Ecological site R102DY037SD
Deep Marsh

Last updated: 8/14/2024
Accessed: 11/21/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 102D–Prairie Coteau

This area makes up about 7,867 square miles (20,375 square kilometers), consisting mostly of nearly level to undulating till plains with potholes and moraines. Elevation ranges from 1,150 to 2,130 feet (350 to 650 meters). The average annual precipitation is 22 to 29 inches (559 to 734 millimeters). The average annual temperature is 42 to 45 degrees F (6 to 7 degrees C). The dominant soil order in this MLRA is Mollisols. The soils in this area dominantly have a frigid temperature regime, and an aquic or udic moisture regime. They are generally very deep and loamy. Soils range from well drained to very poorly drained. Parent materials are dominantly fine-loamy till to clayey material, with smaller amounts of outwash, glaciofluvial deposits, eolian deposits, alluvium, and, to a lesser extent, loess and organic materials.

Classification relationships

Fenneman (1916) Physiographic Regions
Division - Interior Plains
East:
Province - Central Lowland
Section - Western Lake / Dissected Till Plains (12b/12e)

USFS (2007) Ecoregions
Domain - Humid Temperate
Division - Prairie
Province - Prairie Parkland (Temperate)
Section - North-Central Glaciated Plains (251B)

EPA Ecoregions (Omernik 1997)
I - Great Plains (9)
II - Temperate Prairies (9.2)
III - Aspen Parkland/Northern Glaciated Plains (9.2.1)

Ecological site concept

The Deep Marsh Ecological Site typically represents the central portion of a wetland basin or depression on a glaciated prairie landscape with standing water up to 5 feet deep, and at least some tall, emergent vegetation like cattails, bulrushes and reeds. In most years there is at least some standing water but in drought years the basin surface may dry out yet retain groundwater within 1 foot of the surface.

Associated sites

R102DY001SD	**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.
R102DY010SD	**Loamy** These sites occur on upland areas. The soils are well drained and have less than 40 percent clay in the surface and subsoil.
R102DY002SD	**Linear Meadow** These sites occur in drainageways or along the edges of closed depressions. 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.
R102DY006SD	**Limy Subirrigated** These sites occur along the edges of 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. Soils will effervesce with acid at or near the surface.

Similar sites

R102DY001SD	**Shallow Marsh** The Shallow Marsh site is in a similar landscape position, but the site ponds water until early summer in most years. The Shallow Marsh site will have none to very little cattails and more prairie cordgrass than a Deep Marsh site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Typha latifolia* (2) *Schoenoplectus*

Physiographic features

This site occurs on nearly level to concave depressions on uplands and till plains.

Table 2. Representative physiographic features

Landforms	(1) Upland > Depression
Runoff class	Negligible to very low
Flooding duration	Long (7 to 30 days) to very long (more than 30 days)
Flooding frequency	None to frequent
Ponding duration	Very long (more than 30 days)
Ponding frequency	Frequent
Elevation	305–610 m
Slope	0–1%
Water table depth	0–13 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 22 to 28 inches. Half or more of the precipitation falls during the growing season. Rainfall typically occurs during high-intensity, convective thunderstorms in summer. In the western part of the MLRA, rainfall is less abundant and not always adequate for full maturation of crops. Precipitation in winter is typically snow. The average annual temperature is 42 to 45 degrees F. The freeze-free period averages 143 days and ranges from 131 to 151 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	114-128 days
Freeze-free period (characteristic range)	139-149 days
Precipitation total (characteristic range)	610-686 mm
Frost-free period (actual range)	110-131 days
Freeze-free period (actual range)	131-151 days
Precipitation total (actual range)	559-711 mm
Frost-free period (average)	122 days
Freeze-free period (average)	143 days
Precipitation total (average)	635 mm

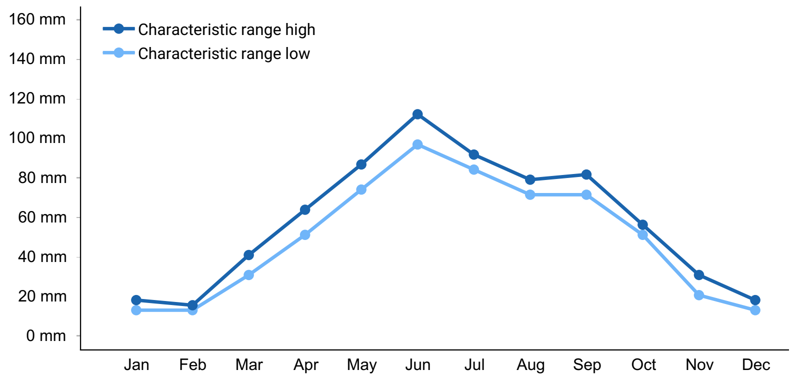


Figure 1. Monthly precipitation range

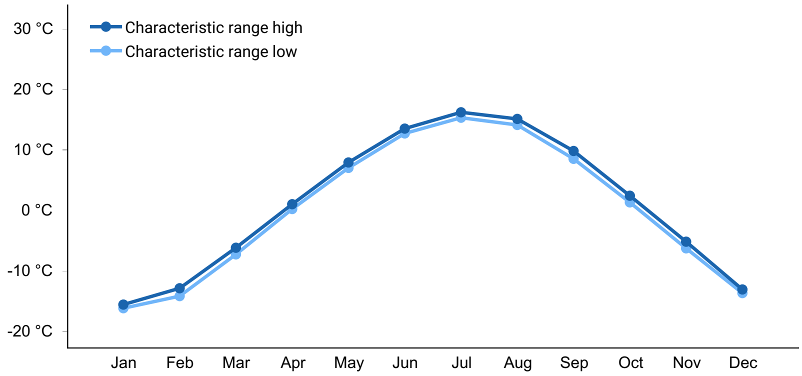


Figure 2. Monthly minimum temperature range

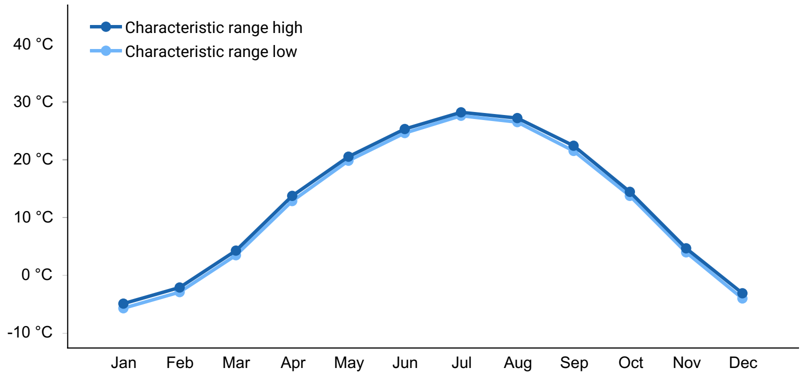


Figure 3. Monthly maximum temperature range

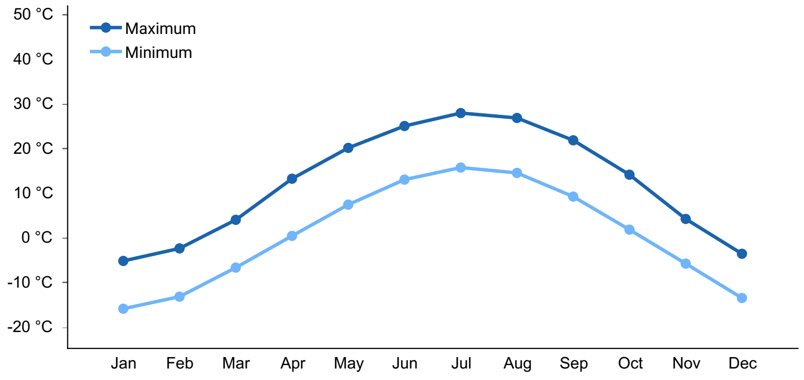


Figure 4. Monthly average minimum and maximum temperature

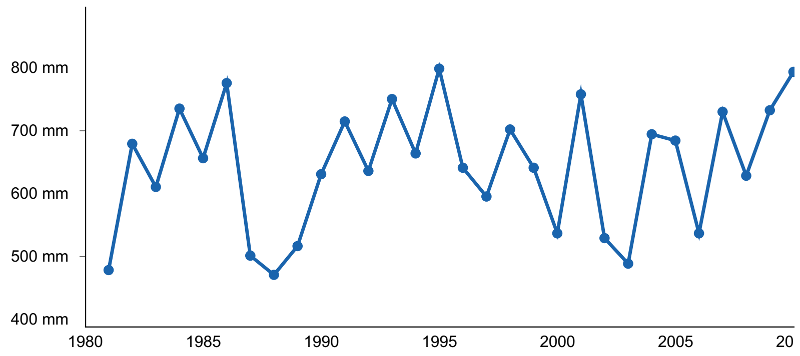


Figure 5. Annual precipitation pattern

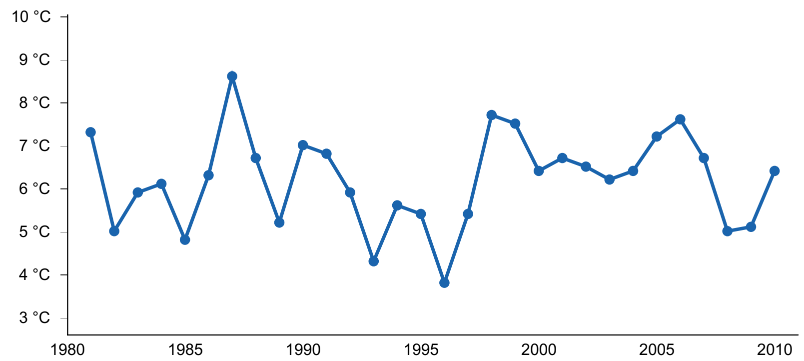


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ROY LAKE [USC00397326], Lake City, SD
- (2) WEBSTER [USC00399004], Webster, SD
- (3) WAUBAY NWR [USC00398980], Waubay, SD
- (4) WATERTOWN RGNL AP [USW00014946], Watertown, SD
- (5) WATERTOWN 1W [USC00398930], Watertown, SD
- (6) CASTLEWOOD [USC00391519], Castlewood, SD
- (7) ARLINGTON 1 W [USC00390281], Arlington, SD
- (8) CLEAR LAKE [USC00391777], Clear Lake, SD
- (9) ASTORIA 4S [USC00390422], White, SD
- (10) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (11) TYLER [USC00218429], Tyler, MN

Influencing water features

This ecological site is heavily influenced by hydrology. Water accumulates in this site from landscape position run off from above and provides the foundational soil and plant relationships found on this site.

Wetland description

This ecological site may be classified as a Palustrine Emergent Semi-permanently flooded to intermittently exposed wetland according to Cowardin et al, 1979.

Soil features

Soils are formed in alluvium in upland depressions. These soils are very poorly drained with slow permeability. Surface textures are typically silty clay loam.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silty clay loam
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)	15.75–18.03 cm
Soil reaction (1:1 water) (0-25.4cm)	6.6–8.4
Subsurface fragment volume <=3" (0-152.4cm)	0–1%
Subsurface fragment volume >3" (0-152.4cm)	0%

Ecological dynamics

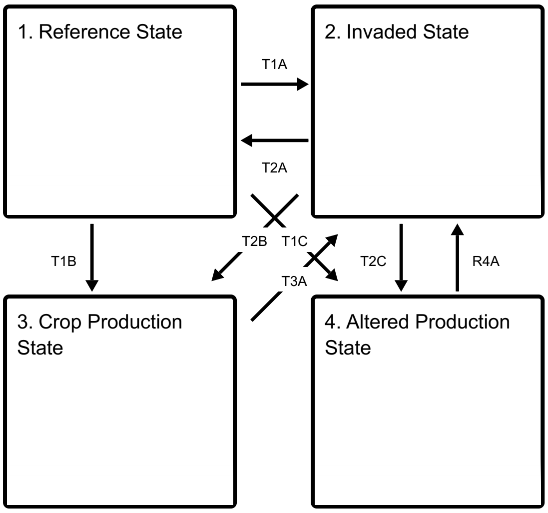
The Deep Marsh Ecological Site typically represents the central portion of a wetland basin or depression on a glaciated prairie landscape with standing water up to 5 feet deep, and at least some tall, emergent vegetation like cattails, bulrushes and reeds. In most years there is at least some standing water but in drought years the basin surface may dry out yet retain groundwater within 1 foot of the surface. Within other classification systems, this ecological site generally corresponds with Stewart and Kantrud's (1971) "Type IV wetland basin," also called a "semipermanent pond or lake"; and with the "Palustrine Emergent Semipermanently Flooded to Intermittently Exposed Wetland" of Cowardin, et al. (1979).

Most uncultivated wetland basins in this MLRA have concentric bands of distinctly different vegetation corresponding with changes in soil and water depth. For example, while the center of the basin supports deep marsh vegetation, it is often surrounded by a zone of shallow marsh vegetation, which is in turn surrounded by a zone of wet meadow vegetation, eventually grading outward into upland soils and vegetation. Degree of slope, type of soils, and nature of the local hydrology tend to dictate the number and width of these concentric zones of vegetation.

Given the climatic extremes of the Great Plains with precipitation that ranges from drought to deluge, Deep Marsh wetland basins undergo cycles of flooding and drawdown with corresponding changes in vegetation.

State and transition model

Ecosystem states



T1A - Species invasion, flooding, and drought

T1B - Drought and tillage

T1C - Drainage

T2A - Deep water or drought, prescribed grazing, prescribed burning, time

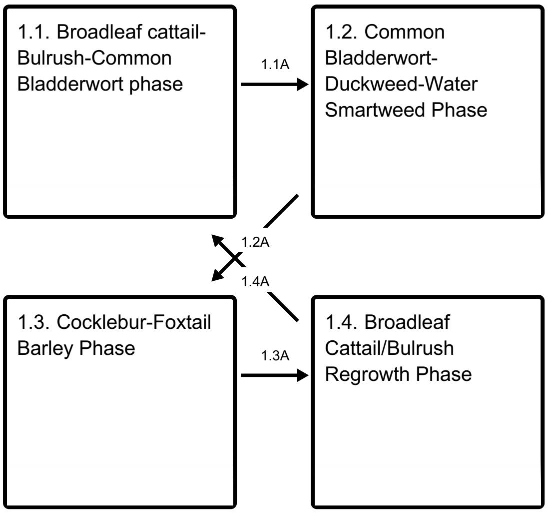
T2B - Time and drought

T2C - Drought and drainage

T3A - Non-use, flooding, invasive encroachment/seeding

R4A - Renovation/restoration

State 1 submodel, plant communities



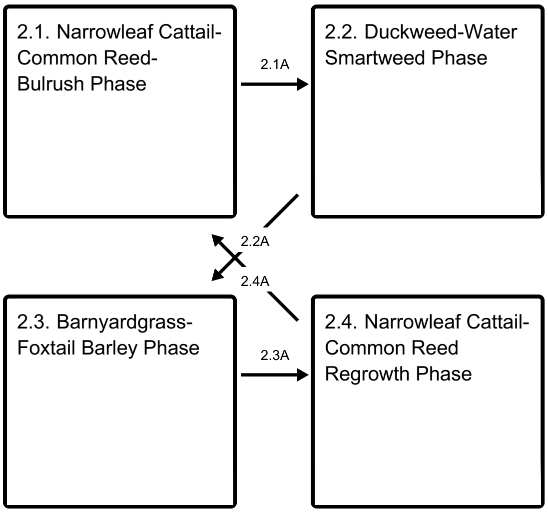
1.1A - Excessive flooding, herbivory activity

1.2A - Drought

1.3A - Normal precipitation and time

1.4A - Return to normal precipitation patterns & time

State 2 submodel, plant communities



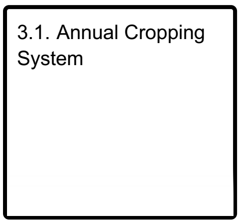
2.1A - Deep water, herbivory, prescribed grazing, and/or flooding

2.2A - Drought

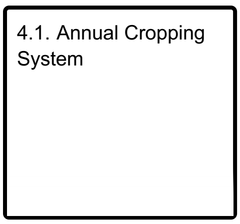
2.3A - Normal precipitation and time

2.4A - Time

State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

This state represents what is believed to show the natural range of variability that dominates the dynamics of the ecological state prior to European settlement. This site, in the Reference State (State 1), is dominated by cattails and grass-like vegetation. Drought and flooding are major drivers between plant community phases, while herbivory by native ungulates and other wildlife and fire played a more minor role. Invasion of nonnative or hybrid cattails during the drawdown/bare soil phase will result in a transition to the Invaded State (State 2).

Dominant plant species

- sedge (*Carex*), grass
- broadleaf cattail (*Typha latifolia*), other herbaceous
- hardstem bulrush (*Schoenoplectus acutus*), other herbaceous
- common bladderwort (*Utricularia macrorhiza*), other herbaceous
- water smartweed (*Polygonum amphibium var. stipulaceum*), other herbaceous

Community 1.1
Broadleaf cattail-Bulrush-Common Bladderwort phase

Historically, this phase of deep marsh vegetation consisted of scattered patches of normal emergent vegetation/ This includes broadleaf cattail and/or stands of bulrushes like hardstem, slender, softstem or prairie bulrush, interspersed with patches of open water supporting submerged or floating leaved aquatic plants like white water-crowfoot, common bladderwort, sago pondweed, water smartweed, and various duckweeds.

Community 1.2
Common Bladderwort-Duckweed-Water Smartweed Phase

The transition to an open water phase is due to increased precipitation during wet years. Flooding will drown out cattails and bulrushes in certain areas, but some will still be present on the periphery of the wetland basin during this phase. Herbivory by muskrats or other native ungulates may also help speed the transition to this state. The central portion of the basin will have open water with various submerged and floating-leaved aquatic plants, like those mentioned above.

Community 1.3
Cocklebur-Foxtail Barley Phase

The transition from an open water phase or normal emergent phase due to drought will result in bareground. Weedy annuals and short-lived perennials will invade the basin. Species such as cockleburs, swamp ragwort, rough barnyardgrass, and foxtail barley will replace the cattails and bulrushes.

Community 1.4
Broadleaf Cattail/Bulrush Regrowth Phase

The return of normal precipitation and runoff will inundate the basin killing the annuals and other plants. Seeds of emergent wetland plants like cattails and bulrushes will be able to germinate and grow on mudflats or areas of very shallow standing water. As the water levels return to normal, cattails and bulrushes will colonize the site through rhizomatous growth and submerged and floating aquatic plants will be supported once again, leading to a transition back to the 1.1 Normal Emergent Community Phase with in the Reference State (State 1).

Pathway 1.1A
Community 1.1 to 1.2

Excessive flooding results in an open water phase with mostly submerged species, and cattails/bulrushes around the periphery of the open water. Herbivory by muskrats or other native species may also decrease the amounts of cattails and lead to open water phases as well will shift this community to the 1.2 Open Water Phase within the Reference State (State 1).

Pathway 1.2A
Community 1.2 to 1.3

Drought leads to a drawdown phase, where open water changes to bareground. Annuals and short-lived perennials colonize the bareground areas will shift this community to the 1.3 Drawdown/Bare Soil Phase within the Reference State (State 1).

Pathway 1.3A
Community 1.3 to 1.4

Normal precipitation and time allows cattails to recolonize areas and will shift this community to the 1.4 Natural Drawdown/Emergent Phase within the Reference State (State 1).

Pathway 1.4A
Community 1.4 to 1.1

Normal precipitation and time allows cattails and other vegetation to return to a normal emergent phase with areas of open water and will shift this community back to the 1.1 Normal Emergent Phase within the Reference State (State 1).

State 2
Invaded State

This state is characterized by a shift from broadleaf cattail dominance to narrowleaf (*Typha angustifolia*) and hybrid (Typha x glauca) cattail dominance – both more invasive cattail species. The transition leads to a more cattail dominated state, decreasing the amount of bulrush species present in this state, and also allowing for Phragmites to invade as well. This state incorporates the same drought and deluge cycles as the reference state, but this state is dominated by invasive/nonnative vegetation.

Dominant plant species

- sedge (*Carex*), grass
- broadleaf cattail (*Typha latifolia*), other herbaceous
- reed (*Phragmites*), other herbaceous
- hardstem bulrush (*Schoenoplectus acutus*), other herbaceous
- cocklebur (*Xanthium*), other herbaceous

Community 2.1
Narrowleaf Cattail-Common Reed-Bulrush Phase

This phase is dominated by narrowleaf/hybrid cattails with minor amounts of bulrush. Phragmites may also invade during this state. This phase has less open water and more continuous stands of cattails.

Community 2.2
Duckweed-Water Smartweed Phase

This phase is similar to Reference State (State 1) condition except water must be deeper or cattails must be grazed cut or crush down and then inundated in order to reach a deep-water phase.

Community 2.3
Barnyardgrass-Foxtail Barley Phase

The transition from an open water phase to the drawdown/bare ground phase occurs due to drought. The bare ground will be invaded by exotic weedy annuals and short-live perennials such as barnyardgrass, foxtail barley, and chenopods.

Community 2.4
Narrowleaf Cattail-Common Reed Regrowth Phase

Once normal precipitation patterns have returned, the native wetland seedbank will try to recolonize the site with bulrushes and cattails, but windblown seeds from narrowleaf and hybrid cattails and Phragmites will most likely compete with the natives for space.

Pathway 2.1A
Community 2.1 to 2.2

Deep water, herbivory, prescribed grazing, and/or flooding lead to an open water phase. Deeper water than than the Reference State (State 1) is needed to drown out narrowleaf/hybrid cattails. An alternative to deeper water is haying/chopping, fire, and/or crushing cattails prior to flooding to drown out those cattail species will shift this community to the 2.2 Open Water Phase within the Invaded State (State 2).

Pathway 2.2A
Community 2.2 to 2.3

Drought leads to bareground, and exotic annual weeds compete with native annuals to colonize the bareground will shift this community to the 2.3 Drawdown/Bare Soil Phase within the Invaded State (State 2).

Pathway 2.3A
Community 2.3 to 2.4

Normal precipitation and time is needed to recolonize the basin with emergent vegetation. Native seed bank species compete with wind-blown seeds of narrowleaf cattail and Phragmites to colonize the area and will shift this community to the 2.4 Natural Drawdown/Emergent Phase within the Invaded State (State 2).

Pathway 2.4A
Community 2.4 to 2.1

Time allows cattails and other vegetation to return to a normal emergent phase with areas of open water and will shift this community back to the 2.1 Emergent Phase within the Invaded State (State 2).

State 3
Crop Production State

This state is characterized by the production of annual crops. This community phase only occurs during extreme drought years when basin is dry enough to be cropped.

Dominant plant species

- corn (*Zea*), grass
- wheat (*Triticum*), grass
- soybean (*Glycine*), other herbaceous

Community 3.1
Annual Cropping System

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

State 4
Altered Production State

This state is characterized by the production of annual crops due to drainage by mechanical means. This state is highly altered and will never return to the Reference State (State 1).

Dominant plant species

- corn (*Zea*), grass
- wheat (*Triticum*), grass
- soybean (*Glycine*), other herbaceous

Community 4.1
Annual Cropping System

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

Transition T1A
State 1 to 2

Invasion of nonnative cattails and phragmites along with flooding and drought may lead to the Invaded State (State 2).

Transition T1B
State 1 to 3

Times of drought will dry out the site, which may allow tillage and annual cropping to commence and may lead to the Crop Production State (State 3).

Transition T1C
State 1 to 4

Drainage of basin may allow for the basin to be cropped and may lead to the Altered Production State (State 4). Restoration of this state may occur, but natural pathways have been altered and site will never return to Reference State (State 1).

Transition T2A
State 2 to 1

Deep water or drought may help the invaded phase return to a more native state within the Reference State (State 1). Narrowleaf/hybrid cattails cannot withstand deep water phases, or drought. A combination of many management types such as prescribe grazing, prescribe burning, and well-timed climate occurrences may allow the site to return to a non-native state (but not likely).

Transition T2B
State 2 to 3

Time and drought will dry out the site, which may allow tillage and annual cropping to commence and may lead to the Crop Production State (State 3).

Transition T2C
State 2 to 4

Drainage and drought of basin may allow for the basin to be cropped and may lead to the Altered Production State (State 4). Restoration of this state may occur, but natural pathways have been altered and site will never return to Reference State (State 1).

Transition T3A
State 3 to 2

Non-use and flooding will allow invasive water-loving plants to revegetate the site over time. Seeding with native vegetation may also speed this process.

Restoration pathway R4A
State 4 to 2

Restoration/renovation of the site by plugging ditches will return this site back to a vegetated state. The site will have been altered too much to allow a restoration back to the Reference State (State 1).

Additional community tables

Inventory data references

MLRA 102D was created in 2022 with Agricultural Handbook 296 updated. This area was MLRA 102A prior to this time. Information was copied from MLRA 102A ESDs to create the MLRA 102D ESDs.

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: Stan Boltz, Range Management Specialist, NRCS; and Dave Ode, Botanist/Plant Ecologist (retired) State of South Dakota.

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United States Department of Agriculture, Natural Resources Conservation Service. 2022. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture, Agriculture Handbook 296.

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	11/21/2024
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):**

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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):**

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

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

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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:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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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:**

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17. **Perennial plant reproductive capability:**