

## Ecological site R102AY002SD Linear Meadow

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### General information

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

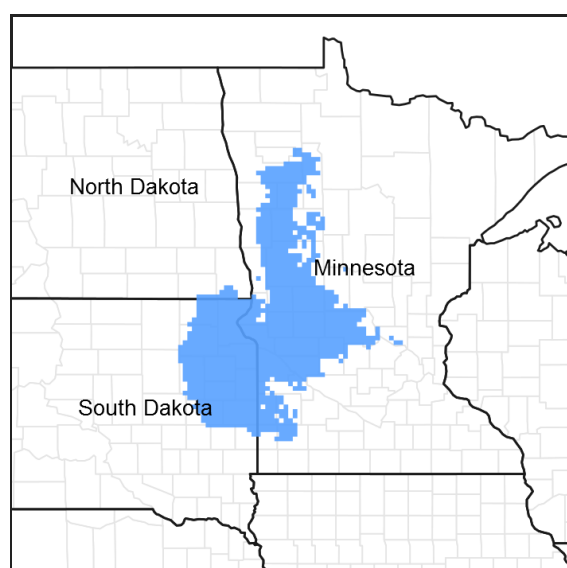


Figure 1. Mapped extent

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

### MLRA notes

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

The Rolling Till Prairie (102A) is located within the Central Feed Grains and Livestock Land Resource Region. It spans 3 states (Minnesota 58 percent, South Dakota 42 percent, and small part in North Dakota), encompassing over 16,000 square miles (Figure 1). The elevation ranges from approximately over 2,000 feet above sea level (ASL) on the Prairie Coteau in Northeastern South Dakota to about 1,000 feet ASL on lowlands. The dominate landform in this area are stagnation moraines, end moraines, glacial outwash plains, terraces, and flood plains. The area is dominated by till covered moraines. The stagnation moraines are gently undulating to steep and have many depressions and poorly defined drainages. Small outwash areas are adjacent to the watercourses. The Cretaceous Pierre Shale underlies the till in the most of the area. Precambrian rocks also occur at depth. Granite is quarried near Milbank, South Dakota and outcrops of Sioux Quartzite are common. (USDA-NRCS 2006).

The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a frigid soil temperature regime, an aquic or udic soil moisture regime, and mixed mineralogy. They generally are very deep, well drained to very poorly drained. This area supports true prairie vegetation characterized by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), porcupinegrass (*Hesperostipa spartea*), and green needlegrass (*Nassella viridula*). Prairie cordgrass (*Spartina pectinata*) commonly grows in wet areas. (USDA-NRCS 2006).

## Classification relationships

Major Land Resource Area (MLRA): Rolling Till Prairie (102A) (USDA-NRCS 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Upper Minnesota River-Des Moines Lobe Subsection (251Ba); Outer Coteau des Prairies Subsection (251Bb); Northwest Iowa Plains Subsection (251Bd); Minnesota and Northeast Iowa Morainal-Oak Savannah Section (222M); Alexandria Moraine-Hardwood Hills Subsection (222Ma) (Cleland et al. 2007).

US EPA Level IV Ecoregion: Tewaukon/Big Stone Stagnation Moraine (46e), Prairie Coteau (46k), Prairie Coteau Escarpment (46l), Big Sioux Basin (46m), Minnesota River Prairie (46o), Des Moines Lobe (47b) , Lake Agassiz Plains (48d), Alexandria Moraines and Detroit Lakes Outwash Plain (51j) (USEPA 2013)

## Ecological site concept

The Linear Meadow ecological site typically occurs in drainageways which can receive excessive run off moisture from within the watershed. Soils are formed in local alluvium and are poorly and very poorly drained, which have a water table within 0 to 2 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. Vegetation in the Reference State is typically codominated by cool-season grass and grass-like species and warm season grasses including: prairie cordgrass, reedgrasses, and a variety of sedges and rushes. Forbs include broadfruit bur-reed, giant goldenrod, Maximilian sunflower, and asters. Non-native species such as reed canarygrass may invade the site due to change in disturbance regime.

## Associated sites

R102AY001SD	<b>Shallow Marsh</b> These sites occur in a basin or closed depression. Soils are very poorly drained and the site will pond water until early summer in most years. The central concept soil series is Parnell and Oldham, but other series are included.
R102AY003SD	<b>Subirrigated</b> These sites occur in drainageways. Soils are somewhat poorly drained which have a water table within 2 to 5 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. The central concept soil series is Badger, but other series are included.
R102AY004SD	<b>Wet Meadow</b> These sites occur in a basin or closed depression. Soils are poorly drained and the site ponds water for 4 to 8 weeks in the spring of the year or after a heavy rain. The central concept soil series is Tonka, but other series are included.
R102AY020SD	<b>Loamy Overflow</b> These sites occur in upland swales. Soils are moderately well drained which have water flow into and over/through the site. The central concept soil series is Aastad, Brookings, Svea, and Waubay but other series are included.

## Similar sites

R102AY001SD	<b>Shallow Marsh</b> The Shallow Marsh site occurs in a basin or closed depression. Soils are very poorly drained and the site will pond water until early summer in most years. A Shallow Marsh site will have less prairie cordgrass and higher production than a Linear Meadow.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Spartina pectinata</i> (2) <i>Calamagrostis stricta</i> ssp. <i>inexpansa</i>

## Physiographic features

This site occurs on nearly level flood plains or drainageways.

**Table 2. Representative physiographic features**

Landforms	(1) Flood plain (2) Outwash plain
Flooding duration	Long (7 to 30 days) to very long (more than 30 days)
Flooding frequency	Occasional to frequent
Elevation	1,000–2,000 ft
Slope	0–1%
Water table depth	0–2 in
Aspect	Aspect is not a significant factor

## Climatic features

MLRA 102A is considered to have a continental climate – cold winters and relatively hot summers, low to moderate humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 21 to 27 inches per year. The average annual temperature is about 43°F. January is the coldest month with average temperatures ranging from about 5°F (Mahnomen 1 W, Minnesota (MN)), to about 14°F (Tracy, MN). July is the warmest month with temperatures averaging from about 69°F (Mahnomen 1 W, MN), to about 73°F (Tracy, MN). The range of normal average monthly temperatures between the coldest and warmest months is about 62°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph.

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

**Table 3. Representative climatic features**

Frost-free period (characteristic range)	112-127 days
Freeze-free period (characteristic range)	137-151 days
Precipitation total (characteristic range)	25-28 in
Frost-free period (actual range)	99-131 days
Freeze-free period (actual range)	130-153 days
Precipitation total (actual range)	24-28 in
Frost-free period (average)	120 days
Freeze-free period (average)	143 days
Precipitation total (average)	26 in

## Climate stations used

- (1) FOSSTON 1 E [USC00212916], Fosston, MN
- (2) MAHNOMEN [USC00215012], Mahnomen, MN
- (3) MELROSE [USC00215325], Melrose, MN
- (4) BENSON [USC00210667], Benson, MN

- (5) MORRIS WC EXP STN [USC00215638], Hancock, MN
- (6) ROY LAKE [USC00397326], Lake City, SD
- (7) CLARK [USC00391739], Clark, SD
- (8) ARLINGTON 1 W [USC00390281], Arlington, SD
- (9) LAKE WILSON [USC00214534], Lake Wilson, MN
- (10) PIPESTONE [USC00216565], Pipestone, MN
- (11) ARTICHOKE LAKE [USC00210287], Correll, MN
- (12) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (13) BROWNS VALLEY [USC00211063], Beardsley, MN
- (14) CASTLEWOOD [USC00391519], Castlewood, SD
- (15) CLEAR LAKE [USC00391777], Clear Lake, SD
- (16) FERGUS FALLS [USC00212768], Fergus Falls, MN
- (17) GLENWOOD 2 WNW [USC00213174], Glenwood, MN
- (18) MILAN 1 NW [USC00215400], Milan, MN
- (19) MILBANK 4 NW [USC00395536], Milbank, SD
- (20) SISSETON [USC00397742], Sisseton, SD
- (21) SUMMIT 1 W [USC00398116], Summit, SD
- (22) TRACY [USC00218323], Tracy, MN
- (23) TYLER [USC00218429], Tyler, MN
- (24) WATERTOWN 1W [USC00398930], Watertown, SD
- (25) WEBSTER [USC00399004], Webster, SD

## Influencing water features

This site has a water table from 0 to 2 inches.

## Soil features

The Linear Meadow site typically occurs in drainageways. Soils are poorly and very poorly drained which have a water table within 0 to 2 feet of the soil surface that persists longer than the wettest part of the growing season typically until the month of August. The central concept soil series is Lamoure, Hidewood, Marysland, Rauville, and Vallery, but others are included.

**Table 4. Representative soil features**

Surface texture	(1) Silty clay (2) Silty clay loam (3) Clay
Family particle size	(1) Clayey
Drainage class	Poorly drained to very poorly drained
Permeability class	Very slow to slow
Soil depth	80 in
Surface fragment cover <=3"	0–2%
Available water capacity (0–40in)	6–8 in
Calcium carbonate equivalent (0–40in)	0–20%
Electrical conductivity (0–40in)	0–4 mmhos/cm
Sodium adsorption ratio (0–40in)	0–3
Soil reaction (1:1 water) (0–40in)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–2%

Subsurface fragment volume >3" (Depth not specified)	0%
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### Ecological dynamics

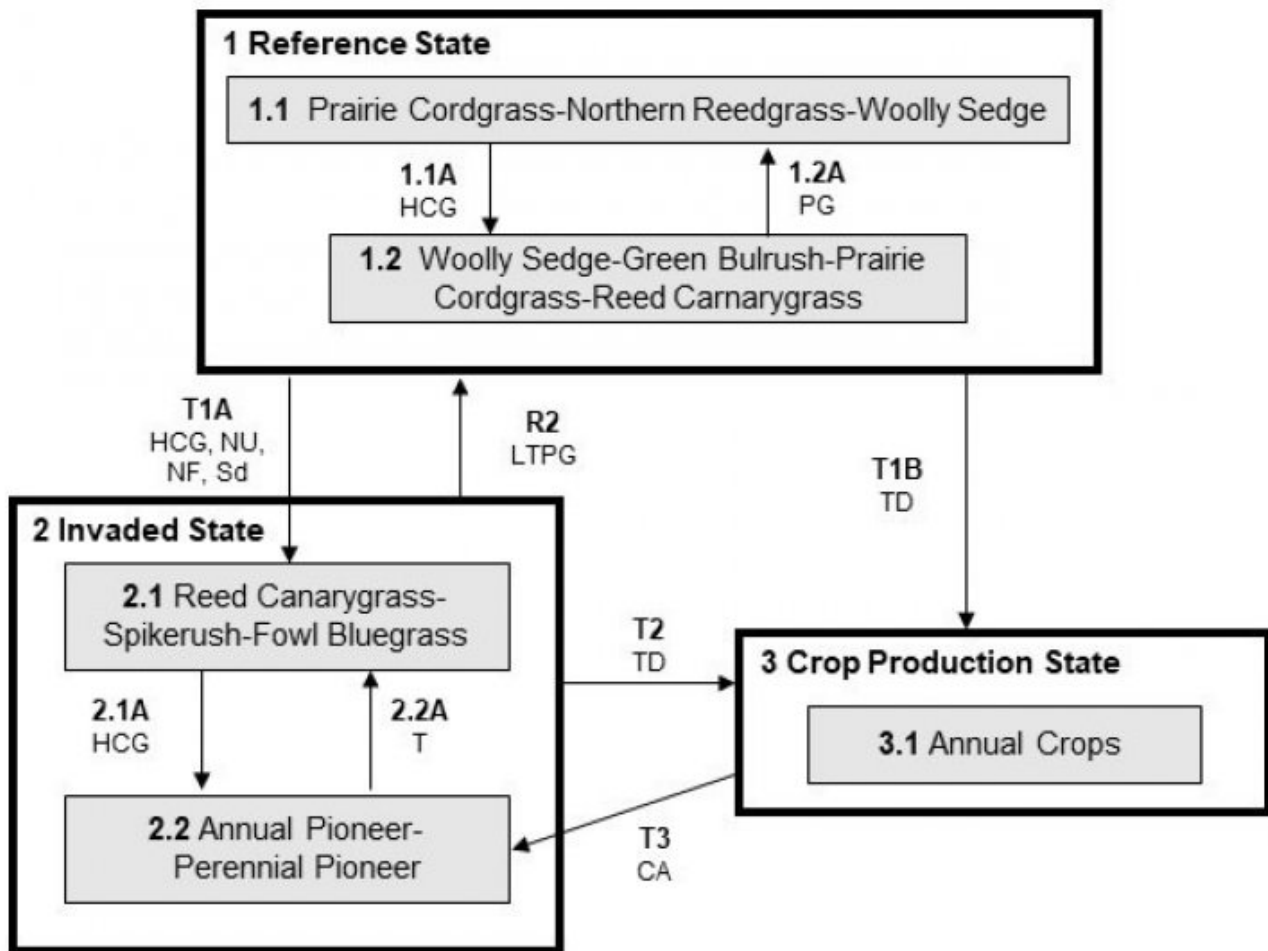
This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), fluctuating water tables and flooding events, and other biotic and abiotic factors that typically influence 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 sedge and rush will initially increase. Prairie cordgrass, northern reedgrass, and bluejoint reedgrass (*Calamagrostis canadensis*) will decrease in frequency and production. Heavy continuous grazing causes reed canarygrass (*Phalaris arundinacea*) to increase and eventually dominate the site. Extended periods of nonuse and no fire will result in a plant community having high litter levels, which also favors an increase in reed canarygrass, spikerush (*Eleocharis*), and bluegrass (*Poa*).

Interpretations are primarily based on the 1.1 Prairie Cordgrass-Northern Reedgrass-Woolly Sedge 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.

### State and transition model

## Linear Meadow– R102AY002SD (4/18/18)



### LEGEND

Linear Meadow– R102AY002SD

CA – Cropped and abandoned  
 HCG – Heavy continuous grazing  
 LTPG – Long-term prescribed grazing  
 NU – Non-use  
 NF– No fire  
 PG – Prescribed grazing  
 Sd – Sedimentation  
 T – Time w/wo disturbances  
 TD – Tillage, Artificial drainage

State 1  
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ecological site (ES). This state is typically codominated by cool-season grass and grass-like species, and warm-season grasses. Before European settlement, the primary disturbance mechanisms for this site in the reference condition included sporadic fire and grazing by large herding ungulates. Frequent surface fires (3 to 5 years) and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today the primary disturbance is from a lack of fire and concentrated livestock grazing. Grasses that are desirable for livestock and wildlife can decline and a corresponding increase in less desirable grasses will occur.

Community 1.1  
Prairie Cordgrass-Northern Reedgrass-Woolly Sedge

This community evolved with grazing by large herbivores, frequent surface fires and relatively frequent flooding and can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The potential vegetation is about 65 percent grasses, 20 percent grass-like species, 10 percent forbs, and 5 percent shrubs by air-dry weight. Prairie cordgrass is the dominant tall warm-season grass occupying this plant community. Reedgrasses (*Calamagrostis*) are the dominant tall cool-season species. A variety of sedges (*Cyperaceae*) and rushes (*Juncaceae*) occur throughout this community as well as fowl mannagrass (*Glyceria striata*), switchgrass (*Panicum virgatum*), reed canarygrass, plains bluegrass (*Poa arida*), and fowl bluegrass (*Poa palustris*). Key forbs include broadfruit bur-reed (*Sparganium eurycarpum*), giant goldenrod (*Solidago gigantea*), New England aster (*Symphyotrichum novae-angliae*), Maximilian sunflower (*Helianthus maximilliani*), white panicle aster (*Symphyotrichum lanceolatum*), and cinquefoil (*Potentilla*). This plant community phase is diverse, stable, and productive, and is well adapted to the Northern Great Plains. The high water table supplies much of the moisture for plant growth. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. The diversity in plant species allows for the variability of both the fluctuations of water table and reoccurring flooding. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	5070	5408	5750
Forb	270	800	1280
Shrub/Vine	60	192	370
Total	5400	6400	7400

Figure 9. Plant community growth curve (percent production by month).  
SD0208, Rolling Till Prairie, lowland cool-season/warm-season codominant..  
Cool-season, warm-season codominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	11	19	23	20	12	6	5	0	0

Community 1.2  
Woolly Sedge-Green Bulrush-Prairie Cordgrass-Reed Canarygrass

This plant community will slowly develop from the adverse effects of continuous grazing, without adequate recovery periods during the growing season following periods of below normal precipitation. Lack of litter and reduced plant heights result in higher soil temperatures and reduced water infiltration rates. Recognition of this plant community will enable the land user to implement key management decisions before a significant ecological threshold is crossed. When compared to the 1.1 Prairie Cordgrass-Northern Reedgrass-Woolly Sedge Plant Community Phase, prairie cordgrass has decreased. Sedge, rush, and other grass-like species are dominant. The grass-like species

have increased while the reedgrass species have been significantly reduced. Switchgrass may be removed at this stage. Reed canarygrass may begin to increase significantly. Forb species would include asters (*Aster*), goldenrod (*Solidago*), and cinquefoil, as well as, a possible invasion of Canada thistle (*Cirsium arvense*). Plant production and frequency have been reduced. The water cycle, nutrient cycle, and energy flow are slightly reduced but continue to function adequately.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	4500	5046	5505
Forb	245	580	960
Shrub/Vine	55	174	335
<b>Total</b>	<b>4800</b>	<b>5800</b>	<b>6800</b>

Figure 11. Plant community growth curve (percent production by month).  
SD0207, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. 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

### Pathway 1.1A Community 1.1 to 1.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 1.2 Woolly Sedge-Green Bulrush-Prairie Cordgrass-Reed Canarygrass Plant Community Phase.

### Pathway 1.2A Community 1.2 to 1.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 1.1 Prairie Cordgrass-Northern Reedgrass-Woolly Sedge Plant Community Phase. This pathway could also occur with a return to more normal precipitation levels and frequencies.

#### Conservation practices

Prescribed Grazing
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## State 2 Invaded State

This state is characterized by the degradation of the biotic integrity of the site due to excessive disturbance resulting in dominance by highly competitive species such as reed canarygrass and possibly the invasion of nonnative species. Loss of diversity and reduction of plant vigor and production have negatively impacted energy flow and nutrient cycling. Infiltration is reduced and native plant mortality is increased. As the disturbance level increases, native plant density decreases even more, giving way to annual species and invasive perennial species, as well as, an increase in bare ground.

### Community 2.1 Reed Canarygrass-Spikerush-Fowl Bluegrass

This plant community phase develops either with increased sedimentation, heavy continuous grazing, or with a long-term lack of grazing and/or no surface fire. In each case, native plant vigor is reduced allowing the increase of



competitive species and eventually the introduction of nonnative species. Spikerush and other grass-like species, as well as, bluegrasses will increase. The more competitive forbs will also increase. Reed canarygrass often will increase to the point of dominance while prairie cordgrass will diminish significantly. Other invasive plants such as creeping meadow foxtail (*Alopecurus arundinaceus*) or Canada thistle may become prevalent if a seed source is present or nearby. Nutrient cycling will be greatly diminished and the energy flow will shift significantly and be reduced as well. Infiltration will be reduced somewhat compared to the Reference State. This plant community is somewhat resistant to change. The combination of both grazing and fire is most effective in moving this plant community towards the Reference State.

**Table 7. Annual production by plant type**

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3400	3956	4485
Forb	200	575	960
Shrub/Vine	0	69	155
<b>Total</b>	<b>3600</b>	<b>4600</b>	<b>5600</b>

**Figure 13. Plant community growth curve (percent production by month). SD0206, Rolling Till Prairie, lowland cool-season dominant.. 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

## Community 2.2

### Annual Pioneer-Pioneer Perennial

This plant community developed with heavy continuous grazing without adequate recovery periods between grazing events or abandonment after cropping. The dominant vegetation includes pioneer annual or perennial grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include inland saltgrass (*Distichlis spicata*), foxtail barley (*Hordeum jubatum*), barnyardgrass (*Echinochloa crus-galli*), quackgrass (*Elymus repens*), fowl bluegrass, Kentucky bluegrass (*Poa pratensis*), Baltic rush (*Juncus balticus*), and sedges. The dominant forbs may include cocklebur (*Xanthium*), Canada thistle, and other early successional species. The community is susceptible to invasion of nonnative species due to severe soil disturbances and relatively high percent of bare ground. This plant community is resistant to change as long as soil disturbance or severe vegetation defoliation persists, thus holding back secondary plant succession. Significant economic inputs, management, and time would be required to move this plant community toward a higher successional stage. Secondary succession is highly variable, depending upon availability and diversity of a viable reproductive source of higher successional species. This plant community may be renovated to improve the production capability but management changes would be needed to maintain the new plant community.

## Pathway 2.1A

### Community 2.1 to 2.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 2.2 Annual Pioneer-Perennial Pioneer Plant Community Phase.

## Pathway 2.2A

### Community 2.2 to 2.1

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 2.1 Reed Canarygrass-Spikerush-Fowl Bluegrass Plant Community Phase.

State 3

Crop Production State

This state is characterized by the production of annual crops using a variety of tillage and cropping systems along with management practices. Cropping on this site is enabled during years with drier than normal precipitation or with artificial drainage (surface or subsurface).

Community 3.1

Annual Crops

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

Transition T1A

State 1 to 2

T1A – Sedimentation beyond normal levels due to increased flooding or non-use and no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, or heavy continuous grazing will likely lead this state over a threshold resulting in the 2.1 Reed Canarygrass-Spikerush-Fowl Bluegrass Plant Community Phase within the Invaded State (State 2).

Transition T1B

State 1 to 3

T1B – Tillage, Artificial drainage (surface and subsurface) will cause a shift over a threshold leading to the 3.1 Annual Crops within the Crop Production State (State 3).

Restoration pathway R2

State 2 to 1

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) may lead this plant community phase over a threshold to the Reference State (State 1). Wetland restoration techniques may be necessary to restore biotic integrity and plant diversity and productivity.

Conservation practices

Wetland Restoration
Prescribed Grazing

Transition T2

State 2 to 3

Tillage, Artificial drainage (surface and subsurface) will cause a shift over a threshold leading to the 3.1 Annual Crops within the Crop Production State (State 3).

Transition T3

State 3 to 2

Cropping followed by abandonment may lead this plant community phase over a threshold to the Invaded State (State 2) and more specifically to the 2.2 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Additional community tables

Table 8. Community 1.1 plant community composition

					Annual Production	Foliar Cover
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Group	Common Name	Symbol	Scientific Name	(Lb/Acre)	(%)
<b>Grass/Grasslike</b>					
1	<b>Tall Cool-season Grasses</b>			1280–2880	
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	1280–2560	–
	spiked muhly	MUGL3	<i>Muhlenbergia glomerata</i>	0–320	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0–320	–
2	<b>Cool-season Grasses</b>			640–1920	
	northern reedgrass	CASTI3	<i>Calamagrostis stricta</i> ssp. <i>inexpansa</i>	128–1280	–
	bluejoint	CACA4	<i>Calamagrostis canadensis</i>	128–960	–
	slimstem reedgrass	CASTS5	<i>Calamagrostis stricta</i> ssp. <i>stricta</i>	128–512	–
	Graminoid (grass or grass-like)	2GRAM	Graminoid (grass or grass-like)	0–320	–
	reed canarygrass	PHAR3	<i>Phalaris arundinacea</i>	64–320	–
	fowl bluegrass	POPA2	<i>Poa palustris</i>	64–192	–
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	64–192	–
	fowl mannagrass	GLST	<i>Glyceria striata</i>	64–192	–
3	<b>Grass-likes</b>			320–1600	
	fox sedge	CAVU2	<i>Carex vulpinoidea</i>	64–640	–
	woolly sedge	CAPE42	<i>Carex pellita</i>	64–640	–
	awlfruit sedge	CAST5	<i>Carex stipata</i>	0–512	–
	bottlebrush sedge	CAHY4	<i>Carex hystericina</i>	0–512	–
	smoothcone sedge	CALA12	<i>Carex laeviconica</i>	0–512	–
	Grass-like (not a true grass)	2GL	Grass-like (not a true grass)	0–320	–
	green bulrush	SCAT2	<i>Scirpus atrovirens</i>	0–320	–
	flatsedge	CYPER	<i>Cyperus</i>	0–192	–
	spikerush	ELEOC	<i>Eleocharis</i>	64–192	–
	rush	JUNCU	<i>Juncus</i>	64–192	–
<b>Forb</b>					
4	<b>Forbs</b>			320–1280	
	Forb, native	2FN	<i>Forb, native</i>	64–320	–
	milkweed	ASCLE	<i>Asclepias</i>	64–192	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	64–192	–
	goldenrod	SOLID	<i>Solidago</i>	64–192	–
	broadfruit bur-reed	SPEU	<i>Sparganium eurycarpum</i>	64–192	–
	New England aster	SYNO2	<i>Symphotrichum novae-angliae</i>	64–192	–
	broadleaf cattail	TYLA	<i>Typha latifolia</i>	0–192	–
	prairie ironweed	VEFA2	<i>Vernonia fasciculata</i>	0–128	–
	meadow zizia	ZIAP	<i>Zizia aptera</i>	64–128	–
	white panicle aster	SYLA6	<i>Symphotrichum lanceolatum</i>	64–128	–
	marsh skullcap	SCGA	<i>Scutellaria galericulata</i>	0–128	–
	marsh fleabane	SECO2	<i>Senecio congestus</i>	0–128	–
	hemlock waterparsnip	SISU2	<i>Sium suave</i>	64–128	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	64–128	–
	common boneset	EUDE3	<i>Eupatorium perfoliatum</i>	64–128	–

	common boneset	LOFL3	<i>Eupatorium perfoliatum</i>	04-128	—
	wild mint	MEAR4	<i>Mentha arvensis</i>	0-128	—
	water knotweed	POAM8	<i>Polygonum amphibium</i>	0-128	—
	curlytop knotweed	POLA4	<i>Polygonum lapathifolium</i>	64-128	—
	northern water plantain	ALTR7	<i>Alisma triviale</i>	0-128	—
	Canadian anemone	ANCA8	<i>Anemone canadensis</i>	64-128	—
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	64-128	—
	silverweed cinquefoil	ARAN7	<i>Argentina anserina</i>	64-128	—
	nodding beggartick	BICE	<i>Bidens cernua</i>	0-64	—
	spotted water hemlock	CIMA2	<i>Cicuta maculata</i>	0-64	—
	Illinois bundleflower	DEIL	<i>Desmanthus illinoensis</i>	0-64	—
	Macoun's buttercup	RAMA2	<i>Ranunculus macounii</i>	0-64	—
	western dock	RUAQ	<i>Rumex aquaticus</i>	0-64	—
	Virginia strawberry	FRVI	<i>Fragaria virginiana</i>	0-64	—
	rough bugleweed	LYAS	<i>Lycopus asper</i>	0-64	—
<b>Shrub/Vine</b>					
5	<b>Shrubs</b>			64-320	
	false indigo bush	AMFR	<i>Amorpha fruticosa</i>	64-320	—
	willow	SALIX	<i>Salix</i>	0-192	—
	Forb, native	2FN	<i>Forb, native</i>	0-192	—

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Tall Warm-season Grasses</b>			290-1450	
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	290-1450	—
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0-116	—
2	<b>Cool-season Grasses</b>			290-1450	
	reed canarygrass	PHAR3	<i>Phalaris arundinacea</i>	116-696	—
	fowl bluegrass	POPA2	<i>Poa palustris</i>	58-464	—
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0-290	—
	northern reedgrass	CASTI3	<i>Calamagrostis stricta</i> ssp. <i>inexpansa</i>	0-290	—
	bluejoint	CACA4	<i>Calamagrostis canadensis</i>	0-232	—
	slimstem reedgrass	CASTS5	<i>Calamagrostis stricta</i> ssp. <i>stricta</i>	0-174	—
	fowl mannagrass	GLST	<i>Glyceria striata</i>	0-116	—
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	0-58	—
3	<b>Grass-likes</b>			870-2610	
	woolly sedge	CAPE42	<i>Carex pellita</i>	58-870	—
	fox sedge	CAVU2	<i>Carex vulpinoidea</i>	58-870	—
	rush	JUNCU	<i>Juncus</i>	116-870	—
	awlfruit sedge	CAST5	<i>Carex stipata</i>	58-580	—
	bottlebrush sedge	CAHY4	<i>Carex hystericina</i>	58-580	—
	smoothcone sedge	CAI A12	<i>Carex laeviconica</i>	58-580	—

	spikerush	ELEOC	<i>Eleocharis</i>	116–464	–
	flatsedge	CYPER	<i>Cyperus</i>	0–406	–
	green bulrush	SCAT2	<i>Scirpus atrovirens</i>	0–232	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–174	–
<b>Forb</b>					
4	<b>Forbs</b>			290–870	
	goldenrod	SOLID	<i>Solidago</i>	58–348	–
	broadfruit bur-reed	SPEU	<i>Sparganium eurycarpum</i>	0–290	–
	New England aster	SYNO2	<i>Symphyotrichum novae-angliae</i>	58–290	–
	broadleaf cattail	TYLA	<i>Typha latifolia</i>	0–232	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	58–232	–
	Forb, native	2FN	<i>Forb, native</i>	0–174	–
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	58–174	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	58–174	–
	white panicle aster	SYLA6	<i>Symphyotrichum lanceolatum</i>	58–174	–
	spotted water hemlock	CIMA2	<i>Cicuta maculata</i>	0–116	–
	milkweed	ASCLE	<i>Asclepias</i>	0–116	–
	water knotweed	POAM8	<i>Polygonum amphibium</i>	0–116	–
	curlytop knotweed	POLA4	<i>Polygonum lapathifolium</i>	0–58	–
	Macoun's buttercup	RAMA2	<i>Ranunculus macounii</i>	0–58	–
	marsh skullcap	SCGA	<i>Scutellaria galericulata</i>	0–58	–
	hemlock waterparsnip	SISU2	<i>Sium suave</i>	0–58	–
	prairie ironweed	VEFA2	<i>Vernonia fasciculata</i>	0–58	–
	meadow zizia	ZIAP	<i>Zizia aptera</i>	0–58	–
	nodding beggartick	BICE	<i>Bidens cernua</i>	0–58	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	0–58	–
	wild mint	MEAR4	<i>Mentha arvensis</i>	0–58	–
	silverweed cinquefoil	ARAN7	<i>Argentina anserina</i>	0–58	–
	Canadian anemone	ANCA8	<i>Anemone canadensis</i>	0–58	–
<b>Shrub/Vine</b>					
6	<b>Shrubs</b>			58–290	
	false indigo bush	AMFR	<i>Amorpha fruticosa</i>	58–290	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–116	–
	meadow willow	SAPE5	<i>Salix petiolaris</i>	0–58	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Tall Warm-season Grasses</b>			0–230	
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	0–230	–
2	<b>Cool-season Grasses</b>			920–2070	
	reed canarygrass	PHAR3	<i>Phalaris arundinacea</i>	690–1840	–
	fowl bluegrass	POPA2	<i>Poa palustris</i>	92–460	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–230	–
3	<b>Grass-likes</b>			690–2070	
	spikerush	ELEOC	<i>Eleocharis</i>	460–1150	–
	rush	JUNCU	<i>Juncus</i>	230–920	–
	woolly sedge	CAPE42	<i>Carex pellita</i>	0–230	–
	awlfruit sedge	CAST5	<i>Carex stipata</i>	0–230	–
	fox sedge	CAVU2	<i>Carex vulpinoidea</i>	0–230	–
	bottlebrush sedge	CAHY4	<i>Carex hystericina</i>	0–230	–
	smoothcone sedge	CALA12	<i>Carex laeviconica</i>	0–138	–
	flatsedge	CYPER	<i>Cyperus</i>	0–92	–
	green bulrush	SCAT2	<i>Scirpus atrovirens</i>	0–46	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–46	–
<b>Forb</b>					
4	<b>Forbs</b>			230–920	
	Forb, introduced	2FI	<i>Forb, introduced</i>	46–552	–
	goldenrod	SOLID	<i>Solidago</i>	46–368	–
	New England aster	SYNO2	<i>Symphotrichum novae-angliae</i>	46–276	–
	broadleaf cattail	TYLA	<i>Typha latifolia</i>	46–276	–
	white panicle aster	SYLA6	<i>Symphotrichum lanceolatum</i>	46–184	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	0–92	–
	Forb, native	2FN	<i>Forb, native</i>	0–92	–
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	0–92	–
	milkweed	ASCLE	<i>Asclepias</i>	0–46	–
	spotted water hemlock	CIMA2	<i>Cicuta maculata</i>	0–46	–
	water knotweed	POAM8	<i>Polygonum amphibium</i>	0–46	–
	broadfruit bur-reed	SPEU	<i>Sparganium eurycarpum</i>	0–46	–
<b>Shrub/Vine</b>					
5	<b>Shrubs</b>			0–138	
	false indigo bush	AMFR	<i>Amorpha fruticosa</i>	0–138	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–46	–

## Animal community

### Animal Community – Grazing Interpretations

The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often,

the current plant composition does not entirely match any particular plant community (as described in this ES description). Because of this a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Prairie Cordgrass/Reedgrass/Sedge (1.1)

Average Annual Production (lbs./acre, air-dry): 6400

Stocking Rate\* (AUM/acre): 1.75

Sedge/Rush/Prairie Codgrass/Reed Canarygrass (1.2)

Average Annual Production (lbs./acre, air-dry): 5800

Stocking Rate\* (AUM/acre): 1.59

Reed Canarygrass/Spikerush/Bluegrass (2.1)

Average Annual Production (lbs./acre, air-dry): 4600

Stocking Rate\* (AUM/acre): 1.26

Annual/Pioneer Perennial (2.2)

Average Annual Production (lbs./acre, air-dry): 1600

Stocking Rate\* (AUM/acre): 0.44

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

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

## Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic groups C and D. Infiltration is typically slow to very slow and runoff potential for this site varies from negligible to medium 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 lower runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

## Recreational uses

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

## Wood products

No appreciable wood products are typically present on this site.

## Other products

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

## Inventory data references

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.

Data Source Sample Period State County  
NP-ESC-1 (0011346039) 2007 SD Deuel  
NP-ESC-1 (0090746039) 2007 SD Deuel  
NP-ESC-1 (0040846039) 2008 SD Deuel

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## Rangeland health reference sheet

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

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

## Indicators

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

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2. **Presence of water flow patterns:** Barely observable.

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3. **Number and height of erosional pedestals or terracettes:** Essentially, non-existent.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than 5% and less than 2 inches in diameter.

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class 6. Typically high root content, and organic matter. Soil surface is very resistant to erosion.

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

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

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident.
- 

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

Dominant: Tall warm-season rhizomatous grass >> mid & tall cool-season grass-likes

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

Other:

Additional:

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

14. **Average percent litter cover (%) and depth ( in):** 85-90%, roughly 1-3 inches. Litter cover is in contact with soil surface.
- 

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 5800 – 7000 lbs./acre air-dry weight, average 6,400 lbs./acre air-dry weight
- 

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Refer to State and Local Noxious Weed List, also reed canarygrass.
- 

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