USDA Natural Resources
Conservation Service

Ecological site R102AY001SD
Shallow Marsh

Last updated: 6/27/2024
Accessed: 05/13/2025

General information

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

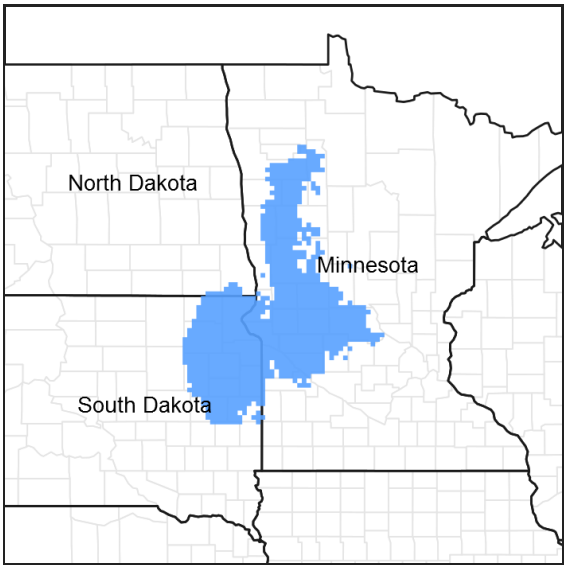


Figure 1. Mapped extent

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 landforms 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 Shallow Marsh ecological site typically occurs in a basin or closed depression, and receives water directly from precipitation, surface overland flow, and groundwater discharge. Soils are formed in local alluvium and are very poorly drained, which have a water table within 1 foot of the soil surface. Permeability is very slow due to the clayey subsoil and the site will pond water until early summer in most years. Ponded water conditions and very slow permeability strongly influences the soil-water-plant relationship. Vegetation in the Reference State is typically dominated by cool-season grass and grass-like species including Whitetop, slough sedge, woolly sedge, American mannagrass, prairie cordgrass, and spikerush. Forb species may include smartweeds, western dock, and white panicle aster. Nonnative species such as quackgrass, creeping meadow foxtail, and Kentucky bluegrass may invade the site due to change in disturbance regime.

Associated sites

R102AY003SD	**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 Badger, but other series are included.
R102AY004SD	**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 Tonka, but other series are included.
R102AY020SD	**Loamy Overflow** 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, Svea, and Waubay, but other series are included.
R102AY002SD	**Linear Meadow** These sites occur 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 are Vallers and Colvin, but other series are included.

Similar sites

R102AY004SD	**Wet Meadow** Wet Meadow is similar in landscape position, but the site ponds water only for 4 to 8 weeks in the spring of the year or after a heavy rain. A Wet Meadow site will have more prairie cordgrass and lower production than a Shallow Marsh.

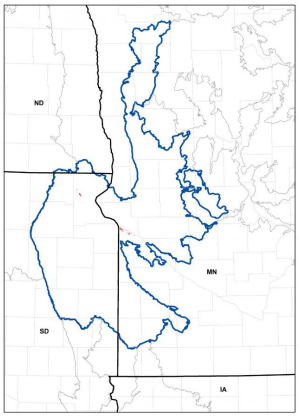


Figure 2.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Scolochloa festucacea* (2) *Carex atherodes*

Physiographic features

This site occurs on nearly level to concave depressions on uplands.

Table 2. Representative physiographic features

Landforms	(1) Pothole
Ponding duration	Long (7 to 30 days) to very long (more than 30 days)
Ponding frequency	Occasional to frequent
Elevation	305–610 m
Slope	0–1%
Ponding depth	0–61 cm
Water table depth	0–56 cm
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)	635-711 mm
Frost-free period (actual range)	99-131 days
Freeze-free period (actual range)	130-153 days
Precipitation total (actual range)	610-711 mm
Frost-free period (average)	120 days
Freeze-free period (average)	143 days
Precipitation total (average)	660 mm

Climate stations used

- (1) LAKE WILSON [USC00214534], Lake Wilson, MN
- (2) TRACY [USC00218323], Tracy, MN
- (3) ARLINGTON 1 W [USC00390281], Arlington, SD
- (4) CLEAR LAKE [USC00391777], Clear Lake, SD
- (5) CLARK [USC00391739], Clark, SD
- (6) MILBANK 4 NW [USC00395536], Milbank, SD
- (7) ROY LAKE [USC00397326], Lake City, SD
- (8) ARTICHOKE LAKE [USC00210287], Correll, MN
- (9) BENSON [USC00210667], Benson, MN
- (10) GLENWOOD 2 WNW [USC00213174], Glenwood, MN
- (11) MELROSE [USC00215325], Melrose, MN
- (12) FERGUS FALLS [USC00212768], Fergus Falls, MN
- (13) MAHNOMEN [USC00215012], Mahnomen, MN
- (14) FOSSTON 1 E [USC00212916], Fosston, MN
- (15) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (16) BROWNS VALLEY [USC00211063], Beardsley, MN
- (17) CASTLEWOOD [USC00391519], Castlewood, SD
- (18) MILAN 1 NW [USC00215400], Milan, MN
- (19) MORRIS WC EXP STN [USC00215638], Hancock, MN
- (20) PIPESTONE [USC00216565], Pipestone, MN
- (21) SISSETON [USC00397742], Sisseton, SD
- (22) SUMMIT 1 W [USC00398116], Summit, SD
- (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 22 inches.

Soil features

The Shallow Marsh ecological site typically occurs in a basin or closed depression, and receives water directly from precipitation, surface overland flow, and groundwater discharge. Soils are very poorly drained and formed in local alluvium. Permeability is very slow and the site will pond water until early summer in most years. The central concept soil series is Oldham and Parnell, but other series are included. Ponded water conditions and very slow

permeability strongly influences the soil-water-plant relationship.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Very poorly drained
Permeability class	Very slow
Soil depth	203 cm
Available water capacity (0-101.6cm)	15.24–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0–20%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–2%
Subsurface fragment volume >3" (Depth not specified)	0%

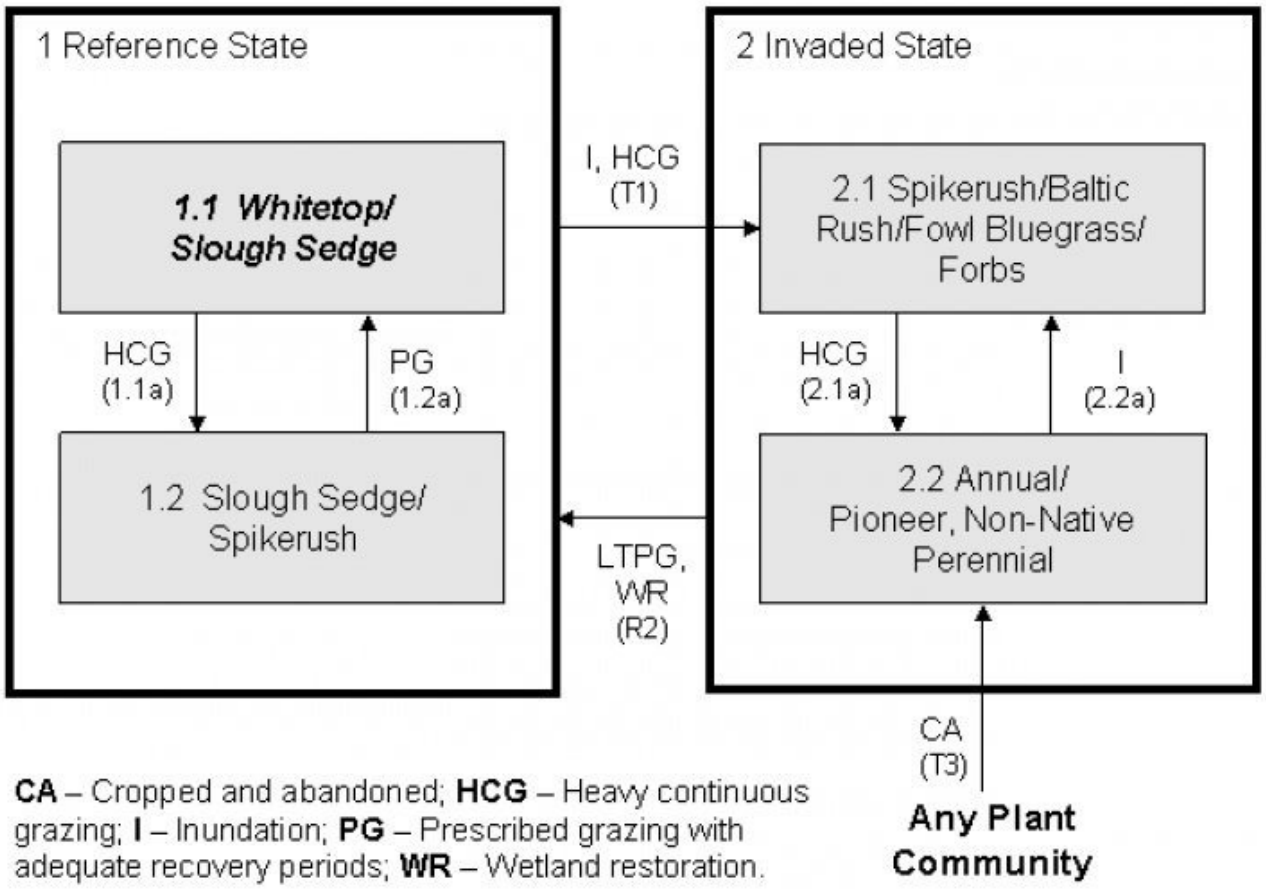
Ecological dynamics

The site, located in the Prairie Pothole Region of the MLRA, developed under Northern Great Plains climatic conditions and included historic natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Whitetop-Slough Sedge Plant Community Phase. This community phase and the Reference State have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered.

This ecological site (ES) has been grazed by domestic livestock since they have been introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have changed the ecological dymanics of this site. Heavy continuous grazing without adequate recovery periods following each grazing occurrence causes this site to depart from the Reference State due to the compaction and overgrazing. Species such as fowl bluegrass (*Poa palustris*), spikerush (Eleocharis), and Baltic rush (Juncus balticus) will initially increase. Whitetop and slough sedge will decrease in frequency and production. Continued heavy grazing eventually causes a dominance by spikerush, rushes (Juncus), and unpalatable forbs such as curly dock (*Rumex crispus*).

Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and/or states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

State and transition model



State 1
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ES. This state is typically dominated by cool-season grass and grass-like species. Before European settlement, the primary disturbance mechanisms for this site in the reference condition included periodic fire, grazing by large herding ungulates, and fluctuations in the water table and ponding frequency and duration. 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, concentrated livestock grazing, and weather fluctuations. Species that are desirable for livestock and wildlife can decline and a corresponding increase in less desirable species will occur.

Community 1.1
Whitetop-Slough Sedge

Interpretations are based primarily on the 1.1 Whitetop-Slough Sedge Plant Community Phase (this is also considered to be climax). This plant community evolved with grazing by large herbivores, frequent surface fires, and periodic flooding events and is suited for grazing by domestic livestock. This plant community can be found on areas that are grazed and where the grazed plants receive adequate periods of rest during the growing season in order to recover. The potential vegetation is about 45 percent grasses, 40 percent grass-likes, and 15 percent forbs. The major grasses and grass-likes include whitetop (also called common rivergrass), slough sedge (also called wheat sedge), woolly sedge (*Carex pellita*), American mannagrass (*Glyceria grandis*), prairie cordgrass, and spikerush.

Key forbs include smartweeds (Polygonum), western dock (*Rumex aquaticus*), and white panicle aster (*Symphyotrichum lanceolatum*). 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 variability of both the fluctuations of water table and reoccurring ponding allows for the diversity in plant species. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Community 1.2
Slough Sedge-Spikerush

This plant community will slowly develop from the adverse effects of continuous grazing, without adequate recovery periods between each grazing event during the growing season. When compared to the 1.1 Whitetop-Slough Sedge Plant Community Phase, whitetop, prairie cordgrass, and American mannagrass have decreased. The grass-like species, such as slough sedge, spikerush, woolly sedge, and rushes, have increased and tend to dominate this plant community.

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 Slough Sedge-Spikerush Plant Community Phase.

Pathway 1.2
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 Whitetop-Slough 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 increase in bare ground due to trampling caused by excessive use and/or by inundation for extended periods which causes a temporary shift in the plant composition and cover. This allows for the invasion of nonnative species, which, with continued heavy grazing, can increase to eventual dominance. Loss or reduction of native cool- and warm-season species can negatively impacted energy flow and nutrient cycling. Infiltration will be reduced and native plant mortality will increase. As the disturbance level increases, native plant density decreases even more, giving way to annual species and invasive perennial species, as well as, a further increase in bare ground.

Community 2.1
Spikerush-Baltic Rush-Fowl Bluegrass-Forbs

This plant community developed with heavy continuous grazing without adequate recovery periods between grazing events and/or inundation during periods of extended above-average precipitation. Spikerush, Baltic rush, bulrush (Scheonoplectus), and other less desirable grass-likes, along with grasses such as fowl bluegrass, and American sloughgrass (*Beckmannia syzigachne*), dominate the community. Quackgrass (*Elymus repens*), creeping meadow foxtail (*Alopecurus arundinaceus*), Kentucky bluegrass (*Poa pratensis*), and other nonnative species can invade on drier portions of the community. Whitetop, slough sedge, other sedges, prairie cordgrass, and reedgrass (Calamagrostis) will be virually eliminated from the plant community. Smartweed (Polygonum), dock (Rumex), and cinquefoil (Potentilla) have increased. Areas of bare ground can be present throughout the site. A significant amount of production and diversity has been lost when compared to the 1.1 Whitetop-Slough Sedge Plant Community Phase. Loss or reduction of native grasses, grass-likes, and forbs has negatively impacted energy flow

and nutrient cycling. It will take a long time to restore this plant community with improved management or return of more normal precipitation patterns.

Community 2.2
Annual Pioneer-Perennial Pioneer

This plant community developed with heavy continuous grazing without adequate recovery periods between grazing events and no surface fire or abandonment after cropping. The dominant vegetation includes pioneer annual and/or perennial native and non-native grasses, grass-likes, forbs, and shrubs. Grasses may include foxtail barley (*Hordeum jubatum*), rough barnyard grass (*Echinochloa muricata*), quackgrass, fowl bluegrass, Kentucky bluegrass, Baltic rush, and sedges. The dominant forbs include knotweed (Polygonum), Canada thistle (*Cirsium arvense*), and other early successional species. 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. 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.

Pathway 2.1
Community 2.1 to 2.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites and no surface fire for extended periods of time (typically for 10 years or more) causing litter levels to become high enough to reduce native grass vigor, diversity, and density will shift this community to the 2.2 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Pathway 2.2
Community 2.2 to 2.1

Inundation for extended periods beyond normal ponding and drying patterns will convert this plant community to the 2.1 Spikerush-Baltic Rush-Fowl Bluegrass-Forbs Plant Community Phase within the Invaded State (State 2).

State 3
Crop Production State (Any Plant Community)

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

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), no surface fire for extended periods of time (typically for 10 years or more) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, and/or inundation for extended periods beyond normal ponding and drying patterns will eventually cause a shift over a threshold leading to the 2.1 Spikerush-Baltic Rush-Fowl Bluegrass-Forbs Plant Community Phase within the Invaded State (State 2). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Transition T1B
State 1 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).

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.

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).

Restoration pathway 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

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.

Whitetop/Slough Sedge (1.1)
Average Anuual Production (lbs./acre, air-dry): 6800
Stocking Rate* (AUM/acre): 1.86

Slough Sedge/Spikerush (1.2)
Average Annual Production (lbs./acre, air-dry): 5500
Stocking Rate* (AUM/acre): 1.51

Spikerush/Baltic Rush/Fowl Bluegrass/Forbs (2.1)
Average Annual Production (lbs./acre, air-dry): 3200
Stocking Rate* (AUM/acre): 0.88

Annual/Pioneer, Non-Native 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 is negligible due to the concave shape of the landform that this site occupies.

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 (0150746039) 2007 SD Deuel
NP-ESC-1 (0010846039) 2008 SD Deuel

Other references

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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.

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.

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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.

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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.

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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 cool-season rhizomatous grass > mid & tall cool-season rhizomatous grass-like

    Sub-dominant: > tall warm-season rhizomatous grass > forb

    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.

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14. **Average percent litter cover (%) and depth (in):** 85-90%, roughly 1-2 inches. Litter cover is in contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 6200 – 7400 lbs./acre air-dry weight, average 6,800 lbs./acre air-dry weight

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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.

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