Ecological site R102AY039SD
Shallow Peatland

Last updated: 8/20/2024
Accessed: 05/11/2025

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.

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 Shallow Peatland ecological site typically occur on level or slightly concave landscape positions, (slopes 0 – 1%) on depressions in uplands, along streams and drainageways, and less often as floating mats on lakeshores. Soil surface textures are muck or sapric peat (Histic Humaquepts to Terric Haplosaprists). Organic sediments are typically shallow, but can be >16 inches (40 cm) deep. Soils are very poorly drained, formed in thin mantles of highly decomposed organic soil material, overlying loamy, calcareous till or lacustrine sediments on lake plains, glacial moraines, and till plains. Permeability is moderate in the organic material, rapid in the sandy sediments, and moderate or moderately slow in the underlying loamy material. The plants associated with this site concept in the

reference state are well-adapted to waterlogged conditions, but they cannot tolerate excessively long continuous periods of inundation.

Associated sites

R102AY001SD	**Shallow Marsh** These sites occur in a basin or closed depression. These soils formed in mineral materials. The site ponds water for long duration often until early summer. The central concept soil series is Oldham, but other series are included.
R102AY002SD	**Linear Meadow** These sites occur in drainageways. These soils formed in mineral materials. 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.
R102AY004SD	**Wet Meadow** These sites occur in a basin or closed depression. These soils formed in mineral materials. 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.

Similar sites

R102AY001SD	**Shallow Marsh** These sites occur in a basin or closed depression. These soils formed in mineral materials. The site ponds water for long duration often until early summer. The central concept soil series is Oldham, but other series are included.
R102AY037SD	**Deep Marsh** These sites occur in basins or closed depressions. These soils formed in mineral materials. Soils are very poorly drained and are ponded year round in most years. The central concept soil series Southam, but other series are included.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Calamagrostis canadensis* (2) *Carex stricta*

Physiographic features

The Shallow Peatland ecological site typically occur on level or slightly concave landscape positions, (slopes 0 – 1%) on depressions in uplands, and along streams and drainageways.

Table 2. Representative physiographic features

Landforms	(1) Upland > Drainageway (2) Depression
Runoff class	Negligible to low
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Rare to frequent
Elevation	850–1,000 ft
Slope	0–2%
Ponding depth	0–6 in

Water table depth	0–12 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)	108-120 days
Freeze-free period (characteristic range)	134-146 days
Precipitation total (characteristic range)	25-26 in
Frost-free period (actual range)	100-124 days
Freeze-free period (actual range)	133-147 days
Precipitation total (actual range)	25-28 in
Frost-free period (average)	114 days
Freeze-free period (average)	140 days
Precipitation total (average)	26 in

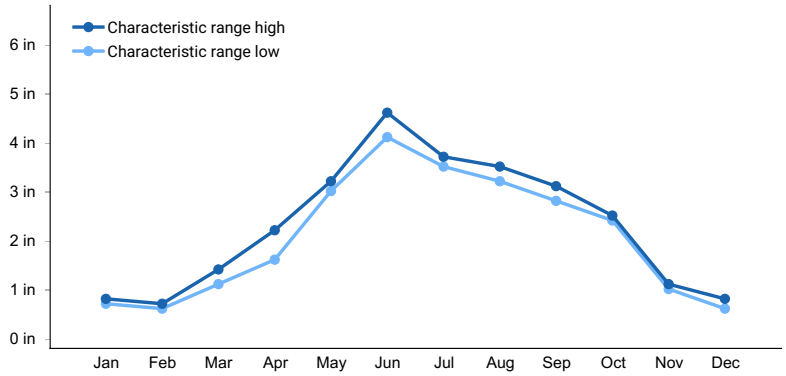


Figure 1. Monthly precipitation range

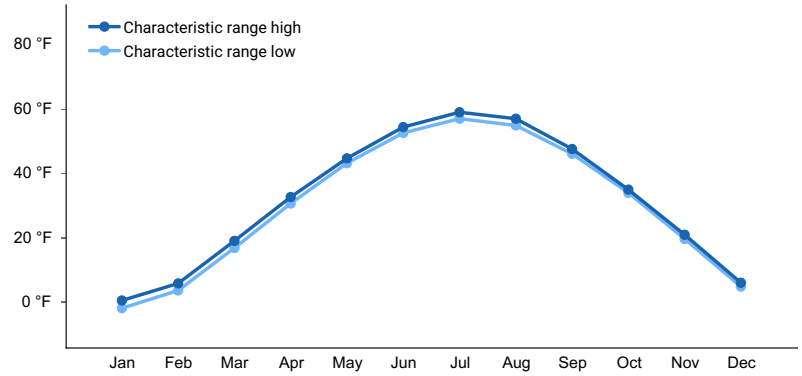


Figure 2. Monthly minimum temperature range

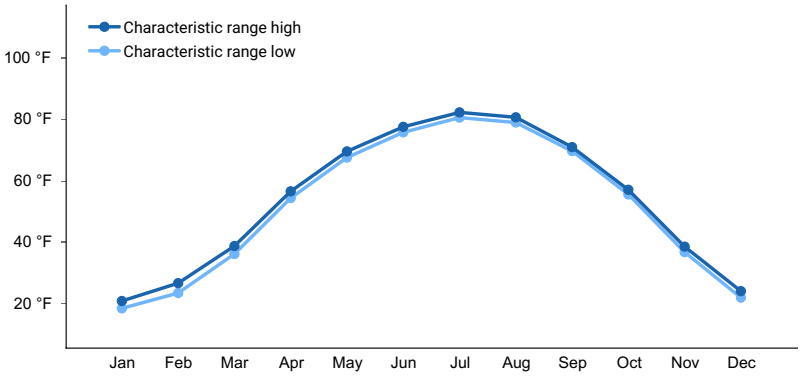


Figure 3. Monthly maximum temperature range

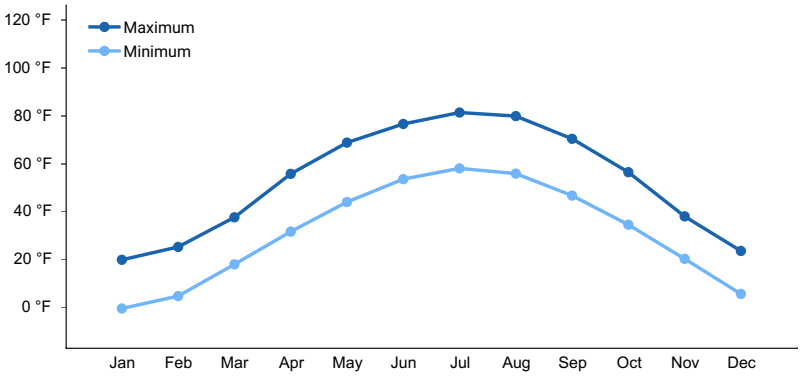


Figure 4. Monthly average minimum and maximum temperature

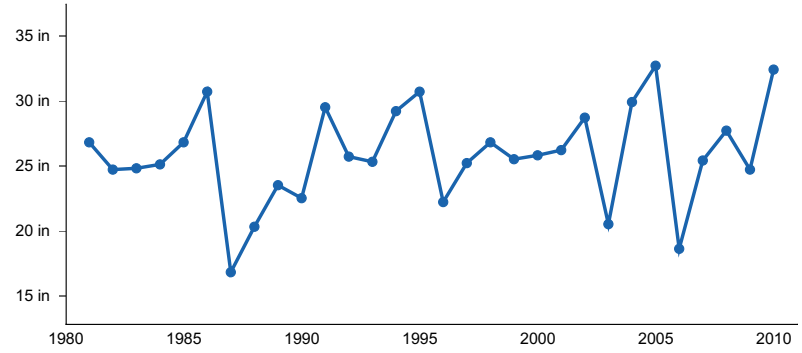


Figure 5. Annual precipitation pattern

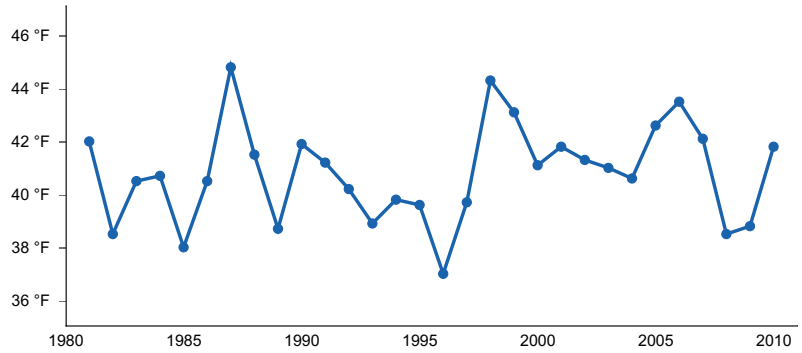


Figure 6. Annual average temperature pattern

Climate stations used

- (1) FERGUS FALLS [USC00212768], Fergus Falls, MN
- (2) FOSSTON 1 E [USC00212916], Fosston, MN
- (3) GLENWOOD 2 WNW [USC00213174], Glenwood, MN
- (4) MAHNOMEN [USC00215012], Mahnomen, MN
- (5) MELROSE [USC00215325], Melrose, MN

Influencing water features

The water table can be close to the surface or up to a depth of 1.0 foot during the growing season in an average precipitation year. Flooding is usually rare to none, except in cases where the site is located at the bottom of slopes or is associated with seeps or lateral flow from groundwater or an adjacent stream channel. These sites usually receive water through precipitation, overland surface flow, and/or flow-through (lateral flow) from an adjacent stream channel, therefore the mineral and nutrient content is high. In some cases, such as stream terraces, floodplains, or beach ridges, they can receive groundwater discharge; however, the central concept for this site is that of a recharge closed depression system (Brinson 1993), palustrine fresh meadow/shrub swamp (Cowardin et al, 1979). These sites are subject to moderate inundation following spring thaw and heavy rains and periodic drawdowns during the summer months and drought, but water levels are typically high and persistent enough to prevent tree establishment. These sites are particularly important for their water quality protection functions, including the trapping of sediments and assimilation of nutrients, and stormwater and floodwater retention.

Wetland description

The central concept for this site is that of a recharge closed depression system (Brinson 1993), palustrine fresh meadow/shrub swamp (Cowardin et al, 1979).

Soil features

The common soil features of soils in this site is the organic material underlain by a lacustrine or fine-loamy till subsoil and slopes 0 to 2 percent. The soils in this site are very poorly drained and formed in organic deposits within glacial moraines. The peat (hemic or sapric material) surface layer is 6 to 12 inches thick. The soil surface is stable and intact. Subsurface soil layers are nonrestrictive to water movement and root penetration. These soils are not susceptible to water erosion. Ponded water conditions and organic material strongly influences the soil-water-plant relationship.

Table 4. Representative soil features

Parent material	(1) Organic material
Surface texture	(1) Peat
Drainage class	Very poorly drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	80 in

Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-60in)	10–13.8 in
Calcium carbonate equivalent (0-40in)	0–60%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Soil reaction (1:1 water) (0-40in)	6.1–7.8
Subsurface fragment volume <=3" (0-40in)	1–3%
Subsurface fragment volume >3" (0-40in)	0–1%

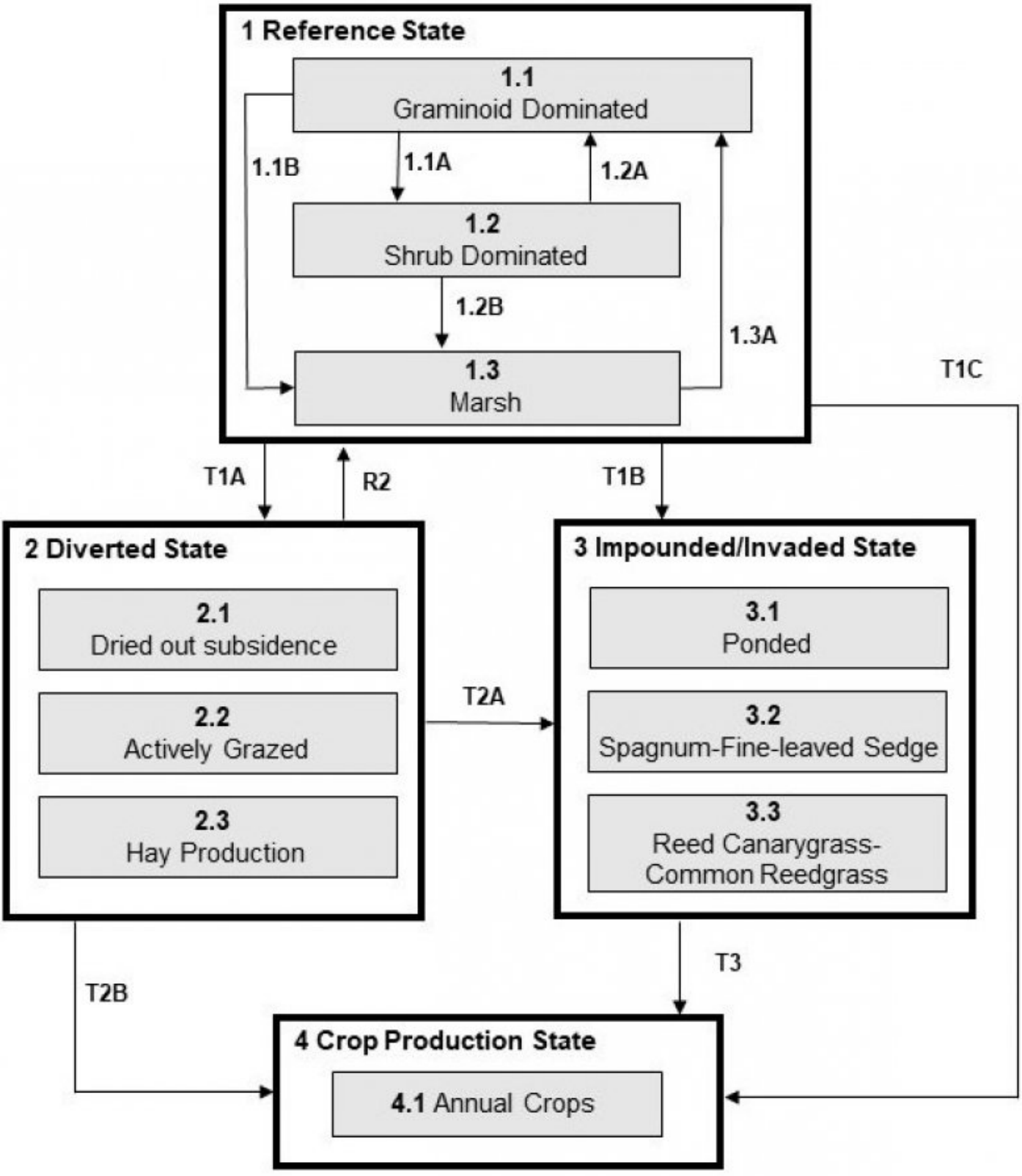
Ecological dynamics

Shallow Peatland typically occur on level or slightly concave landscape positions, (slopes 0 – 1%) on depressions in uplands, along streams and drainageways, and less often as floating mats on lakeshores. Soil surface textures are muck or sapric peat (Histic Humaquepts to Terric Haplosaprists). Organic sediments are typically shallow, but can be >16 inches (40 cm) deep. Soils are very poorly drained, formed in thin mantles of highly decomposed organic soil material, overlying loamy, calcareous till or lacustrine sediments on lake plains, glacial moraines, and till plains. Permeability is moderate in the organic material, rapid in the sandy sediments, and moderate or moderately slow in the underlying loamy material.

The water table can be close to the surface or up to a depth of 1.0 foot during the growing season in an average precipitation year. Flooding is usually rare to none, except in cases where the site is located at the bottom of slopes or is associated with seeps or lateral flow from groundwater or an adjacent stream channel. These sites usually receive water through precipitation, overland surface flow, and/or flow-through (lateral flow) from an adjacent stream channel, therefore the mineral and nutrient content is high. In some cases, such as stream terraces, floodplains, or beach ridges, they can receive groundwater discharge; however, the central concept for this site is that of a recharge closed depression system (Brinson 1993), palustrine fresh meadow/shrub swamp (Cowardin et al, 1979). These sites are subject to moderate inundation following spring thaw and heavy rains and periodic drawdowns during the summer months and drought, but water levels are typically high and persistent enough to prevent tree establishment. These sites are particularly important for their water quality protection functions, including the trapping of sediments and assimilation of nutrients, and stormwater and floodwater retention.

State and transition model

Shallow Peatland – MLRA 102A



LEGEND

Shallow Peatland – R102AY039SD

Code	Process
T1A	Diversion of water off-site, typically due to drainage or ditching, or extended periods of drought
T1B	Impoundment of water on-site, maintenance of water on-site, and/or establishment of invasive species
T1C	Tile, drainage, tilling, seeding, herbicide
T2A	Removal of drainage, impoundment of water on-site, maintenance of water on-site, and/or establishment of invasive species
T2B	Tile, drainage, tilling, seeding, herbicide
T3	Tile, drainage, tilling, seeding, herbicide
1.1A	Lack of surface fire and/or periodic drought
1.1B	Beaver dam off-site restricts water flow or contributes to ponding on-site
1.2A	Frequent surface fires (3 – 5 years) or higher than average precipitation
1.2B	Beaver dam off-site restricts water flow or contributes to ponding on-site
1.3A	Removal of beaver or beaver dam
R2A	Restoration of reference condition hydrology, seeding, and invasive species removal

State 1
Reference State

The plants associated with the Shallow Peatland ecological site concept in the reference state are well-adapted to waterlogged conditions, but they cannot tolerate excessively long continuous periods of inundation (water table <20 in [50 cm]). Plant species are also adapted to periods of dessication, by developing root stems or collars that provide access to oxygen when the rest of the root system is submerged, or by having roots that extend very deep into permanently wet or moist substrates, or by having hard-walled cells (sclerenchyma) on the outer surfaces of their root systems which prevent water loss (MNDNR 2005). Although this site may temporarily exhibit floating or submergent vegetation, they typically do not last due to frequent periods of dessication on site. In situations where water levels are higher than average, or beaver impoundment is impacting the amount of water ponding on-site, the vegetation community may resemble more of a marsh. Tussock-forming sedges (i.e. *Carex stricta* Lam.) and bluejoint (*Calamagrostis canadensis* (Michx.) P. Beauv.) can form floating mats that elevate rootlets above the water surface. These thick mats also tend to reduce plant diversity and the available habitat on-site for forbs. Shrubs tend to dominate (alder, willow, dogwoods) on sites with more frequent draw-down of water or less frequent histories of fire. The transition of Shallow Peatland to a rich or poor fen is readily reversed by re-establishment of higher or more fluctuating water table or precipitation levels or impoundment, such as that from beaver activity. In reference condition, these sites provide important nesting and food sources for sand-hill cranes, pheasants, snipes, rails, songbirds, raptors, and small mammals.

Dominant plant species

- red maple (*Acer rubrum*), tree
- black ash (*Fraxinus nigra*), tree
- American elm (*Ulmus americana*), tree
- tamarack (*Larix laricina*), tree
- paper birch (*Betula papyrifera*), tree
- American red raspberry (*Rubus idaeus*), shrub
- meadow willow (*Salix petiolaris*), shrub
- pussy willow (*Salix discolor*), shrub
- redosier dogwood (*Cornus sericea*), shrub
- gray alder (*Alnus incana*), shrub
- Bebb willow (*Salix bebbiana*), shrub
- bog birch (*Betula pumila*), shrub
- white meadowsweet (*Spiraea alba*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- hairy sedge (*Carex lacustris*), grass
- Northwest Territory sedge (*Carex utriculata*), grass
- water sedge (*Carex aquatilis*), grass
- woolly sedge (*Carex pellita*), grass
- prairie sedge (*Carex prairea*), grass
- fowl mannagrass (*Glyceria striata*), grass
- prairie cordgrass (*Spartina pectinata*), grass

- common spikerush (*Eleocharis palustris*), grass

Community 1.1
Graminoid dominated

Frequent fires in the surrounding landscape may play an important role in on-site surface fires reducing peat accumulation as well as reducing the presence of trees and shrubs and increasing spring growth of sedges. Shrub cover <25%. Typical graminoids include bluejoint, hairy sedge (*Carex lacustris* Willd.), tussock sedge, Northwest Territory sedge (*C. utriculata* Boott), water sedge (*C. aquatilis* Wahlenb.), woolly sedge (*C. pellita* Muhl. ex Willd.), prairie sedge (*C. prairea* Dewey ex Alph. Wood), fowl mannagrass (*Glyceria striata* (Lam.) Hitchc.), prairie cordgrass (Spartina pectinate Bosc ex Link), and common spikerush (*Eleocharis palustris* (L.) Roem. & Schult.). Moss cover is usually <5% (brown mosses) but can become >75% (typically Sphagnum sp.). Seeps that are associated with calcareous fens or that occur on bases of slopes influenced by streams or lateral groundwater flow are typically dominated by aquatic sedge, prickly bog sedge (*Carex interior* L. H. Bailey), Sartwell's sedge (*C. sartwellii* Dewey), and hardstem bulrush (Scirpus acutus (Muhl. ex Bigelow) Á. Löve & D. Löve). Shrub cover is commonly <25%. Common forbs include northern bog aster (*Symphyotrichum boreale* (Torr. & A. Gray) Á. Löve & D. Löve), marsh marigold (*Caltha palustris* L.), and water hemlock (*Cicuta bulbifera* L.). In areas adjacent to wet forests, where shade-tolerant species can thrive, and where there is a stronger connection to groundwater seepage which prevents tree establishment, this site concept can exhibit more forbs (Impatiens sp.) and less cover of sedges and graminoids.

Community 1.2
Shrub dominated

Open wetland with abundant broad-leaved graminoids, shrub cover >25%. Shrub cover can include American red raspberry (*Rubus idaeus* L.), meadow willow (*Salix petiolaris* Sm.), pussy willow (*Salix discolor* Muhl.), red-osier dogwood (*Cornus sericea* L), gray alder (*Alnus incana* L.), white meadowsweet (*Spiraea alba* Du Roi), Bebb willow (*Salix bebbiana* Sarg.), and bog birch (*Betula pumila* L.). If there are trees in the surrounding environment, tree species can include red maple (*Acer rubrum* L.), black ash (*Fraxinus nigra* Marshall), American elm (Ulmus Americana L.), tamarack (*Larix laricina* (Du Roi) K. Koch), and paper birch (*Betula papyrifera* Marshall).

Community 1.3
Marsh

Water is ponded on the surface throughout the duration of the growing season, converting vegetation temporarily to more aquatic or emergent vegetation, such as duckweed, pondweeds, native broadleaf cattail (*Typha latifolia* L), and rushes.

Pathway 1.1A
Community 1.1 to 1.2

Draw down of water levels, decreased precipitation/short drought periods, or prolonged periods without surface fire (>5 years) will likely lead this state over a threshold leading to the 1.2 Shrub Dominated Plant Community Phase.

Pathway 1.1B
Community 1.1 to 1.3

Beaver dams contribute to the ponding and retention of water on-site will likely lead this state over a threshold leading to the 1.3 Marsh Plant Community Phase.

Pathway 1.2A
Community 1.2 to 1.1

Frequent (3 – 5 year) surface fires would have converted this plant community to the 1.1 Graminoid Dominated Plant Community Phase.

Pathway 1.2B
Community 1.2 to 1.3

Beaver dams contribute to the ponding and retention of water on-site will likely lead this state over a threshold leading to the 1.3 Marsh Plant Community Phase.

Pathway 1.3A
Community 1.3 to 1.1

Removal of beaver, and/or the beaver dam, cessation of surface ponding, and restoration of fluctuations and draw-down of the water table periodically throughout the growing season would have converted this plant community to the 1.1 Graminoid Dominated Plant Community Phase.

State 2
Diverted State

Many areas that are drained are used for growing crops, hay, and pasture, or are used for grazing. Historically, a lot of these sites may have been ditched, or are adjacent to channels that have been channelized. Salinity can increase in soils that are drained or dried out for prolonged periods of time.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- green bulrush (*Scirpus atrovirens*), grass

Community 2.1
Dried out subsidence

When water levels drop low enough, during periods of drought, or when water is prevented from entering or staying on the site due to diversion (such as roads or tile drainage), trees such as paper birch or aspen can become established. Shrub cover and presence of forbs will increase. Peat can become oxidized and subside. This phase can also become more susceptible to catastrophic burns, which can also reduce peat or prevent peat accumulation. Green bulrush (*Scirpus atrovirens* Willd.) often colonizes or increases in abundance when the peat is disturbed.

Community 2.2
Actively Grazed

When the hydrology of the site is altered, and the site is also managed for active grazing on a yearly basis, mana grasses and northern reed grass would be eaten first and would tend to decrease over time, increasing the abundance of sedges. Heavy grazing can increase compaction in the soil, and may increase or accentuate the presence of hummocks, vegetation tussocks, ridges, and rills.

Community 2.3
Hay Production

When the site is drained or ditched, hay production can be accomplished.

State 3
Impounded/Invaded State

This state describes three various ways in which the reference state changes to an altered state by either water impounding or invasion by reed canary grass or common reed or an increase in sphagnum species.

Dominant plant species

- narrowleaf cattail (*Typha angustifolia*), grass
- hybrid cattail (*Typha ×glauca*), grass

- reed canarygrass (*Phalaris arundinacea*), grass
- sphagnum (*Sphagnum*), other herbaceous

Community 3.1
Ponded

Hydrologic changes which result in a raising of the water table, or a prolongment of the inundation period, can result in conversion of the site concept to a marsh community, usually resulting in invasion by non-native cattail or hybrid cattail species (*Typha angustifolia* L., T. glauca L.). Occasionally these impounded phases are converted for wild rice production.

Community 3.2
Sphagnum-fine-leaved sedge

This Shallow Peatland site concept can be invaded by peat-producing bryophytes (sphagnum), causing a decline in nutrient levels and replacement of dominant broad-leaved sedges with fine-leaved sedges, leading to conversion to a true “peatland” plant community. Conversion to a rich fen can also occur after stabilization of water flow through the site, or when the site receives sedimentary deposition, contributing to peat accumulation.

Community 3.3
Reed canary grass/common reedgrass

Site hydrology is usually altered, either increasing flow to the site, or altering periodic drawdowns, etc. Invasion from reed canary grass (*Phalaris arundinacea* L.) or common reed grass (*Phragmites australis* (Cav.) Trin. ex Steud.) is the most common outcome, which displace native species and will produce monocultures within a short period of time if steps are not taken to eradicate their presence on-site. Proximity to invaded sites, heavy grazing, and/or an excess of nitrogen and phosphorus on-site from silt-laden runoff from agricultural land can also lead to invasion.

State 4
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.

Dominant plant species

- corn (*Zea mays*), grass
- common wheat (*Triticum aestivum*), grass
- common oat (*Avena sativa*), grass
- soybean (*Glycine max*), other herbaceous

Community 4.1
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

Tile drainage, ditching, diversion of surface flow, extreme prolonged drought will cause a shift over a threshold leading to the Diverted State (State 2).

Transition T1B
State 1 to 3

Artificial impoundment, roads, or any alteration in hydrology restricting water leaving the site or contributing excess water drainage to the site causing ponding and retention of water at the surface for prolonged periods of time throughout the growing season will cause a shift over a threshold leading to the Impounded/Invaded State (State 2).

Transition T1C
State 1 to 4

Tile drainage, tillage, seeding, and herbicides will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

Restoration pathway R2
State 2 to 1

Reversal of drainage and maintenance of normal hydrology and water level fluctuations, seeding, and invasive species removal may lead this Diverted State (State 2) over a threshold to the Reference State (State 1).

Transition T2A
State 2 to 3

Removal of drainage, impoundment of water on-site, maintenance of water on-site, and/or establishment of invasive species will cause a shift over a threshold leading to the Impounded/Invaded State (State 3).

Transition T2B
State 2 to 4

Tile drainage, tillage, seeding, and herbicides will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

Transition T3
State 3 to 4

Tile drainage, tillage, seeding, and herbicides will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

Additional community tables

Inventory data references

There is no NRCS clipping data and other inventory currently available for this site. Information presented here has been derived using field observations from range-trained personnel. Those involved in developing this site include: Stacey Clark, Ecological Site Inventory Specialist, NRCS.

Other references

Brinson, M. M. 1993. A Hydrogeomorphic Classification for Wetlands. Wetlands Research Program Technical Report WRP-DE-4, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Washington, DC: U.S. Fish and Wildlife Service, FWS/OBS-79/31.

Eggers, Steve D. and Donal M. Reed. 1997. Wetland Plants and Plant Communities of Minnesota and Wisconsin. U.S. Army Corps of Engineers, St. Paul District.

Minnesota Department of Natural Resources (2005). Field Guide to the Native Plant Communities of Minnesota: The Prairie Parkland and Tallgrass Aspen Parklands Provinces. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MNDNR St. Paul, MN.

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

USDA, NRCS. 2018. The PLANTS Database (http://plants.usda.gov, 27 March 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

Contributors

Lance Howe
Steve Winter

Approval

Suzanne Mayne-Kinney, 8/20/2024

Acknowledgments

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

Additional Information Acknowledgment: Jason Hermann (Jason.Hermann@usda.gov), Area Rangeland Management Specialist, USDA-NRCS, Redfield, SD; Stacey Clark (Stacey.Clark@usda.gov), Ecological Site Inventory Specialist, USDA-NRCS, St. Paul, MN; Tom Neuenfeldt, Soil Survey Office Leader, USDA-NRCS, Fergus Falls, MN (retired).

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)	
Contact for lead author	
Date	05/11/2025
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

---

5. **Number of gullies and erosion associated with gullies:**

---

6. **Extent of wind scoured, blowouts and/or depositional areas:**

---

7. **Amount of litter movement (describe size and distance expected to travel):**

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

---

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:

    Sub-dominant:

    Other:

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

---

14. **Average percent litter cover (%) and depth (in):**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**