatures between the coldest and warmest months is about 62°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph.

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

	<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

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

Representative Soil Features

The soils in this site are somewhat poorly drained and formed in alluvium, loamy till, or silty drift. The loam to silty clay loam surface layer is 7 to 13 inches thick and typically has a granular structure. Dark colors are deep in these soils. The soils have a moderately slow infiltration rate. This site 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. These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of the soil surface layer on this site can result in a shift in species composition and/or production.

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

Parent Material Kind: till, drift, or alluvium
Parent Material Origin:
Surface Texture: loam, silty clay loam, silt loam
Surface Texture Modifier: none
Subsurface Texture Group: loamy
Surface Fragments ≤3” (% Cover): 0-5
Surface Fragments >3” (%Cover): 0-2
Subsurface Fragments ≤3” (% Volume): 0-40
Subsurface Fragments >3” (% Volume): 0-2

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	somewhat poorly	somewhat poorly
Permeability Class:	moderately slow	moderately slow
Depth (inches):	80	80
Electrical Conductivity (mmhos/cm)*:	0	4
Sodium Absorption Ratio*:	0	2
Soil Reaction (1:1 Water)*:	6.6	8.4
Soil Reaction (0.1M CaCl2)*:	NA	NA
Available Water Capacity (inches)*:	5	8
Calcium Carbonate Equivalent (percent)*:	10	45

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

Plant Communities

Ecological Dynamics of the Site

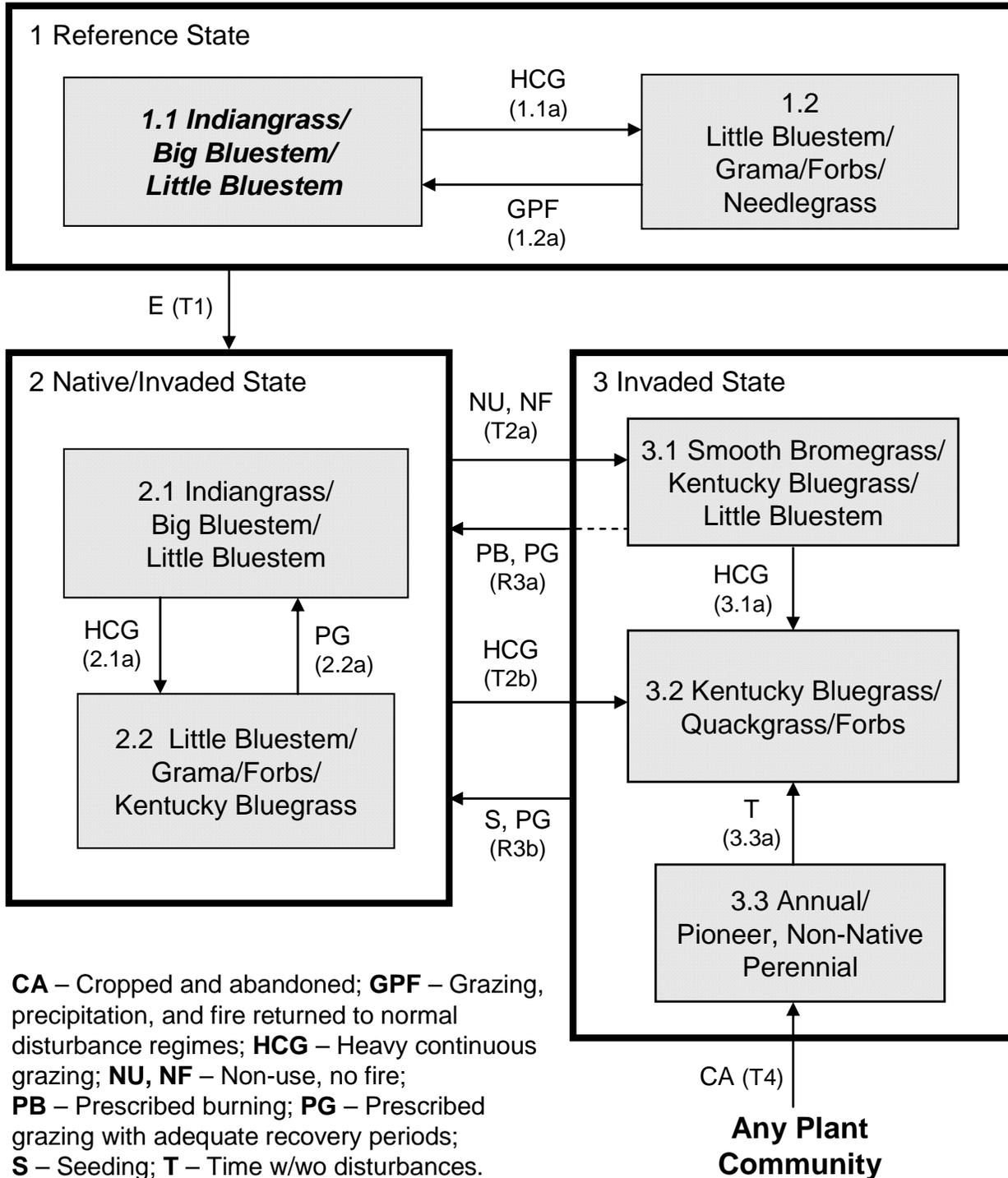
This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur 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 that may not be described within this document.

Heavy continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the interpretive plant community. Species such as little bluestem, sideoats grama, and blue grama will initially increase. Big bluestem, Indiangrass, and switchgrass will decrease in frequency and production. Heavy continuous grazing causes Kentucky bluegrass to increase and eventually develop into a sod condition. Extended periods of nonuse and no fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and smooth brome grass. In time, shrubs such as western snowberry will also increase.

Interpretations are primarily based on the 1.1 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase. 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



Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SCIENTIFIC NAME	SYMBOL	1.1 Indiangrass/Big Bluestem/ Little Bluestem		
			Group	lbs./acre	% Comp
GRASSES & GRASS-LIKES				3360 - 3780	80 - 90
TALL WARM-SEASON GRASSES			1	840 - 1890	20 - 45
Indiangrass	Sorghastrum nutans	SONU2	1	420 - 1680	10 - 40
big bluestem	Andropogon gerardii	ANGE	1	210 - 1470	5 - 35
switchgrass	Panicum virgatum	PAVI2	1	0 - 210	0 - 5
MID WARM-SEASON GRASSES			2	630 - 1260	15 - 30
little bluestem	Schizachyrium scoparium	SCSC	2	420 - 1260	10 - 30
sideoats grama	Bouteloua curtipendula	BOCU	2	84 - 630	2 - 15
prairie dropseed	Sporobolus heterolepis	SPHE	2	0 - 210	0 - 5
COOL-SEASON GRASSES			3	210 - 1050	5 - 25
porcupine grass	Hesperostipa spartea	HESP11	3	84 - 840	2 - 20
green needlegrass	Nassella viridula	NAVI4	3	42 - 420	1 - 10
Canada wildrye	Elymus canadensis	ELCA4	3	42 - 210	1 - 5
slender wheatgrass	Elymus trachycaulus	ELTR7	3	42 - 210	1 - 5
northern reedgrass	Calamagrostis stricta ssp. inexpansa	CASTI3	3	0 - 126	0 - 3
western wheatgrass	Pascopyrum smithii	PASM	3	0 - 126	0 - 3
OTHER NATIVE GRASSES			4	42 - 210	1 - 5
blue grama	Bouteloua gracilis	BOGR2	4	0 - 168	0 - 4
prairie junegrass	Koeleria macrantha	KOMA	4	0 - 42	0 - 1
Scribner panicum	Dichantherium oligosanthes var. scribnerianum	DIOLS	4	0 - 42	0 - 1
other grasses		2GRAM	4	42 - 168	1 - 4
GRASS-LIKES			5	42 - 210	1 - 5
sedge	Carex spp.	CAREX	5	42 - 210	1 - 5
spikerush	Eleocharis spp.	ELEOC	5	0 - 126	0 - 3
other grass-likes		2GL	5	0 - 84	0 - 2
FORBS			7	210 - 630	5 - 15
American licorice	Glycyrrhiza lepidota	GLLE3	7	42 - 84	1 - 2
black-eyed Susan	Rudbeckia hirta	RUHI2	7	0 - 84	0 - 2
bluebell bellflower	Campanula rotundifolia	CARO2	7	0 - 42	0 - 1
blue-eyed grass	Sisyrinchium spp.	SISYR	7	0 - 42	0 - 1
closed bottle gentian	Gentiana andrewsii	GEAN	7	0 - 42	0 - 1
cudweed sagewort	Artemisia ludoviciana	ARLU	7	42 - 126	1 - 3
downy gentian	Gentiana puberulenta	GEPUS	7	0 - 42	0 - 1
false gromwell	Onosmodium bejariense var. occidentale	ONBEO	7	42 - 84	1 - 2
goldenrod	Solidago spp.	SOLID	7	42 - 126	1 - 3
heartleaf Alexanders	Zizia aptera	ZIAP	7	42 - 84	1 - 2
heath aster	Symphyotrichum ericoides	SYER	7	42 - 84	1 - 2
horsetail	Equisetum laevigatum	EQLA	7	0 - 42	0 - 1
Indianhemp	Apocynum cannabinum	APCA	7	42 - 84	1 - 2
Maximilian sunflower	Helianthus maximiliani	HEMA2	7	42 - 84	1 - 2
meadow anemone	Anemone canadensis	ANCA8	7	0 - 42	0 - 1
New England aster	Symphyotrichum novae-angliae	SYNO2	7	0 - 84	0 - 2
Norwegian cinquefoil	Potentilla norvegica	PONO3	7	42 - 84	1 - 2
palespike lobelia	Lobelia spicata	LOSP	7	0 - 42	0 - 1
prairie coneflower	Ratibida columnifera	RACO3	7	0 - 42	0 - 1
prairie violet	Viola pedatifida	VIPE2	7	0 - 42	0 - 1
purple prairie clover	Dalea purpurea	DAPU5	7	42 - 84	1 - 2
rough bugleweed	Lycopus asper	LYAS	7	0 - 42	0 - 1
stiff sunflower	Helianthus pauciflorus	HEPA19	7	42 - 84	1 - 2
tall gayfeather	Liatris aspera	LIAS	7	42 - 84	1 - 2
western ragweed	Ambrosia psilostachya	AMPS	7	0 - 42	0 - 1
western yarrow	Achillea millefolium var. occidentalis	ACMIO	7	0 - 84	0 - 2
wild strawberry	Fragaria virginiana	FRVI	7	0 - 42	0 - 1
yellow stargrass	Hypoxis hirsuta	HYHI2	7	0 - 42	0 - 1
native forbs		2FN	7	42 - 168	1 - 4
SHRUBS			8	42 - 210	1 - 5
leadplant	Amorpha canescens	AMCA6	8	42 - 168	1 - 4
rose	Rosa spp.	ROSA5	8	0 - 84	0 - 2
snowberry	Symphoricarpos spp.	SYMPH	8	0 - 84	0 - 2
willow	Salix spp.	SALIX	8	0 - 84	0 - 2
other shrubs		2SHRUB	8	0 - 84	0 - 2

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	3075 -	3654	4105
FORBS	185 -	420	755
SHRUBS	40 -	126	240
TOTAL	3300 -	4200	5100

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 Indiangrass/Big Bluestem/Little Bluestem			2.2 Little Bluestem/Grama/ Forbs/Kentucky Bluegrass			3.1 Smooth Bromegrass/Ken-tucky Bluegrass/Little Bluestem			3.2 Kentucky Bluegrass/ Quackgrass/Forbs		
		Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp
GRASSES & GRASS-LIKES													
TALL WARM-SEASON GRASSES													
Indiangrass	SONU2	1	420 - 1680	10 - 40	1	0 - 360	0 - 10	1	0 - 120	0 - 3			
big bluestem	ANGE	1	210 - 1470	5 - 35	1	0 - 360	0 - 10	1	0 - 120	0 - 3	1	0 - 48	
switchgrass	PAVI2	1	0 - 210	0 - 5	1	0 - 108	0 - 3	1	0 - 80	0 - 2	1	0 - 24	
MID WARM-SEASON GRASSES													
little bluestem	SCSC	2	420 - 1260	10 - 30	2	360 - 1260	10 - 35	2	0 - 800	0 - 20	2	0 - 120	
sideoats grama	BOCU	2	84 - 630	2 - 15	2	180 - 648	5 - 18	2	0 - 240	0 - 6	2	0 - 72	
prairie dropseed	SPHE	2	0 - 210	0 - 5									
COOL-SEASON GRASSES													
porcupine grass	HESP11	3	84 - 840	2 - 20	3	0 - 180	0 - 5	3	0 - 200	0 - 5			
green needlegrass	NAV14	3	42 - 420	1 - 10	3	0 - 108	0 - 3	3	0 - 320	0 - 8	3	0 - 48	
Canada wildrye	ELCA4	3	42 - 210	1 - 5	3	0 - 108	0 - 3	3	0 - 40	0 - 1			
slender wheatgrass	ELTR7	3	42 - 210	1 - 5	3	0 - 144	0 - 4	3	0 - 120	0 - 3			
northern reedgrass	CAST13	3	0 - 126	0 - 3									
western wheatgrass	PASM	3	0 - 126	0 - 3	3	0 - 72	0 - 2	3	0 - 40	0 - 1	3	0 - 72	
OTHER NATIVE GRASSES													
blue grama	BOGR2	4	0 - 168	0 - 4	4	36 - 252	1 - 7	4	0 - 120	0 - 3	4	0 - 144	
prairie junegrass	KOMA	4	0 - 42	0 - 1	4	0 - 36	0 - 1	4	0 - 40	0 - 1			
Scribner panicum	DIOLS	4	0 - 42	0 - 1	4	0 - 72	0 - 2	4	0 - 40	0 - 1	4	0 - 24	
other grasses	2GRAM	4	42 - 168	1 - 4	4	36 - 144	1 - 4	4	0 - 160	0 - 4	4	0 - 72	
GRASS-LIKES													
sedge	CAREX	5	42 - 210	1 - 5	5	36 - 180	1 - 5	5	40 - 200	1 - 5	5	24 - 168	
spikerush	ELEOC	5	0 - 126	0 - 3	5	0 - 144	0 - 4	5	0 - 160	0 - 4	5	0 - 120	
other grass-likes	2GL	5	0 - 84	0 - 2	5	0 - 72	0 - 2	5	0 - 80	0 - 2	5	0 - 48	
NON-NATIVE GRASSES													
Kentucky bluegrass	POPR				6	180 - 540	5 - 15	6	400 - 1400	10 - 35	6	480 - 1440	
quackgrass	ELRE4				6	0 - 180	0 - 5	6	0 - 120	0 - 3	6	24 - 240	
reed canarygrass	PHAR3				6	0 - 180	0 - 5	6	0 - 600	0 - 15	6	0 - 120	
smooth bromegrass	BRIN2				6	0 - 252	0 - 7	6	600 - 2200	15 - 55	6	0 - 120	
FORBS													
American licorice	GLLE3	7	42 - 84	1 - 2	7	36 - 108	1 - 3	7	40 - 120	1 - 3	7	0 - 48	
black-eyed Susan	RUHI2	7	0 - 84	0 - 2	7	0 - 36	0 - 1						
bluebell bellflower	CARO2	7	0 - 42	0 - 1									
blue-eyed grass	SISYR	7	0 - 42	0 - 1									
closed bottle gentian	GEAN	7	0 - 42	0 - 1									
cudweed sagewort	ARLU	7	42 - 126	1 - 3	7	36 - 180	1 - 5	7	40 - 200	1 - 5	7	24 - 168	
downy gentian	GEPUS	7	0 - 42	0 - 1									
false gromwell	ONBEO	7	42 - 84	1 - 2	7	0 - 108	0 - 3	7	0 - 40	0 - 1			
goldenrod	SOLID	7	42 - 126	1 - 3	7	36 - 216	1 - 6	7	40 - 200	1 - 5	7	24 - 192	
heartleaf Alexanders	ZIAP	7	42 - 84	1 - 2	7	0 - 36	0 - 1						
heath aster	SYER	7	42 - 84	1 - 2	7	36 - 108	1 - 3	7	40 - 120	1 - 3	7	24 - 72	
horsetail	EQLA	7	0 - 42	0 - 1	7	0 - 36	0 - 1	7	0 - 40	0 - 1	7	0 - 24	
Indianhemp	APCA	7	42 - 84	1 - 2	7	36 - 108	1 - 3	7	0 - 80	0 - 2	7	0 - 72	
Maximilian sunflower	HEMA2	7	42 - 84	1 - 2	7	0 - 36	0 - 1						
meadow anemone	ANCA8	7	0 - 42	0 - 1									
New England aster	SYNO2	7	0 - 84	0 - 2	7	0 - 108	0 - 3	7	0 - 160	0 - 4	7	0 - 96	
Norwegian cinquefoil	PONO3	7	42 - 84	1 - 2	7	0 - 36	0 - 1	7	0 - 40	0 - 1	7	0 - 24	
palespike lobelia	LOSP	7	0 - 42	0 - 1									
prairie coneflower	RACO3	7	0 - 42	0 - 1									
prairie violet	VIPE2	7	0 - 42	0 - 1									
purple prairie clover	DAPU5	7	42 - 84	1 - 2	7	0 - 36	0 - 1						
rough bugleweed	LYAS	7	0 - 42	0 - 1	7	0 - 36	0 - 1	7	0 - 40	0 - 1			
stiff sunflower	HEPA19	7	42 - 84	1 - 2	7	0 - 36	0 - 1						
tall gayfeather	LIAS	7	42 - 84	1 - 2	7	0 - 72	0 - 2	7	0 - 40	0 - 1			
western ragweed	AMPS	7	0 - 42	0 - 1	7	36 - 144	1 - 4	7	40 - 120	1 - 3	7	24 - 120	
western yarrow	ACMIO	7	0 - 84	0 - 2	7	36 - 108	1 - 3	7	0 - 80	0 - 2	7	24 - 96	
wild strawberry	FRVI	7	0 - 42	0 - 1									
yellow stargrass	HYHI2	7	0 - 42	0 - 1									
native forbs	2FN	7	42 - 168	1 - 4	7	0 - 108	0 - 3	7	0 - 120	0 - 3	7	0 - 48	
introduced forbs	2FI				7	36 - 108	1 - 3	7	40 - 160	1 - 4	7	24 - 168	
SHRUBS													
leadplant	AMCA6	8	42 - 168	1 - 4	8	0 - 72	0 - 2	8	0 - 40	0 - 1			
rose	ROSA5	8	0 - 84	0 - 2	8	0 - 72	0 - 2	8	0 - 80	0 - 2	8	0 - 24	
snowberry	SYMPH	8	0 - 84	0 - 2	8	36 - 144	1 - 4	8	40 - 200	1 - 5	8	0 - 120	
willow	SALIX	8	0 - 84	0 - 2	8	0 - 36	0 - 1	8	0 - 80	0 - 2			
other shrubs	2SHRUB	8	0 - 84	0 - 2	8	0 - 72	0 - 2	8	0 - 80	0 - 2	8	0 - 48	
Annual Production lbs./acre													
GRASSES & GRASS-LIKES													
LOW RV HIGH													
3075 - 3654 - 4105													
FORBS													
185 - 420 - 755													
SHRUBS													
40 - 126 - 240													
TOTAL													
3300 - 4200 - 5100													
2705 - 3042 - 3235													
160 - 450 - 865													
35 - 108 - 200													
2890 - 3480 - 3855													
175 - 400 - 720													
205 - 360 - 570													
35 - 120 - 225													
0 - 60 - 130													
1600 - 2400 - 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 warm-season grasses. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and/or above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. In some locations, this site likely received relatively heavy grazing pressure. Tall warm-season grasses would have declined and shorter warm-season grasses would have increased. Today, a similar state (State 2) 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.

1.1 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase

Interpretations are based primarily on the Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase (this is also considered to be climax). The potential vegetation was about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses. The major grasses included Indiangrass, big bluestem, and little bluestem. Other grass or grass-like species included sideoats grama, porcupine grass, green needlegrass, slender wheatgrass, and sedge. 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: SD0205

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

Growth curve description: Warm-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	2	5	15	25	30	15	7	1	0	0

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

- 1.1a – Heavy continuous grazing which included herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or a combination of disturbances such as extended periods of below average precipitation coupled with periodic or chronic heavy grazing would have shifted this community to the *1.2 Little Bluestem/Grama/Forbs/Needlegrass Plant Community Phase*.

1.2 Little Bluestem/Grama/Forbs/Needlegrass Plant Community Phase

This plant community evolved under heavy continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 75 percent grasses and grass-like species, 20 percent forbs, and 5 percent shrubs. Dominant grasses included little bluestem, sideoats grama, and green needlegrass. Grasses of secondary importance included Indiangrass, big bluestem, blue grama, porcupine grass, and slender wheatgrass. Forbs commonly found in this plant community included Canada goldenrod, cudweed sagewort, heath aster, scurfpea, stiff goldenrod, and western yarrow. This plant community had similar plant composition to the 2.2 Little Bluestem/Grama/Forbs/Kentucky Bluegrass Plant Community Phase (refer to the plant

composition tables). The main difference is that this plant community phase did not have the presence of nonnative invasive species such as Kentucky bluegrass and smooth brome grass.

When compared to the Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase (1.1), sideoats grama and little bluestem increased. Production of tall warm-season grasses was reduced. This plant community was moderately resistant to change. The herbaceous species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term. Most of the components of the ecological processes would have been functioning at optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses would have been reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allowed for an increase in shorter-statured (and shallower rooted) species.

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: SD0204

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

Growth curve description: Warm-season dominant, cool-season subdominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	7	17	25	25	15	7	1	0	0

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

- 1.2a – Grazing, precipitation, and/or 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 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase*.

Transition from the Reference State (State 1) to the Native/Invaded State (State 2)

- T1 – Encroachment of non-native grasses such as Kentucky bluegrass and smooth brome grass, and disruption of natural disturbance regimes (typically as a result of fire suppression following settlement) led this state over a threshold to the *Native/Invaded State (State 2)*.

Native/Invaded State (State 2)

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

2.1 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase

This plant community phase is similar to the 1.1 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase but it also contains minor amounts of nonnative invasive grass species such as Kentucky bluegrass and smooth brome grass (up to about 10 percent by air-dry weight). The potential vegetation is about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community is dominated by warm-season grasses. The major grasses include Indiangrass, big bluestem, and little bluestem. Other grass or grass-like species include sideoats grama, porcupine grass, green needlegrass, slender wheatgrass, and sedge. This plant community is resilient and well

adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

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: SD0205

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

Growth curve description: Warm-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	2	5	15	25	30	15	7	1	0	0

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

- 2.1a – Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year), 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 Little Bluestem/Grama/Forbs/Kentucky Bluegrass Plant Community Phase*.

2.2 Little Bluestem/Grama/Forbs/Kentucky Bluegrass Plant Community Phase

This plant community is a result of heavy continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 20 percent forbs, and 5 percent shrubs. Dominant grasses include little bluestem, sideoats grama, and green needlegrass. Grasses of secondary importance included Indiangrass, big bluestem, blue grama, porcupine grass, and slender wheatgrass. Forbs commonly found in this plant community included Canada goldenrod, cudweed sagewort, heath aster, scurfpea, stiff goldenrod, and western yarrow.

When compared to the Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase (1.1), sideoats grama and little bluestem increased. Production of tall warm-season grasses was reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. Most of the components of the ecological processes are functioning at optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses are reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allows for an increase in shorter-statured (and shallower rooted) species. The introduction of nonnative invasive species such as Kentucky bluegrass and smooth brome grass results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers and the structure will begin to be modified. These changes favor the shallow-rooted species and hasten their eventual dominance if steps are not taken to reduce these species.

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: SD0204

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

Growth curve description: Warm-season dominant, cool-season subdominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	7	17	25	25	15	7	1	0	0

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

- T2b – Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and at the same time of year each year) will cause a shift across a threshold leading to the *3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase* within the *Invaded State (State 3)*.
- 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 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase*.

Transition from the Native/Invaded 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 Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem Plant Community Phase* within the *Invaded State (State 3)*.

Invaded State (State 3)

This state is a result of encroachment mainly by invasive introduced cool-season grasses. The ecological processes are not functioning, especially the biotic processes and the hydrologic functions. The introduced cool-season grasses cause reduced infiltration and increased runoff. 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. The opportunity for high intensity spring burns is severely reduced by early greenup and increased moisture and humidity at the soil surface and grazing pressure cannot cause a reduction in sodgrass dominance. Production is limited to the sod forming species. Infiltration continues to decrease and runoff increases and energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by root depth of the dominant species.

3.1 Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem Plant Community Phase

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

The dominance of these introduced species has been shown to alter the biotic component of the soil, as well as organic matter levels and eventually the soil structure. These alterations perpetuate the dominance of Kentucky bluegrass and smooth bromegrass and tend to make establishment of native species extremely difficult.

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: SD0201

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

Growth curve description: Cool-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	4	12	25	36	10	5	4	4	0	0

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

- 3.1a – Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year) will convert this plant community to the *3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase*.
- R3a - Prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) coupled with prescribed burning may lead this plant community phase over a threshold to the *Native/Invaded State (State 2)*. Pest management (i.e., herbicide) may also be needed to suppress cool-season invasive grasses. This will likely take a long period of time and recovery may not be attainable. Success depends on whether native reproductive propagules remain intact on the site.

3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass and quackgrass. 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: SD0201

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

Growth curve description: Cool-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	4	12	25	36	10	5	4	4	0	0

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

- 3.2a – Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the *3.1 Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem Plant Community Phase*.

Transition Pathway from Any Plant Community to the 3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase within the Invaded State (State 3)

- T4 – Encroachment of non-native invasive/noxious species, abandonment of cropping, or seeding of introduced and/or native improved varieties of forage species may lead this plant community phase over a threshold to the *Invaded State (State 3)* and more specifically to the *3.3 Annual/Pioneer, Non-native Perennial Plant Community Phase*. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

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

This plant community developed under continuous heavy grazing or other excessive disturbances. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include 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.

Transitions or pathways leading to other states are as follows:

- 3.3a – 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 *3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase*.

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

- R3b – Seeding followed by prescribed grazing may lead this plant community phase over a threshold to the *Native/Invaded State (State 2)*.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Indiangrass/Big Bluestem/Little Bluestem Plant Community Phases (1.1 & 2.1):

Little Bluestem/Grama/Forbs/Needlegrass Plant Community Phase (1.2):

Little Bluestem/Grama/Forbs/Kentucky Bluegrass Plant Community Phase (2.2):

Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem Plant Community Phase (3.1):

Kentucky Bluegrass/Quackgrass/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							
big bluestem	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
blue grama	U D P U	D P P D	U D P U	D P P D	D P P D	U D P U	U D P U
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
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
Indiangrass	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
little bluestem	U D D U	N D N N	U D D U	N D N N	N D N N	U D D U	U D D U
northern reedgrass	U P U D	N D N U	U P U D	N D N U	N D N U	U P U D	U P U D
porcupine grass	U P U D	N D N U	U P U D	N D N U	N D N U	U P U D	U P 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
prairie dropseed	N U P U	N U D U	N U P U	N U D U	N U D U	N U P U	N U P U
prairie junegrass	U D U D	N D N U	U D U D	N D N U	N D N U	U D U D	U D U D
Scribner panicum	U U D U	N U N N	U U D U	N U N N	N U N N	U U D U	U U D U
sedge	U D U D	U P N D	U D U D	U D U D	U D U D	U D U D	U D U D
sideoats grama	U D P U	U P D U	U D P U	U P D U	U P D U	U D P U	U D P 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
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
black-eyed Susan	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
bluebell bellflower	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
blue-eyed grass	U U U U	U U P U	U U U U	U U P U	U U P U	U U U U	U U P U
closed bottle gentian	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
cutweed 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
downy gentian	N N N N	N N U N	N N N N	N N U N	N N U N	N N N N	N N N N
false gromwell	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
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
horsetail	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
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
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
New England 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
Norwegian 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
palespike lobelia	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
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
prairie violet	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N
purple prairie clover	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
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
stiff 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
tall gayfeather	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
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
wild strawberry	U D U U	N U U N	U D U U	N U U N	N U U N	U D U U	N U U N
yellow stargrass	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
Shrubs							
leadplant	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
rose	U D D U	U D D U	U D D U	U D D U	U D D U	U D D U	U D D U
snowberry	U U U U	U U U U	U U U U	D U D D	U U U U	U U U U	D U U U
willow	P U D P	P U D P	P U D P	P U D P	U U U U	P U D P	P U D P

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)
Indiangrass/Big Bluestem/Little Bluestem (1.1 & 2.1)	4,200	1.15
Little Bluestem/Grama/Forbs/Kentucky Bluegrass (2.2)	3,600	0.99
Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem (3.1)	4,000	1.10
Kentucky Bluegrass/Quackgrass/Forbs (3.2)	2,400	0.66
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 B and C. Infiltration is typically moderately slow 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 higher infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by Kentucky bluegrass and/or smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational Uses

This site provides hunting, hiking, photography, bird watching, and other opportunities. The wide varieties of plants that bloom from spring until fall have an esthetic value that appeals to visitors.

Wood Products

No appreciable wood products are typically present on this site.

Other Products

Seed harvest of native plant species can provide additional income on this site.

Supporting Information

Associated Sites

Wet Meadow (R102AY004SD), Loamy Overflow (R102AY020SD), Subirrigated (R102AY003SD)

Similar Sites

(R102AY003SD) – Subirrigated [more big bluestem, less little bluestem; higher 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; and Bruce Kunze, Soil Scientist, 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