USDA Natural Resources Conservation Service

Ecological site R102BY002SD
Linear Meadow

Last updated: 2/09/2024
Accessed: 05/04/2024

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): 102B–Till Plains

The Till Plains (102B) is located within the Western Lake Section of the Central Lowland Province of the Interior Plains. It is entirely in South Dakota, encompassing 2,215 square miles (Figure 1). The elevation ranges from 1,140 to 1,880 feet. The MLRA is characterized by glaciated, nearly level to hilly plains populated by stagnation and end moraines, glacial outwash terraces, and floodplains as the major landforms. The dominant parent materials are silty drift, glacial till, glacial outwash, and alluvium. (USDA-NRCS 2006)

The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a mesic temperature regime, a udic ustic moisture regime and mixed or smectitic mineralogy. They generally are very deep, well drained to poorly drained, and clayey or loamy. This area is in the western area of the tall grass prairie and supports big bluestem (Andropogon gerardi), little bluestem (Schizachyrium scoparium), Indiangrass (Sorghastrum nutans), porcupine grass (Hesperostipa spartea), and green needlegrass (Nassella viridula) as the dominant native species. Cattails (Typha), prairie cordgrass (Spartina pectinate), bulrush (Cyperaceae) and reed canarygrass (*Phalaris arundinacea*) are commonly found on the poorly drained soils. (USDA-NRCS, 2006).

Classification relationships

Major Land Resource Area (MLRA): Till Plains (102B) (USDA-NRCS, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Outer Coteau des Prairies (251Bb); Yankton Hills and Valleys (251Bf); Northwest Iowa Plains (251Bd); (Cleland et al., 2007).

US EPA Level IV Ecoregion: Prairie Coteau (46k); James River Lowland (46n); Loess Prairies (47a); Big Sioux Basin (46m) - (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. These soils have a water table within zero to two 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 co-dominated 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 with a change in disturbance regime.

Associated sites

R102BY003SD	**Subirrigated** 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 Chancellor, but other series are included.
R102BY004SD	**Wet Meadow** 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 Tetonka, but other series are included.
R102BY001SD	**Shallow Marsh** 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 Worthing, but other series are included.

Similar sites

R102BY001SD	**Shallow Marsh** The Shallow Marsh site occurs in a basin or closed depression. The soils are very poorly drained and the site will pond water until early summer in most years. The Shallow Marsh Site has less prairie cordgrass and more vegetative production than the Linear Meadow site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Carex aquatilis* (2) *Spartina pectinata*

Physiographic features

This site occurs on nearly level flood plains or drainageways.

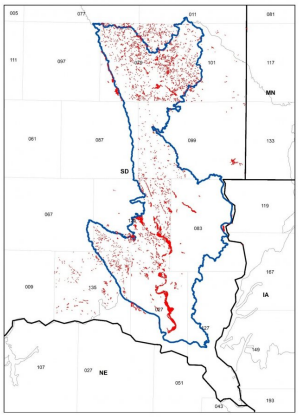


Figure 2. The Site Distribution map for the Linear Meadow site in MLRA 102B.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Outwash plain
Flooding duration	Long (7 to 30 days)
Flooding frequency	Frequent
Ponding frequency	None
Elevation	335–579 m
Slope	0–1%
Water table depth	0–51 cm
Aspect	Aspect is not a significant factor

Climatic features

Major Land Resource Area 102B is considered to have a continental climate with 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 the location of this MLRA 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 24 to 26 inches per year. The average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 14°F (Wentworth 2 WNW, South Dakota, to about 18°F (Canton 4 WNW, SD). July is the warmest month with temperatures averaging from about 72°F (Wentworth 2 WNW, SD), to about 73°F (Canton 4 WNW, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 57°F. This large annual range attests to the continental nature of the climate of this area. 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. Green-up 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)	124-127 days
Freeze-free period (characteristic range)	138-140 days

Precipitation total (characteristic range)	660 mm
Frost-free period (actual range)	123-128 days
Freeze-free period (actual range)	137-141 days
Precipitation total (actual range)	660-686 mm
Frost-free period (average)	126 days
Freeze-free period (average)	139 days
Precipitation total (average)	660 mm

Climate stations used

- (1) MONTROSE 8N [USC00395738], Montrose, SD
- (2) MADISON 2SE [USC00395090], Madison, SD
- (3) WENTWORTH 2.5 WNW [USC00399042], Wentworth, SD
- (4) CANTON [USC00391392], Canton, SD
- (5) CENTERVILLE 6 SE [USC00391579], Beresford, SD

Influencing water features

The Linear Meadow ecological site has a combination of physical and hydrological features that: 1) provide season-long ground water within two feet of the surface, 2) allows relatively free movement of water and air in the upper part of the soil, and 3) are occasionally or frequently flooded.
Wetland Description: Cowardin, et. al., 1979
System: Palustrine
Subsystem: N/A
Class: Persistent Emergent Wetland
Subclass: Semi-permanently, or Seasonally Flooded, or Saturated

Soil features

These are very deep, very poorly drained, medium to fine textured soils. Salinity and sodicity are none to slight. Water tables on this site range from the surface to about 20 inches below the surface during most of the growing season. This site occurs mainly along drainageways. Slope ranges from zero to one percent. This site should show no evidence of rills, wind scoured areas or pedestalled plants. The soil surface is stable and intact. Subsurface soil layers are nonrestrictive to water movement and root penetration. These soils are not typically susceptible to water erosion. The high water table and slow permeability strongly influences the soil-water-plant relationship.

The central concept soil series for this site include Clamo and Arlo, but others are included as well.

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

Table 4. Representative soil features

Surface texture	(1) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Very poorly drained
Permeability class	Slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	17.78–20.32 cm

Calcium carbonate equivalent (0-101.6cm)	5–20%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

State and Community Phases
The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

This site developed under Southern Black Glaciated Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or human-caused wildfire (often of light intensities), fluctuating water tables, flooding events, and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant communities due to short-term weather variations, impacts of native and exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances can cause significant shifts in plant communities and species composition that may not be described within this document.

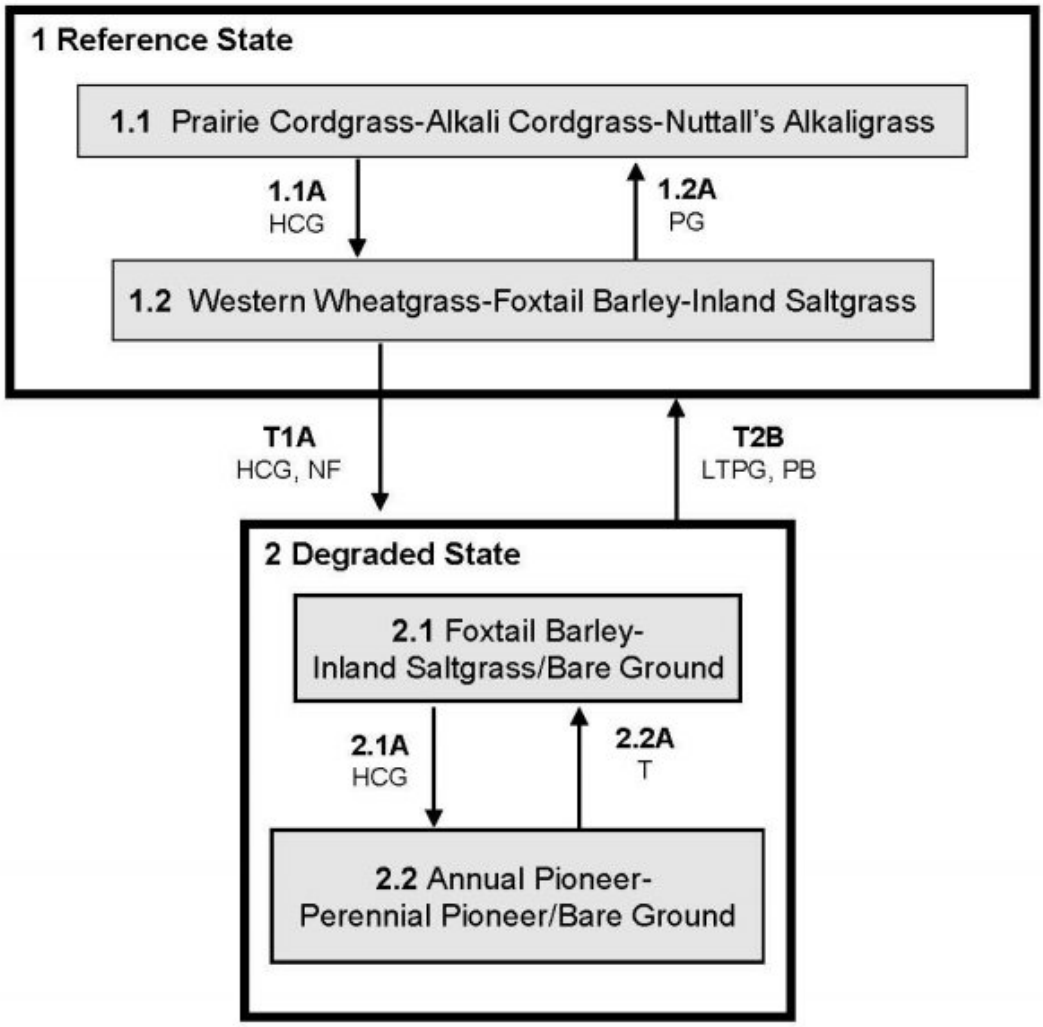
Heavy, continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the Reference plant community. Species such as sedge (Carex) and rush (Juncus) will initially increase. Prairie cordgrass, northern reedgrass, and bluejoint reedgrass (*Calamagrostis canadensis*), will decrease in frequency and level of production. Heavy, continuous grazing causes reed canarygrass (*Phalaris arundinacea*) to increase and eventually dominate the site. Extended periods of non-use and no fire will result in a plant community having high litter levels, which also favors an increase in reed canarygrass, spikerush (Eleocharis) and fowl bluegrass.

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.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition and community pathways between them. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Saline Lowland – R102BY007SD



LEGEND
Saline Lowland – R102BY007SD

HCG – Heavy, continuous grazing
LTPG – Long-term prescribed grazing
NF – No fire
PB – Prescribed burning
PG – Prescribed grazing
T – Time w/wo disturbances

Figure 9. State-And-Transition Model and Legend for the Linear Meadow site in MLRA 102B.

Code	Process
T1A	Heavy, continuous grazing, no fire
T2B	Long term prescribed grazing, prescribed burning
1.1A	Heavy, continuous grazing
1.2A	Prescribed grazing with recovery periods
2.1A	Heavy, continuous grazing
2.2A	Time w/wo disturbances

Figure 10. Matrix for the Linear Meadow site in MLRA 102B.

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 co-dominated by cool-season grass and grass-like species, and warm-season grasses. Before Europeans settled in North America, the primary disturbance mechanisms for this site in the Reference condition included sporadic fire and grazing by large herding ungulates. Frequent surface fires (occurring every 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 species will occur.

Community 1.1
Prairie Cordgrass-Northern Reedgrass-Woolly Sedge

Figure 11. Typical vegetation of the Reference Community in MLRA 102B.

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, ten percent forbs, and five 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 maximiliani*), 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, the nutrient water cycles, 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	5896	6251	6585
Forb	308	925	1502
Shrub/Vine	73	222	432
Total	**6277**	**7398**	**8519**

Figure 13. Plant community growth curve (percent production by month). SD0218, Till Plains, 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 slowly develops from the adverse effects of continuous growing season grazing without adequate recovery periods. Periods of below normal precipitation exacerbates this process. The resulting 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. Sedges, rushes, 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 and nutrient cycles and energy flow are slightly reduced but continue to function adequately.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	5358	6046	6591
Forb	291	695	1076
Shrub/Vine	67	208	404
Total	**5716**	**6949**	**8071**

Figure 15. Plant community growth curve (percent production by month). SD0217, Till Plains, 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 shifts 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.

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 the invasion of non-native 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, and 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 non-native 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	4024	4722	5419
Forb	235	687	1121
Shrub/Vine	–	83	185
Total	**4259**	**5492**	**6725**

Figure 17. Plant community growth curve (percent production by month). SD0216, Till Plains, 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 (Echinochia 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 non-native 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 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 leads 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 only possible 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, and a variety of other crops.

Transition T1A
State 1 to 2

Sedimentation beyond normal levels due to increased flooding, non-use, no surface fire for extended periods of time (typically for 10 or more years), or heavy continuous grazing will lead this state over a threshold to the 2.1 Reed Canarygrass-Spikerush-Fowl Bluegrass Plant Community.

Transition T1B
State 1 to 3

Tillage and artificial drainage (surface and subsurface) causes a shift to the 3.1 Annual Crops Plant Community.

Restoration pathway T2A
State 2 to 1

Favorable long-term prescribed grazing shifts this plant community to the Reference State (State 1). Wetland restoration techniques may be necessary to restore the biotic integrity and plant diversity and productivity.

Conservation practices

Prescribed Grazing
Wetland Restoration

Transition T2B
State 2 to 3

Tillage and artificial drainage (surface and subsurface) leads to the 3.1 Annual Crops Plant Community.

Restoration pathway T3A
State 3 to 2

Cropping followed by abandonment shifts this plant community phase to the 2.2 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass-likes**			2219–3699	
	water sedge	CAAQ	*Carex aquatilis*	740–2589	–
	awlfruit sedge	CAST5	*Carex stipata*	74–740	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–592	–
	woolly sedge	CAPE42	*Carex pellita*	74–592	–
	bottlebrush sedge	CAHY4	*Carex hystericina*	0–370	–
	smoothcone sedge	CALA12	*Carex laeviconica*	0–370	–
	green bulrush	SCAT2	*Scirpus atrovirens*	0–370	–
	flatsedge	CYPER	*Cyperus*	74–222	–
	spikerush	ELEOC	*Eleocharis*	74–222	–
	rush	JUNCU	*Juncus*	74–222	–
2	**Tall Warm-season Grasses**			370–1480	
	prairie cordgrass	SPPE	*Spartina pectinata*	370–1480	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–370	–
	switchgrass	PAVI2	*Panicum virgatum*	0–222	–
3	**Cool-season Grasses**			740–1480	
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	148–1110	–
	bluejoint	CACA4	*Calamagrostis canadensis*	74–592	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	74–370	–
	slimstem reedgrass	CASTS5	*Calamagrostis stricta ssp. stricta*	0–370	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–370	–
	Canada wildrye	ELCA4	*Elymus canadensis*	74–222	–
	fowl mannagrass	GLST	*Glyceria striata*	74–222	–
	fowl bluegrass	POPA2	*Poa palustris*	74–222	–
Forb					
4	**Forbs**			370–1480	
	Forb, native	2FN	*Forb, native*	74–370	–
	milkweed	ASCLE	*Asclepias*	74–222	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	74–222	–
	goldenrod	SOLID	*Solidago*	74–222	–
	broadfruit bur-reed	SPEU	*Sparganium eurycarpum*	74–222	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	74–222	–
	broadleaf cattail	TYLA	*Typha latifolia*	0–222	–
	prairie ironweed	VEFA2	*Vernonia fasciculata*	0–148	–
	meadow zizia	ZIAP	*Zizia aptera*	74–148	–
	white panicle aster	SYLA6	*Symphyotrichum lanceolatum*	74–148	–
	marsh skullcap	SCGA	*Scutellaria galericulata*	0–148	–
	marsh fleabane	SECO2	*Senecio congestus*	0–148	–
	hemlock waterparsnip	SISU2	*Sium suave*	74–148	–

	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	74–148	–
	common boneset	EUPE3	*Eupatorium perfoliatum*	74–148	–
	wild mint	MEAR4	*Mentha arvensis*	0–148	–
	water knotweed	POAM8	*Polygonum amphibium*	0–148	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	74–148	–
	northern water plantain	ALTR7	*Alisma triviale*	0–148	–
	Canadian anemone	ANCA8	*Anemone canadensis*	74–148	–
	Indianhemp	APCA	*Apocynum cannabinum*	74–148	–
	silverweed cinquefoil	ARAN7	*Argentina anserina*	74–148	–
	nodding beggartick	BICE	*Bidens cernua*	0–74	–
	spotted water hemlock	CIMA2	*Cicuta maculata*	0–74	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–74	–
	Macoun's buttercup	RAMA2	*Ranunculus macounii*	0–74	–
	western dock	RUAQ	*Rumex aquaticus*	0–74	–
	Virginia strawberry	FRVI	*Fragaria virginiana*	0–74	–
	rough bugleweed	LYAS	*Lycopus asper*	0–74	–
Shrub/Vine					
5	**Shrubs**			74–370	
	false indigo bush	AMFR	*Amorpha fruticosa*	74–370	–
	willow	SALIX	*Salix*	0–222	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–222	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass-likes**			1042–2780	
	water sedge	CAAQ	*Carex aquatilis*	69–1042	–
	rush	JUNCU	*Juncus*	139–1042	–
	spikerush	ELEOC	*Eleocharis*	139–556	–
	awlfruit sedge	CAST5	*Carex stipata*	0–347	–
	flatsedge	CYPER	*Cyperus*	0–347	–
	woolly sedge	CAPE42	*Carex pellita*	0–278	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–208	–
	bottlebrush sedge	CAHY4	*Carex hystericina*	0–208	–
	smoothcone sedge	CALA12	*Carex laeviconica*	0–208	–
	green bulrush	SCAT2	*Scirpus atrovirens*	0–139	–
2	**Tall Warm-season Grasses**			347–2085	
	prairie cordgrass	SPPE	*Spartina pectinata*	347–2085	–
	switchgrass	PAVI2	*Panicum virgatum*	0–69	–
3	**Cool-season Grasses**			347–1737	
	reed canarygrass	PHAR3	*Phalaris arundinacea*	139–834	–
	fowl bluegrass	POPA2	*Poa palustris*	69–556	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–347	–

	like)				
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	0–347	–
	bluejoint	CACA4	*Calamagrostis canadensis*	0–278	–
	slimstem reedgrass	CASTS5	*Calamagrostis stricta ssp. stricta*	0–208	–
	fowl mannagrass	GLST	*Glyceria striata*	0–139	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–69	–
Forb					
4	**Forbs**			347–1042	
	goldenrod	SOLID	*Solidago*	69–417	–
	broadfruit bur-reed	SPEU	*Sparganium eurycarpum*	0–347	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	69–347	–
	broadleaf cattail	TYLA	*Typha latifolia*	0–278	–
	Forb, introduced	2FI	*Forb, introduced*	69–278	–
	Forb, native	2FN	*Forb, native*	0–208	–
	Indianhemp	APCA	*Apocynum cannabinum*	69–208	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	69–208	–
	white panicle aster	SYLA6	*Symphyotrichum lanceolatum*	69–208	–
	milkweed	ASCLE	*Asclepias*	0–139	–
	water knotweed	POAM8	*Polygonum amphibium*	0–139	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–69	–
	Macoun's buttercup	RAMA2	*Ranunculus macounii*	0–69	–
	marsh skullcap	SCGA	*Scutellaria galericulata*	0–69	–
	hemlock waterparsnip	SISU2	*Sium suave*	0–69	–
	prairie ironweed	VEFA2	*Vernonia fasciculata*	0–69	–
	meadow zizia	ZIAP	*Zizia aptera*	0–69	–
	nodding beggartick	BICE	*Bidens cernua*	0–69	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–69	–
	wild mint	MEAR4	*Mentha arvensis*	0–69	–
	silverweed cinquefoil	ARAN7	*Argentina anserina*	0–69	–
	Canadian anemone	ANCA8	*Anemone canadensis*	0–69	–
Shrub/Vine					
5	**Shrubs**			69–347	
	false indigo bush	AMFR	*Amorpha fruticosa*	69–347	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–139	–
	meadow willow	SAPE5	*Salix petiolaris*	0–69	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass-likes**			824–2197	
	spikerush	ELEOC	*Eleocharis*	549–1373	–
	rush	JUNCU	*Juncus*	275–1098	–
	water sedge	CAAQ	*Carex aquatilis*	0–275	–
	flatsedge	CYPER	*Cyperus*	0–110	–
	bottlebrush sedge	CAHY4	*Carex hystericina*	0–55	–
	awlfruit sedge	CAST5	*Carex stipata*	0–55	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–55	–
2	**Tall Warm-season Grasses**			0–275	
	prairie cordgrass	SPPE	*Spartina pectinata*	0–275	–
	switchgrass	PAVI2	*Panicum virgatum*	0–55	–
3	**Cool-season Grasses**			1098–2471	
	reed canarygrass	PHAR3	*Phalaris arundinacea*	824–2197	–
	fowl bluegrass	POPA2	*Poa palustris*	110–549	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–275	–
Forb					
4	**Forbs**			275–1098	
	Forb, introduced	2FI	*Forb, introduced*	55–659	–
	goldenrod	SOLID	*Solidago*	55–439	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	55–330	–
	broadleaf cattail	TYLA	*Typha latifolia*	55–330	–
	white panicle aster	SYLA6	*Symphyotrichum lanceolatum*	55–220	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–110	–
	Forb, native	2FN	*Forb, native*	0–110	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–110	–
	milkweed	ASCLE	*Asclepias*	0–55	–
	spotted water hemlock	CIMA2	*Cicuta maculata*	0–55	–
	water knotweed	POAM8	*Polygonum amphibium*	0–55	–
	broadfruit bur-reed	SPEU	*Sparganium eurycarpum*	0–55	–
Shrub/Vine					
5	**Shrubs**			0–165	
	false indigo bush	AMFR	*Amorpha fruticosa*	0–165	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–55	–

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. Stocking rates are calculated using Animal-Unit-Month (AUM), which is the amount of air-dry forage required to feed a cow, with or without calf, for one month.

Sedge/Prairie Cordgrass/Reedgrass (1.1)
Average Annual Production (lbs./acre, air-dry): 6,600
Stocking Rate* (AUM/acre): 1.81

Sedge/Rush/Prairie Cordgrass/Reed Canarygrass (1.2)
Average Annual Production (lbs./acre, air-dry): 6,200
Stocking Rate* (AUM/acre): 1.70

Reed Canarygrass/Spikerush/Bluegrass (2.1)
Average Annual Production (lbs./acre, air-dry): 4,900
Stocking Rate* (AUM/acre): 1.34

Annual/Pioneer Perennial (2.2)
Average Annual Production (lbs./acre, air-dry): 1,600
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 group D. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be an area where shortgrasses form a strong sod and dominate the site. Dominance by bluegrass, 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 variety of plants that bloom from spring until fall have an aesthetic 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.

Other information

Ecological Site Correlation Issues and Questions:

• SD099 Minnehaha County, SD did not use the (Ra) Rauville silty clay loam (national symbol fzdv) as used in the adjoining SD079 Lake County, SD. Note: Rauville is a frigid soil and should not be used in MLRA 102B. A future project is needed to determine the correct soil series for these areas.

• SD083 Lincoln County, SD did not use the (Ca) Chancellor silty clay loam, 0 to 2 percent slopes, frequently flooded (national symbol 2vwcg) as used in the adjoining SD125 Turner County, SD. Note: The Chancellor component in this map unit is poorly drained. The (Ca) Chancellor-Tetonka complex, 0 to 2 percent slopes (national symbol 2vwch) used in SD083 Lincoln County, SD, the Chancellor component is somewhat poorly drained.

• SD027 Clay County, SD did not use the (Ba) Baltic clay loam (national symbol g10g) as used in the adjoining SD135 Yankton County, SD.

• Reference and alternative states within the state and transition model are may not be fully documented and may require additional field sampling for refinement.

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
None

Other references

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

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

Samson, F.B., & Knopf, F.L. 1996. Prairie Conservation Preserving North America's Most Endangered Ecosystem. Washington, DC: Island Press.

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

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

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

USDA, NRCS. 2018. The PLANTS Database (http://plants.usda.gov, accessed 27 March 2018). National Plant Data Team.

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

High Plains Regional Climate Center, University of Nebraska, Lincoln, NE. http://www.hprcc.unl.edu/

USDA, NRCS. National Water and Climate Center, Portland, OR. http://wcc.nrcs.usda.gov

USDA, NRCS. National Soil Information System, Information Technology Center, Fort Collins, CO. http://nasis.nrcs.usda.gov

Contributors

Stan Boltz

Approval

Suzanne Mayne-Kinney, 2/09/2024

Acknowledgments

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

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

This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. It was officially approved for publication by David Kraft as of 11/12/2020.

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	david.schmidt@sd.usda.gov 605-352-1236
Date	12/07/2004
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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.

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: Mid and tall grass-like species >>

    Sub-dominant: Tall warm-season grasses = cool-season grasses = forbs >>

    Other: Shrubs

    Additional:

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

14. **Average percent litter cover (%) and depth (in):** 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):** Production ranges from 5,600-7,600 lbs./acre (air-dry weight). Reference value production is 6,600 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.