United States Department of Agriculture
Natural Resources Conservation Service

Ecological Site Description

Site Stage: Provisional

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

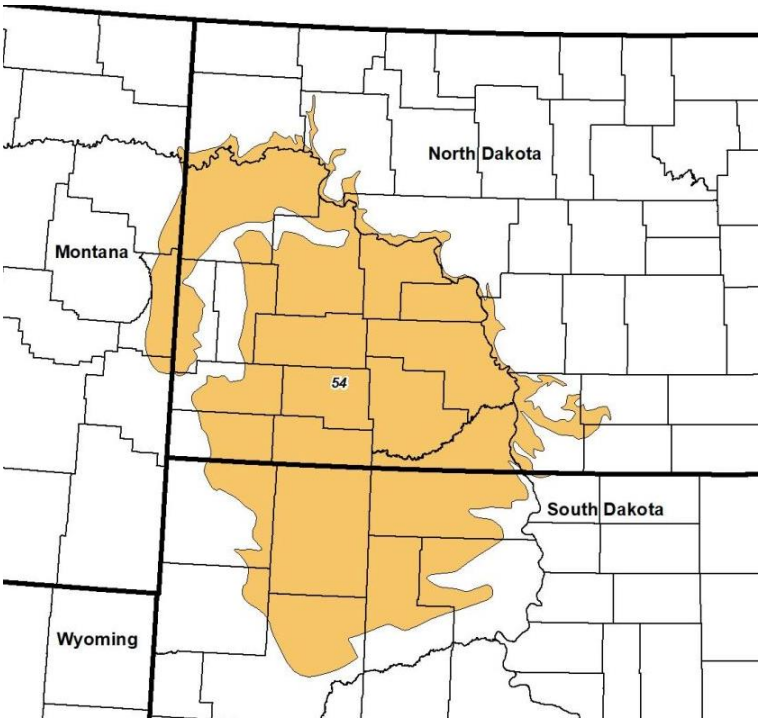
Site Name: Shallow Marsh

Site Type: Rangeland

Site ID: R054XY036ND

Major Land Resource Area: 54-Rolling Soft Shale Plain

For more information on MLRAs, refer to the following web site: https://www.nrcs.usda.gov/resources/data-and-reports/major-land-resource-area-mlra



Location of MLRA 54 - Rolling Soft Shale Plain in North Dakota, South Dakota, and Montana

MLRA 54 covers 29,280 square miles and encompasses approximately 18.7 million acres. MLRA 54 spans three states with 64 percent of it in North Dakota, 33 percent in South Dakota, and 3 percent in Montana. Most of MLRA 54 is underlain by soft, calcareous shale, siltstone, and sandstone of the Tertiary Fort Union Group and the Cretaceous Fox Hills and Hell Creek Formations. Most of the soils in MLRA 54 developed from residuum weathered in place including colluvial and alluvial deposits from residuum. Along the eastern and northern edges of the MLRA where MLRA 54 transitions into the glaciated Missouri plateau, remnants of glacial till parent materials remain on the high areas of the landscape. The MLRA 54 landscape is characterized by moderately dissected rolling plains with areas of local badlands, hills, and isolated buttes. Elevation is 1,650 feet (505 meters) on the eastern side of the MLRA with a gradual rise to 3,600 feet (1,100 meters) on the western side. The Missouri River runs along the north and east side of MLRA 54. Most of the Standing Rock Indian Reservation, the northwest third of the Cheyenne River Indian Reservation, and the Grand River National Grasslands are in the southern part of the MLRA.

Ecological Site Concept

The Shallow Marsh ecological site is commonly located in deep depressions. The soil is very deep. Typically, the dark-colored surface soil is more than 7 inches thick and generally more than 20 inches thick. A few soils have organic surface soils >8 inches thick. The site is very poorly drained; under normal climatic conditions, it is ponded for very long periods during the growing season. Typically, the depth of ponding is less than 3 feet in the spring and less than 1.5 feet in late summer. Typically, these soils are non-saline, but very slight or slight salinity (E.C. <8 dS/m) is allowable on this site. Effervescence is typically none to a depth of more than 2 feet in mineral soils. In organic soils, effervescence ranges from none to strong. Hydrology (surface and sub-surface) is the primary factor used in identifying this site. All textures are included in the site. Slope is less than 1 percent. On the landscape, this site is below the Closed Depression, Loamy Overflow, and Wet Meadow ecological sites. The Saline Lowland site is slightly higher on rims of depressions and adjacent flats; it has moderate to very strong soil salinity.

Physiographic Features

This site typically occurs in deep depressions on uplands. It also occurs in upland drainageways and isolated, relict oxbows. Parent materials are local alluvium. Slope is less than 1 percent.

Landform: depression, drainageway, relict oxbow

	Minimum	Maximum
Elevation (feet):	1650	3600
Slope (percent):	0	1
Water Table Depth (inches):	0	18
Flooding:		
Frequency:	None	None
Ponding:		
Depth (inches):	0	36
Frequency:	Frequent	Frequent
Duration:	Long	Very long
Runoff Class:	None	Negligible
Aspect:	No influence on this site	

Climatic Features

MLRA 54 is considered to have a continental climate with cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are common and characteristic of the MLRA. The continental climate is the result of this MLRA's location in the geographic center of North America. There are

few natural barriers on the northern Great Plains, so air masses move unobstructed across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 14 to 18 inches per year. The normal average annual temperature is about 42° F. January is the coldest month with average temperatures ranging from about 13° F (Beach, ND) to about 16° F (Bison, SD). July is the warmest month with temperatures averaging from about 69° F (Beach, ND) to about 72° F (Timber Lake, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 57° F. This large temperature range attests to the continental nature of MLRA 54's climate. Wind speeds average about 11 miles per hour, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime wind speeds are generally stronger than nighttime wind speeds, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of native cool-season plants begins in late March and continues through early to mid-July. Native warm-season plants begin growth in mid-May and continue to the end of August. Greening up of cool-season plants can occur again in September and October when adequate soil moisture is present.

Climate Station(s) 1981 - 2010

Sation	Name	Location	Elevation	Lat	Long
USC00323207	FT YATES 4 SW	Fort Yates	1674.9	46.05	-100.6667
USC00392429	DUPREE	Dupree	2375.0	45.0481	-101.5992
USC00324178	HETTINGER	Hettinger	2680.1	45.9925	-102.6442
USC00329233	WATFORD CITY	Watford City	2169.9	47.8039	-103.2892
USC00325479	MANDAN EXP STN	Mandan	1750.0	46.8128	-100.9097
USC00395048	LUDLOW 3 SSE	Ludlow	2990.2	45.785	-103.3719
USC00324102	HEBRON	Hebron	2167.0	46.9028	-102.0478

Climate Normals

	Representative		Actual		
	High	Low	High	Low	Average
Mean annual precipitation (in):	18	15	18	15	16
Frost free period (days):	111	95	114	91	101
Freeze free period (days):	127	118	129	116	123

Normal Monthly Precipitation (in)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.4	0.4	1.0	1.7	2.8	3.3	2.7	1.7	1.5	1.4	0.7	0.4
Representative low:	0.3	0.3	0.6	1.0	2.5	3.0	2.2	1.4	1.1	1.2	0.5	0.3
Actual high:	0.5	0.5	1.1	1.9	3.0	3.4	3.1	2.1	1.5	1.5	0.7	0.5
Actual low:	0.2	0.3	0.6	0.9	2.3	2.9	2.1	1.3	1.0	1.1	0.4	0.2

Normal Monthly Minimum Temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	8.3	12.0	20.5	31.0	42.7	52.3	57.8	55.5	44.9	32.8	20.1	9.3
Representative low:	2.1	7.3	17.1	28.7	40.2	49.7	55.1	52.8	41.8	30.0	18.1	6.2
Actual high:	9.2	12.8	21.3	31.9	43.3	52.7	58.7	56.8	46.3	34.0	21.0	10.3
Actual low:	2.0	6.7	17.0	28.4	39.6	49.7	55.0	52.4	41.6	29.5	17.4	5.8
Average:	4.7	9.1	18.8	29.9	41.3	50.9	56.6	54.4	43.5	31.5	19.0	7.5

Normal Monthly Maximum Temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	29.1	33.2	43.2	58.3	69.1	78.5	86.6	85.6	73.9	59.8	42.2	30.1
Representative low:	23.5	28.9	39.6	55.1	66.4	75.2	83.2	82.6	71.2	56.6	39.3	26.4
Actual high:	29.8	33.5	43.7	59.1	70.1	79.8	87.3	86.7	75.5	60.6	42.4	30.6
Actual low:	23.1	28.2	39.3	55.0	65.8	74.9	82.8	82.1	70.5	56.4	38.8	25.9
Average:	26.3	30.9	41.4	56.6	67.6	76.6	84.6	84.1	72.5	57.9	40.6	28.3

30 Year Annual Rainfall (inches): D-Dry; N-Normal; W-W

1981 N	1982 W	1983 D	1984 N	1985 D	1986 N	1987 D	1988 D	1989 D	1990 D	1991 N	1992 N	1993 W	1994 N	1995 W
15.1	26.3	12.7	16.1	14	18.9	14.7	10.6	14.8	11.2	15.4	15.3	19.9	17.4	21.5

1996 W	1997 D	1998 W	1999 N	2000 N	2001 N	2002 D	2003 D	2004 D	2005 B	2006 N	2007 N	2008 N	2009 N	2010 W
19.5	14.2	21.5	16.9	17.9	15.9	10.2	14.4	13.8	17.3	11.5	17.1	18.4	16.8	22.5

Influencing Water Features

This site is very poorly drained. Under average climatic conditions, it is inundated for very long periods (>30 days) during the growing season. Some soils in this site have endosaturation (the soil is saturated with water in all layers) and others have episaturation (perched water table above a subsoil layer with low or moderately low saturated hydraulic conductivity). Water tables in endosaturated soils typically range from 1.5 feet above to 6 inches below the surface during most of the growing season. The depth of ponding on episaturated soils, typically, is less than 3 feet in the spring and less than 1.5 feet in late summer. Surface water may not be evident in late summer; but saturation is generally within a depth of 18 inches during this time.

Water on the site is typically received from upland runoff; however, where organic soils occur, subsurface water flow sustains near-surface saturated conditions throughout the growing season. Surface infiltration ranges from very slow to very rapid. Permeability ranges from very slow to moderate. These typically are flowthrough wetlands but can also be recharge wetlands. See **Site Development and Testing plan** for discussion of discharge wetlands.

Wetlands receive water from different sources including ground water movement. Recharge wetlands have groundwater flow predominantly away from the wetland moving toward or into a flowthrough or discharge wetland basin. Flowthrough wetlands have groundwater flowing away from the wetland basin but is balanced with water flowing into the basin.

Water loss is primarily through evapotranspiration and lateral movement into (and evaporation from) adjacent soils. During periods of drought or extreme wetness, water table fluctuations will also have an impact on depth

of ponding. During periods of drawdown (e.g., prolonged drought), soil and water chemistry may significantly impact the soil/water/vegetation dynamics of the site (see **Site Development and Testing Plan**).

Soils in these depressions are considered seasonal wetlands; however, during wetter than average climate cycles, these soils may have continuous, deep ponding throughout the growing season (or through multiple growing seasons).

Representative Soil Features

Soils associated with Shallow Marsh ES are primarily in the Mollisol order; however, a few Entisols are also included. The Mollisols are classified further as Vertic Argiaquolls or Vertic Epiaquolls. The Entisols are classified further as Vertic Fluvaquents. These soils were developed under wetland vegetation associated with very long periods of ponding. They formed in local alluvium from residuum or till. A few inches of organic materials are common on the surface of mineral soils that have never been cultivated.

The common feature of soils in this site is frequent seasonal inundation (typically extends into mid-summer or longer). The soils are very deep and very poorly drained; they occur in deep depressions that are ponded through most of the growing season. A few included soils occur in isolated, relict oxbows which are no longer significantly impacted by flooding. Soils associated with floodplains (occasional to very frequently flooded) are excluded from the Shallow Marsh ecological site (see Riparian Complex ecological sites). Surface textures, typically, are silty clay, clay, silty clay loam, or silt loam. However, since hydrology (surface and sub-surface) is the primary factor used in identifying this site, all textures are allowable in the site. Therefore, soil physical properties associated with texture may vary widely. Typically, the dark-colored surface soil is more than 7 inches thick and generally more than 20 inches thick; however, in isolated, relict oxbows, the surface layer is less than 3 inches thick. A few inches of organic materials are common on the surface of mineral soils that have never been cultivated.

Soil salinity is typically none to very slight (E.C. <4 dS/m) but slight (E.C. 4 to 8 dS/m) is allowable. Sodicity is typically none or very low (SAR <2); but SAR may be as high as 5 within a depth of 40 inches. Soil reaction typically is slightly acid to moderately alkaline (pH 6.1 to 8.4). The calcium carbonate content ranges from 0 to 35 percent.

Sub-surface soil layers are non-restrictive to root penetration, but in some soils water movement downward is slowed. These soils are not susceptible to water erosion. Ponded water conditions strongly influence the soil/water/plant relationship.

The major soil series correlated to the Shallow Marsh site are Dimmick, Grano, and Parnell. Also included are Lallie soils which occur in isolated, relict oxbows which are now more influenced by ponding than flooding.

Access Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx) for specific local soils information.

Parent Material Kind: alluvium
Parent Material Origin: residuum, glacial till
Surface Texture: silty clay, clay, silty clay loam, silt loam
Surface Texture Modifier: none
Subsurface Texture Group: clayey, silty
Surface Fragments <3" (% Cover): 0
Surface Fragments ≥3" (%Cover): 0
Subsurface Fragments <3" (% Volume): 0-35
Subsurface Fragments ≥3" (% Volume): 0-2

	Minimum	Maximum
Drainage Class:	very poorly	very poorly
Permeability Class*:	very slow	moderate
Depth to first restrictive layer (inches):	80	>80
Electrical Conductivity (dS/m)*:	0	4
Sodium Absorption Ratio*:	0	5
Soil Reaction (1:1 Water)*:	6.1	8.4
Soil Reaction (0.1M CaCl2):	NA	NA
Available Water Capacity (inches):	NA	NA
Calcium Carbonate Equivalent (percent)*:	0	35

*These attributes represent from 0-40 inches. Electrical Conductivity (E.C.) values are based on Saturated Paste method; the commonly used 1:1 field method will have E.C. values <2.

Plant Communities

Ecological Dynamics of the Site:

This ecological site description is based on nonequilibrium ecology and resilience theory and utilizes a State-and-Transition Model (STM) diagram to organize and communicate information about ecosystem change as a basis for management. The ecological dynamics characterized by the STM diagram reflect how changes in ecological drivers, feedback mechanisms, and controlling variables can maintain or induce changes in plant community composition (phases and/or states). Weather variables that dramatically change water depths and water chemistry, combined with the application of various management actions, impact the ecological processes which influence the competitive interactions, thereby maintaining or altering plant community structure. Due to these climatic and management factors, species composition within Plant Community Phases and States can be highly variable.

Drainage/Hydrological Manipulation: Hydrological manipulation (surface or tile drainage, pumping, surface water diversion, etc.) modifies this ecological site. For more detailed information on drainage/hydrological manipulation of the site, see the “Hydrology Functions” section of this document.

MLRA 54 has a wide variation of Shallow Marsh sites mainly driven by differences in water source and water chemistry. Shallow Marsh sites associated with residual plains are driven by runoff water (snowmelt and rainfall) from surrounding uplands while sites associated with remnant areas of glacial till or glacial lake plains commonly are driven by both ground water and runoff water. Shallow Marsh sites located in relict oxbows are primarily driven by upland runoff flowing across flood plains and terraces and infrequent stream flooding. In some areas, this ground water can be saline and may impact the ecological site during the drawdown phase. In some Shallow Marsh ecological sites, water is also received from stream flow; typically, it has circumneutral pH (6.0–8.0) and high mineral and nutrient content. Refer to Site Development and Testing Plan section at end of this document.

This site developed under Northern Great Plains climatic conditions which included frequent droughts and wide fluctuations in temperature and precipitation which can result in both short-term and long-term changes in water levels and water chemistry (e.g., alkalinity/salinity). Unlike adjoining upland ecological sites, which are strongly influenced by grazing and fire, the primary ecological drivers for the Shallow Marsh ecological sites are hydrology and water chemistry. Hydrology is mainly a factor of landscape position, including the size of the contributing watershed, connectivity to other basins, ground water movement, and whether the basin has an outlet. Water chemistry is influenced by soil chemistry and whether the site is a recharge or flowthrough site.

Shallow Marsh ecological sites are highly influenced by water levels, including saturated soil, water movement, and water chemistry (i.e., recharge and flowthrough hydrology). Water levels, including soil saturation, influence fire effectiveness and livestock use. Water levels also influence exotic species invasion. As Shallow

Marsh sites drawdown (drying and losing soil moisture), they transition to functioning similarly to Wet Meadow ecological sites and can increase in salinity/alkalinity. Salt and grazing-tolerant foxtail barley can dominate the site during the drawdown phase. Extended periods of drawdown accompanied by grazing may cause this site to function similarly to Saline Lowland or other upland ecological sites. Many factors will dictate the speed of exotic species invasion including duration of drawdown phase: management of the sites during the drawdown phase, change in soil chemistry, and availability of exotic species seed or plants parts. Exotic species invasion usually begins to occur on adjacent Wet Meadow ecological sites, within or between basins, and then moves into the Shallow Marsh ecological site. During extended periods of drawdown, presence of exotic species adjacent to the site and lack of fire or heavy continuous livestock grazing can speed up the invasion of foxtail barley and cool-season exotic grasses (such as quackgrass and barnyard grass) or forbs (such as Canada thistle or sowthistle). Extended periods of drawdown will also allow upland invasive species, such as leafy spurge and Russian olive, to invade the site.

Once the site is invaded, increased water depth can inundate exotic species to a depth above plant height, causing considerable mortality, allowing restoration from the State 2: Native/Invaded State to the State 1: Reference State. Salt accumulation will be difficult to reverse back to levels prior to extended periods of drawdown and may take extended periods of inundation. In addition, exotic grasses (e.g., quackgrass) and foxtail barley can tolerate extended periods of inundation or saturation, which may never totally drown out along the outer margins of the adjacent Wet Meadow or Saline Lowland ecological sites. The continued presence of cool-season exotic grasses will cause this site to transition from State 1: Reference State and State 2: Native/Invaded State as water levels naturally fluctuate.

During extended periods of drawdown, heavy season-long grazing without adequate recovery periods following each grazing occurrence favors foxtail barley (e.g., Community Phase 2.2). During periods of normal water level, extended periods of no use or no fire often favor exotic species, such as exotic strains of reed canarygrass (e.g., Community Phase 2.1) or hybrid cattail. Annual cropping of the site or adjacent upland sites increases nutrient and sediment movement into this ecological site favoring hybrid cattail (State 3.0 Invaded State).

At times, particularly during periods of soil saturation with little standing water, Shallow Marsh sites may be susceptible to pugging damage (or hummocking of the soil) by livestock walking on the site. Pugging is a form of soil compaction due to livestock activity which damages the soil structure. It can seal the soil surface which reduces infiltration and exacerbates waterlogging of the topsoil. The micro-topography created by pugging generally supports plants of more well drained conditions (e.g., adjacent uplands) and is often associated with an increase in weedy species. This can lead to a significant reduction in herbage production and utilization.

Occasionally the margins of a Shallow Marsh can be colonized by Plains cottonwood or quaking aspen. Depending upon subsequent water levels and other environmental factors, these trees may persist. The cottonwood generally will occur as a band of trees near the margin of the Shallow Marsh. However, because quaking aspen is clonal, it may expand to form small clonal stands within the Shallow Marsh as well as into adjacent ecological sites.

Four vegetative states have been identified for the site (Reference, Native/Invaded, Invaded, and Go-Back). Within each state, one or more community phases have been identified. These community phases are named based on the more dominant water phases and visually conspicuous species; they have been determined by study of historical documents, relict areas, scientific studies, and ecological aspects of plant species and plant communities. However, this ecological site is quite dynamic due to wide variations in water depth, water chemistry, and other environmental factors. Management factors are also widely variable. As a result, the species composition and productivity of all states and community phases can vary considerably. Transitional pathways and thresholds have been determined through similar methods.

State 1: Reference State represents the natural range of variability that dominated the dynamics of this ecological site prior to European influence when the primary disturbance mechanisms for this site included water level fluctuations. Periodic fire and grazing by large herding ungulates were not a major disturbance mechanism. Spring snowmelt runoff and rainfall events, coupled with subsurface groundwater movement, dictated the dynamics that occurred within the natural range of variability. Due to those variations, the Reference State is thought to have shifted temporally and spatially between four plant community phases.

Water level fluctuations and water chemistry are the present-day primary disturbances. However, during drawdown phases, livestock grazing and a lack of fire impact this ecological site. Because of the changes in these and other environmental factors, the Reference State is becoming increasingly rare. Once adjacent upland ecological sites are converted to cropland, the Reference State can no longer exist due to sedimentation and increased nutrient loading to the site. The presence of exotic species on the site precludes it from being placed in the Reference State. It must then be placed in one of the other states, commonly State 2: Native/Invaded State (T1A). Tillage of adjacent uplands with increased eutrophication and sedimentation will lead to State 3: Invaded State (T1B).

State 2: Native/Invaded State. Colonization of the site by exotic species results in a transition from State 1: Reference State to State 2: Native/Invaded State (T1A). This transition is probably inevitable; it often results from colonization by exotic species or their hybrids, commonly hybrid cattail or exotic strains/hybrids of reed canarygrass.

Three community phases have been identified for this state. The exotic species/hybrids can be expected to increase. Hybrid cattail and exotic strains/hybrids of reed canarygrass tend to form virtual monocultures and, as such, plants more desirable to wildlife and livestock decline.

Maintenance of communities on the periphery of the wetland (e.g., Wet Meadow ecological site, adjacent upland sites) are critical to the ecological integrity/functioning of the wetland ecosystem. If a buffer zone (50 feet minimum) is not maintained, an increase in eutrophication, sedimentation rate, and invasion by exotic species can be expected. For more information on buffer widths, please refer to the Gilbert et.al. (2006) in the references section.

To slow or limit the invasion of these exotic species and their hybrids, it is imperative that managerial techniques (e.g., prescribed grazing, prescribed burning, maintaining intact buffers) be carefully constructed, monitored, and evaluated with respect to that objective. If management does not include measures to control or reduce these exotic species, the transition to State 3: Invaded State should be expected (T2A). An increase in water depth, however, may drown out the exotic plants, leading to State 1: Reference State (R2A).

State 3: Invaded State. The threshold for this state may be reached when hybrid cattail or the exotic strains/hybrids of reed canarygrass exceed 30% of the plant community and native plants represent less than 40% of the community. One plant community phase has been identified for this state. This state is typically dominated by hybrid cattail or exotic strains/hybrids of reed canarygrass. These species typically form virtual monocultures; as a result, plant diversity is low and habitat suitability for some wildlife species is low as well (e.g., hybrid cattail dominated wetlands may not provide waterfowl habitat but may provide white-tailed deer winter habitat).

A restoration pathway to State 2: Native/Invaded State may be accomplished with a wetland restoration or seeding, increased water depth, chemical treatment and/or sediment/nutrient removal, with successful upland restoration (R3A). However, that may be difficult and expensive.

State 4: Go-Back State often results following cropland abandonment during periods of extended, below average precipitation or drought. It consists of only one plant community phase which often is composed of a variety of annual forbs, grasses, spike rushes, etc., including noxious weeds (e.g., Canada thistle) which may need control. Over time, the site will likely become dominated by exotic strains or hybrids of reed canarygrass and/or hybrid cattail. Cessation of annual cropping followed by a successful wetland restoration/planting with prescribed burning and vegetative management may lead to State 2: Native/Invaded State (R4A). A wetland restoration/seeding with no use and no prescribed burning or vegetation management will likely lead to State 3: Invaded State (R4B).

The following state and transition model diagram illustrates the common states, community phases, community pathways, and transition and restoration pathways that can occur on the site. These are the most common plant community phases and states based on current knowledge and experience; changes may be made as more data are collected. Pathway narratives describing the site's ecological dynamics reference various water regimes and are influenced by management practices (e.g., prescribed grazing, prescribed burning, brush management, herbaceous weed treatment) which, if properly designed and implemented, will positively influence plant community competitive interactions. The design of these management practices will be site specific and should be developed by knowledgeable individuals; based upon management goals and a resource inventory; and supported by an ongoing monitoring protocol.

Due to variations in management, climate, and other factors, the botanical composition within plant community phases and states can be highly variable. The sites are primarily driven by water depth and water chemistry (local and regional). When the management goal is to maintain an existing plant community phase, modification of existing management to ensure native species have the competitive advantage may be required. To restore a previous state or restore to another phase within the same state, water depth and water chemistry may need to be modified, which is rarely available to managers except under hydrological restoration applications. Whether using prescribed grazing, prescribed burning, or a combination of both with or without additional practices, the timing and method of application needs to favor the native species over the exotic species. Adjustments to account for variations in annual growing conditions and implementing an ongoing monitoring protocol will be necessary to track changes and adjust management inputs to ensure desired outcomes. The plant community phase composition table(s) has been developed from the best available knowledge including research, historical records, clipping studies, and inventory records. As more data are collected, plant community species composition and production information may be revised.

Plant Communities and Transitional Pathways

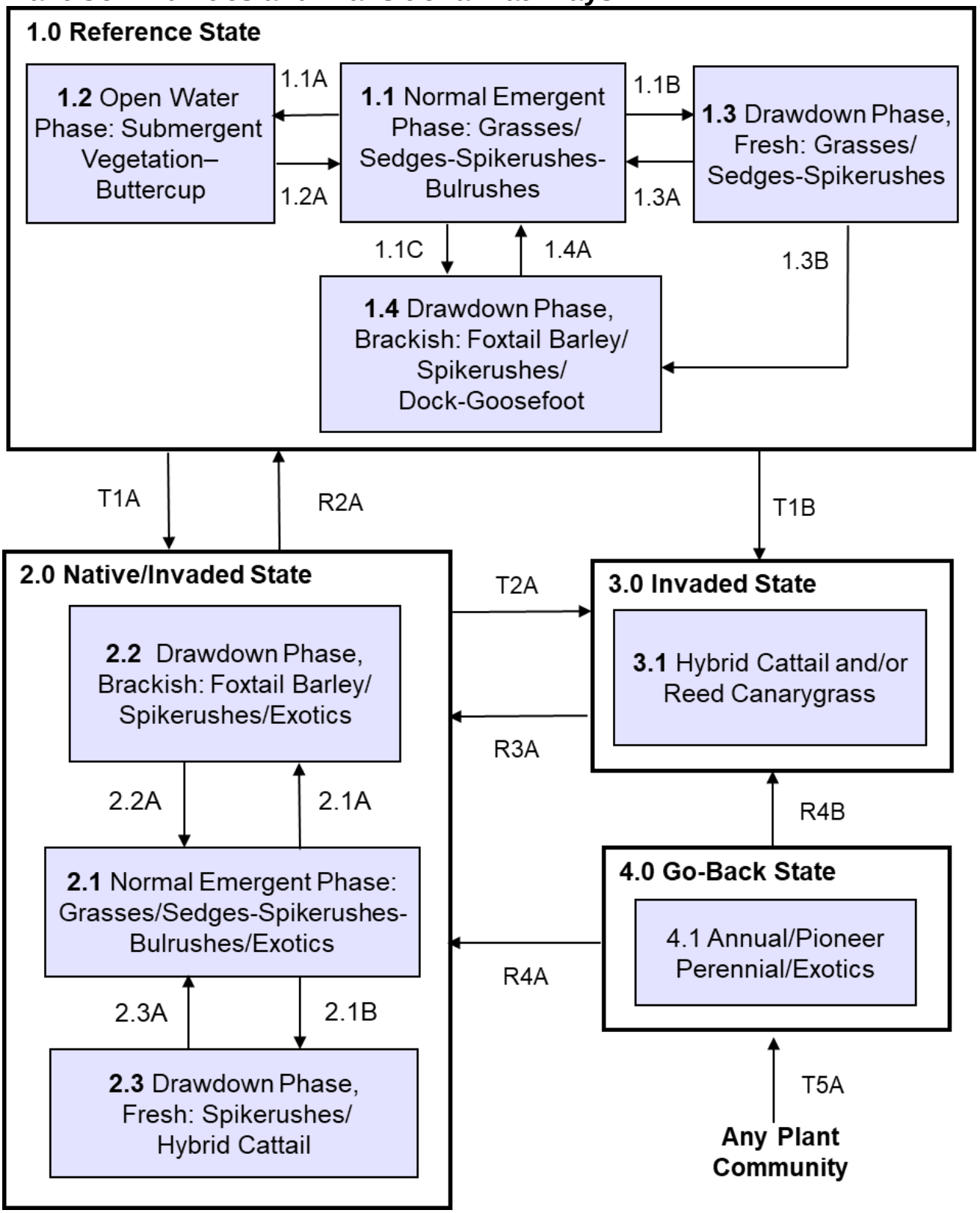


Diagram Legend - MLRA 54 Shallow Marsh	
T1A	Invasion by exotic plants, no-use no fire, heavy season-long grazing, decrease in water depth
T1B	Adjacent upland tillage with increased eutrophication and sedimentation
T2A	Adjacent upland tillage with increased eutrophication and sedimentation
T5A	Cessation of annual cropping
R2A	Increased water depth.
R3A	Wetland restoration or seeding, increased water depth, chemical treatment and/or sediment/nutrient removal, with successful upland restoration
R4A	Cessation of annual cropping, wetland restoration/seeding, prescribed burning, vegetation management
R4B	Cessation of annual cropping, wetland restoration/seeding, no-use and no burning, no vegetation management
CP 1.1 - 1.2 (1.1A)	Increase in water depth, above average precipitation
CP 1.1 - 1.3 (1.1B)	Drawdown phase, below average precipitation, fresh
CP 1.1 - 1.4 (1.1C)	Drawdown phase, below average precipitation, more brackish
CP 1.2 - 1.1 (1.2A)	Drawdown phase, below average to average precipitation
CP 1.3 - 1.1 (1.3A)	Average to above average precipitation, increase in water depth
CP 1.3 - 1.4 (1.3B)	Season-long grazing, no change in precipitation
CP 1.4 - 1.1 (1.4A)	Average to above average precipitation with increased water depth above plant height to cause plant mortality
CP 2.1 - 2.2 (2.1A)	Heavy season-long grazing, drawdown phase, saline soils (discharge site)
CP 2.1 - 2.3 (2.1B)	Heavy season-long grazing, drawdown phase, non-saline (recharge/flowthrough site)
CP 2.2 - 2.1 (2.2A)	Prescribed grazing and prescribed burning, increase in water depth
CP 2.3 - 2.1 (2.3A)	Prescribed grazing and prescribed burning, increase in water depth

State 1: Reference State

This state represents the natural range of variability that dominated the dynamics of this ecological site prior to European settlement. Historically, the primary disturbance mechanisms for this site in the reference condition were large fluctuations of the water table, water levels, soil saturation, and water chemistry (e.g., brackishness/salinity/alkalinity). Periodic fire and grazing by large herding ungulates were also historical disturbances that influenced this site but to a much lesser degree. Climate, weather, and drawdown events (combined with the timing of fires and grazing) dictated the dynamics that occurred within the natural range of variability.

Presently, the main disturbances are climate, weather events, water level fluctuations, lack of fire, concentrated livestock grazing, and agronomic activities on adjacent ecological sites (e.g., tillage, fertilizer and herbicide use, drainage).

The Reference State is composed of four community phases. These phases are largely due to variations in weather and climate factors resulting in considerable fluctuations in water levels and water chemistry (e.g., brackishness), which are the major factors influencing vegetation of the site. Brackishness can be natural due to the type of hydrology and soils of the site. Exotic perennial plants do not exist in this state.

Characteristics and indicators (i.e., characteristics and indicators that can be used to distinguish this state from others). Exotic species and hydrologic manipulation would not be present on this site when it is in State 1: Reference State.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). If intact, the reference state should be managed with current disturbance regimes which has permitted the site to remain in reference condition as well as maintaining the quality and integrity of associated ecological sites. Maintenance of the reference state is contingent upon a monitoring protocol to guide management.

Community Phase 1.1: Normal Emergent Phase: Grasses/Sedges-Spikerushes-Bulrushes (Grasses/*Carex* spp.-*Eleocharis* spp.-*Scripus* spp., *Schoenoplectus* spp.)

This community phase was historically the most dominant both temporally and spatially. Botanical composition can be quite variable due to variations in water chemistry and other factors. It is often dominated by tall and mid-statured, cool-season grasses along with sedges, spikerushes and bulrushes. The dominant grasses include common rivergrass (aka whitetop), mannagrass (i.e., American mannagrass, fowl mannagrass), slimstem reedgrass, bluejoint and American sloughgrass. Wheat sedge is the primary sedge. Bulrushes may include common threesquare (may become dominant in brackish waters); and spikerush includes common spikerush and needle spikerush. Common forbs include bur-reed (mostly broadfuit bur-reed), spotted water hemlock, hemlock water parsnip, water knotweed, and common bladderwort. Moss (*Drepanocladus* spp.) often covers much of the soil surface during drawdown phase. Bulrushes (such as hardstem, river, or softstem) may also be present in the transition zone to deeper open water. Fowl bluegrass, northern reedgrass, and prairie cordgrass (along with various forbs and sedges) occur in the transition zone to Wet Meadow ecological sites.

Annual production can be quite variable but may range from 5400-6400 pounds per acre with graminoids and forbs contributing 95% and 5% of the production, respectively. This is the reference plant community phase and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description.

Plant Community Composition and Group Annual Production

		1.1 Normal Emergent Phase-Grasses/Sedges-Spikerushes-Bulrushes		
COMMON/GROUP NAME	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*4130 - 5310*	*70 - 90*
GRASS-LIKES		**1**	**1770 - 3245**	**30 - 55**
wheat sedge	CAAT2	1	885 - 1180	15 - 20
spikerush	ELEOC	1	295 - 590	5 - 10
woolly sedge	CAPE42	1	295 - 590	5 - 10
river bulrush	SCFL11	1	59 - 295	1 - 5
bur-reed	SPARG	1	59 - 118	1 - 2
mountain rush	JUARL	1	59 - 295	1 - 5
broadleaf cattail	TYLA	1	59 - 295	1 - 5
other grass-likes	2GL	1	59 - 295	1 - 5
WARM-SEASON GRASSES		**2**	**885 - 1180**	**15 - 20**
prairie cordgrass	SPPE	2	885 - 1180	15 - 20
COOL-SEASON GRASSES		**3**	**295 - 1180**	**5 - 20**
common rivergrass	SCFE	3	590 - 885	10 - 15
northern reedgrass	CASTI3	3	59 - 295	1 - 5
American sloughgrass	BESY	3	59 - 295	1 - 5
reed canarygrass	PHAR3	3	59 - 295	1 - 5
American mannagrass	GLGR	3	59 - 295	1 - 5
OTHER NATIVE GRASSES		**4**	**0 - 295**	**0 - 5**
other perennial grasses	2GP	4	0 - 118	0 - 2
FORBS		*5*	*59 - 295*	*1 - 5*
aster	ASTER	5	0 - 118	0 - 2
knotweed	POLYG4	5	59 - 118	1 - 2
Pennsylvania smartweed	POPE2	5	0 - 118	0 - 2
western dock	RUAQ	5	59 - 118	1 - 2
American licorice	GLLE3	5	59 - 118	1 - 2
cinquefoil	POTEN	5	0 - 59	0 - 1
other forbs	2FORB	5	59 - 177	1 - 3

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	5130 -	5605 -	6086
FORBS	270 -	295 -	314
TOTAL	5400 -	5900 -	6400

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative Value.

Community Phase Pathway 1.1A
Community Phase 1.1 to 1.2 occurs with above average precipitation or other factors causing an increase in water depth sufficient to shift the vegetation from a diverse mixture of grasses, sedges, spikerushes, and bulrushes to one with more extensive open water submergent species, such as buttercup.

Community Phase Pathway 1.1B
Community Phase 1.1 to 1.3 occurs with below average precipitation or other factors causing a drawdown phase with fresh water, shifting the vegetation to grasses (e.g., prairie cordgrass, slimstem reedgrass) woolly sedge, and spikerush.

Community Phase Pathway 1.1C
Community Phase 1.1 to 1.4 occurs during a drawdown phase with the water becoming more brackish, often coupled with season-long grazing. This shifts the dominant vegetation from a diverse mixture of grasses, sedges, spikerushes and bulrushes to foxtail barley, spikerush, dock, and goosefoot.

Community Phase 1.2: Open Water Phase: Submergent Vegetation-Buttercups (Submergent Vegetation-*Ranunculus* spp.)
This community phase occurs when increased precipitation or other factors cause the water levels to increase in depth for a sufficient period for the site to become dominated by open water submergent species, such as buttercup (e.g., yellow water buttercup, longbeak buttercup). With a decrease in water levels (e.g., return to average precipitation/runoff), the plant community should return to Community Phase 1.1. Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Community Phase Pathway 1.2A
Community Phase Pathway 1.2 to 1.1 occurs during times of below average precipitation or other conditions that result in a drawdown phase or drop in water levels sufficient to cause a shift in the vegetation from submergent species (such as buttercup) to a diverse mixture of grasses, sedges, spikerushes and bulrushes.

Community Phase 1.3: Drawdown Phase, Fresh: Grasses/Sedges-Spikerushes (Grasses/*Carex spp.-Eleocharis* spp.)
This community phase occurs during prolonged dry periods or other factors leading to decreased water depth with fresh-water conditions. Prairie cordgrass, American sloughgrass, slimstem reedgrass, woolly sedge, spikerush (e.g., common spikerush, needle spikerush), and other sedges from the adjacent, drier sites encroach onto the site. Moss (*Drepanocladus* spp.) often covers much of the soil surface. With an increase in water depth (e.g., return to average precipitation), the plant community will readily return to Community Phase 1.1. Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Community Phase Pathway 1.3A
Community Phase Pathway 1.3 to 1.1 occurs during times of above average precipitation leading to an increase in water depth sufficient to cause a shift in the dominant vegetation from grasses (e.g., prairie cordgrass, slimstem reedgrass), woolly sedge, and spikerush to a diverse mixture of grasses, sedges, spikerushes and bulrushes.

Community Phase Pathway 1.3B
Community Phase Pathway 1.3 to 1.4 occurs with heavy season-long grazing leading to a change from grasses (e.g., prairie cordgrass, slimstem reedgrass), woolly sedge, and spikerush to one dominated by foxtail barley, spikerush, dock, and goosefoot.

Community Phase 1.4: Drawdown Phase, Brackish: Foxtail Barely/Spikerushes/Dock-Goosefoot (*Hordeum jubatum*/*Eleocharis* spp./*Rumex* spp./*Chenopodium spp.*)

This community phase occurs on some wetland soils during a drawdown phase causing more brackish conditions, perhaps coupled with heavy season-long grazing. This leads to marked increases in foxtail barley, spikerush (e.g., common spikerush, needle spikerush), speedwell, dock (e.g., golden dock, western dock), and goosefoot (e.g., red goosefoot). Prairie cordgrass, American sloughgrass, knotweeds, and cinquefoils can also be common associates of this community phase. Annual production and the extent of bare ground can be quite variable.

With continued heavy season-long grazing, increased soil compaction may result in high amounts of bare ground or in the colonization of exotic forbs and grasses. If this occurs, the site will likely begin transition to State 2: Native/Invaded State (T1A) or State3: Invaded State (T1B).

Community Phase Pathway 1.4A

Community Phase Pathway 1.4 to 1.1 occurs with above average precipitation or other factors causing an increase in water depth sufficient to shift the vegetation from foxtail barley and associates to a diverse mixture of grasses, sedges, spikerushes and bulrushes.

Transition T1A

This is the transition from the State 1: Reference State to State 2: Native/Invaded State resulting from the colonization and establishment of exotic plants, often exotic strains/hybrids of reed canarygrass or hybrid cattail. Canada thistle is also known to invade the site during dry periods.

Heavy season-long grazing, prolonged periods of no use and no fire, and a decrease in the water regime of the site are often involved with this transition. Excessive litter accumulation provides conditions favorable to hybrid cattail or exotic strains/hybrids of reed canarygrass which can quickly spread to form virtual monocultures. As a result, the transition to State 3: Invaded State can be expected.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). Restoration to State 1 is dependent upon hydrology, condition of adjacent upland ecological sites (i.e., cropland), and abundance of exotic species.

Transition T1B

This is the transition from State 1: Reference State to State 3: Invaded State. Although State 3: Invaded State often forms via State 2: Native/Invaded State, this direct transition to State 3: Invaded State can occur with tillage of the adjacent upland with an associated increase in eutrophication and sedimentation resulting in vegetation dominance by hybrid cattail or exotic strains/hybrids of reed canarygrass.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). Restoration to State 1 is dependent upon hydrology, condition of adjacent upland ecological sites (i.e., cropland), and abundance of exotic species.

State 2: Native/Invaded State

This state is characterized by the colonization and establishment of minor amounts of exotic plants. Reed canarygrass is native to North America, but exotic strains (largely Eurasian) have been widely introduced and, along with their hybrids, can be quite invasive. Hybrid cattail (the hybrid between narrowleaf cattail and broadleaf cattail) is also a common exotic. Canada thistle is also known to invade the site during dry periods. Although the site is still dominated by native plants, an increase in exotic plants can be expected. Unless a prescribed grazing and/or prescribed burning program is implemented or an increase in water depth drowns out exotic species, a transition to State 3: Invaded State can be expected.

Characteristics and indicators (i.e., characteristics that can be used to distinguish this state from others). The presence of trace amounts of exotic species/hybrids (e.g., cattail, reed canarygrass) indicates a transition from State 1 to State 2.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). Implementation of management techniques and monitoring procedures designed to limit or control exotic species/hybrids.

Community Phase 2.1: Normal Emergent Phase: Grasses/Sedges-Spikerushes-Bulrushes/Exotics (Grasses/*Carex* spp.-*Eleocharis* spp.-*Scripus* spp., *Schoenoplectus* spp./Exotics)

This is the wetter community phase of State 2: Native/Invaded State. This community is similar to Community Phase 1.1. However, exotic species (such as exotic strains/hybrids of reed canarygrass or hybrid cattail, curly dock, narrowleaf dock, oakleaf goosefoot, marshpepper knotweed, spotted ladysthumb, and others) are now minor components of the community. Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Community Phase Pathway 2.1A

Community Phase Pathway 2.1 to 2.2 occurs with heavy-season-long grazing coupled with a drawdown phase and saline soils (discharge site). As the pathway progresses, native plant diversity declines while foxtail barley, spikerush, dock, and exotic forbs increase.

Community Phase Pathway 2.1B

Community Phase Pathway 2.1 to 2.3 occurs with heavy-season-long grazing coupled with a drawdown phase and non-saline soils (recharge/flowthrough site). As the pathway progresses the site becomes more dominated by spikerushes and hybrid cattail.

Community Phase 2.2: Drawdown Phase, Brackish: Foxtail Barely/Spikerushes/Exotics (*Hordeum jubatum*/*Eleocharis* spp./Exotics)

This drawdown phase is a more brackish community. It is dominated by foxtail barley in association with spikerush, dock, and various native forbs (such as water knotweed, Mexican dock, curlytop knotweed, Pursh seepweed, goosefoot, and others). Exotic plants may include exotic strains/hybrids of reed canarygrass (as well as hybrid cattail, curly dock, narrowleaf dock, oakleaf goosefoot, marshpepper knotweeds, spotted ladysthumb, and others) which are now minor components of the community. Absinthium (aka wormwood) may also become prominent if the basin dries-up. Annual production and the extent of bare ground can be quite variable.

Community Phase Pathway 2.2A

Community Phase Pathway 2.2 to 2.1 occurs with the implementation of prescribed grazing, prescribed burning, with the return to near average precipitation resulting in increased water depth. This leads to a shift from foxtail barley, spikerush, dock, and exotic forbs to one of a diverse mixture of grasses, sedges, spikerushes, and bulrushes along with exotic grasses and exotic forbs.

Community Phase 2.3 Drawdown Phase, Fresh: Spikerushes/Hybrid Cattail (*Eleocharis* spp./*Typha* x *glauca*)

This drawdown phase is a more freshwater community dominated by spikerushes and hybrid cattail. Swamp ragwort, burningbush, cocklebur, pale smartweed, and other rather weedy forbs are also common. Exotic strains/hybrids of reed canarygrass may also become minor components of the community. Absinthium (aka wormwood), Canada thistle, and sowthistle may also become prominent if the basin dries-up.

Community Phase Pathway 2.3A
Community Phase 2.3 to 2.1 occurs with the implementation of prescribed grazing, prescribed burning, with the return to near average precipitation resulting in increased water depth. This leads to increasing prevalence of emergent species (such as bulrushes, spikerushes, and sedges).

Transition T2A
The transition from State 2: Native/Invaded State to State 3: Invaded State can occur with tillage on adjacent upland sites resulting in an increase in eutrophication and sedimentation leading to a dominance of hybrid cattail or exotic strains/hybrids of reed canarygrass. Studies indicate that a threshold may exist in the transition to this Native/Invaded State on some upland ecological sites when Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition. Similar thresholds may exist for exotic strains of reed canarygrass and hybrid cattail on this site.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). Restoration to State 2 is dependent upon hydrology and abundance of exotic species/hybrids.

Restoration R2A
This restoration pathway from State 2: Native/Invaded State to State 1: Refence State is initiated by an increase in water depth sufficient to drown out invasive exotic species. Success of this pathway is dependent upon the invasive species present in State 2 Native/Invaded State. Hybrid cattail and exotic strains/hybrids of reed canary grass will likely persist with increased water levels, whereas foxtail barley, dock, or Canada thistle and sowthistle will drown out.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Hydrological restoration/management to remove exotic species/hybrids may necessitate chemical control. Adjacent upland ecological sites will need to remain intact or be reseeded to native species to prevent sedimentation and nutrient loading to the Shallow Marsh site. Prescribed grazing techniques may provide a short-term reduction in reed canarygrass density; however, a combination of mowing and prescribed burning may be more effective than prescribed grazing alone.

State 3: Invaded State
This state occurs when the site becomes dominated by exotic plants. Common exotics of the site include exotic strains/hybrids of reed canarygrass or hybrid cattail. Canada thistle, sowthistle, and absinthium (aka wormwood) may also invade the site during dry periods. Once the state is established, restoration efforts have proven difficult (see Restoration R3A).

Characteristics and indicators (i.e., characteristics that can be used to distinguish this state from others). This site is characterized by exotic species/hybrids dominating the site and controlling the ecological processes (i.e., approximately 30 to 40%).

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). Once established, reed canarygrass and hybrid cattail are very resilient and will withstand grazing, haying, and non-use.

Community Phase 3.1 Hybrid Cattail or Reed Canarygrass (*Typha* x *glauca* or *Phalaris arundinacea*)
Hybrid cattail or exotic strains/hybrids of reed canarygrass often dominate State 3: Invaded State. Whether hybrid cattail or reed canarygrass dominate the site is largely determined by which species propagules

(presence/abundance) are present on the site. Diversity plummets with dominance by either of these species, as both can form monotypic stands.

Hybrid cattail is the hybrid of narrowleaf cattail and broadleaf cattail. The hybrid is also known to backcross with the broadleaf cattail. It is widely regarded as aggressive or invasive and typically forms monotypic stands. It is particularly adapted to nutrient enriched habitats with high sedimentation (i.e., associated with tillage, siltation, drainage).

Reed canarygrass is native to North America, but exotic strains have repeatedly been introduced over the years. These exotic strains and their hybrids are regarded as aggressive or invasive, often forming monotypic stands. Reed canarygrass and hybrid cattail are highly adaptive; managerial efforts to control them has been difficult (see Restoration R3A). Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Restoration R3A

This restoration pathway from State 3: Invaded State to State 2: Native/Invaded State results from a wetland restoration or seeding which also includes invasive species, such as hybrid cattail or other exotic species. The possibility exists to restore to 1.0 Reference State but is rarely accomplished due to the likelihood of exotic invasive species, such as hybrid cattail or reed canarygrass. It is more likely that a wetland restoration effort that is successful will eventually end up in State 2: Native/Invaded State. Hydrological restoration, planting, increased water regime, chemical treatment, and/or sediment/nutrient removal is limited due the persistence of exotic invasive species, such as hybrid cattail or reed canarygrass.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Reed canarygrass and hybrid cattail are difficult to control, largely due to vigorous spreading rhizomes, high seed production, and a large seed bank. Various control techniques may show signs of success but are often short-term with vegetation reverting within a few years.

Prescribed grazing (e.g., heavy seasonal), high-intensity burns, and herbicides have shown some success in reducing the dominance by reed canarygrass. However, within several years the vegetation often reverts.

Herbicides can be effective in reducing or eliminating hybrid cattail and can be followed by reseeding (or plugging) desirable species. Prescribed burning has also been effective during dry periods where fire temperatures may kill rhizomes and seeds. Although expensive, mechanical removal of the substrate has also been an effective technique.

State 4: Go-Back State

This state is highly variable depending on the level and duration of disturbance related to the T5A pathway. In this MLRA, the most probable origin of this state is plant succession following crop abandonment. This plant community will initially include a variety of annual forbs and grasses, some of which may be noxious weeds.

Characteristics and indicators (i.e., characteristics that can be used to distinguish this state from others). Tillage has destroyed the native plant community, altered soil structure and biology, reduced soil organic matter, and resulted in the formation of a tillage induced compacted layer which is restrictive to root growth. Removal of perennial grasses and forbs results in decreased infiltration and increased runoff.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). Continued tillage will maintain the state. Control of noxious weeds will be required.

Community Phase 4.1 Annual/Pioneer Perennial/Exotics

This community phase may be quite variable in composition. Vegetation is generally a mix of pioneer species, both native and exotic, as well as some native and exotic perennials (such as foxtail barley, reed canarygrass, slough grass, spikerush, speedwell, dock, goosefoot, knotweeds, hybrid cattail, water horehound, field sowthistle, and others). Absinthium and Canada thistle are known to be present during extended drawdown periods. Annual production can be quite variable due to wide variations in water chemistry, hydrology, and other factors.

Restoration R4A

This restoration pathway from State 4: Go-Back State to State 2: Native/Invaded State results from cessation of annual cropping, successful wetland restoration/seeding/plugging, prescribed burning, and vegetation management.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). If manipulated, hydrology needs to be restored. Elevated soil nitrogen levels and sedimentation have been shown to benefit reed canarygrass and hybrid cattail. Sedimentation may need to be removed to preexisting conditions. A successful range planting will include proper seedbed preparation, weed control (both prior to and after the planting), selection of adapted native species representing functional/structural groups inherent to the State 1, and proper seeding technique. Management (e.g., prescribed grazing, prescribed burning) during and after establishment must be applied in a manner that maintains the competitive advantage for the seeded native species.

Restoration R4B

This restoration pathway from State 4: Go-Back State to State 3: Invaded State results from cessation of annual cropping followed by a failed wetland restoration/seeding with no use and no fire.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Failure to restore hydrology and failed range plantings can result from many causes (both singularly and in combination) including drought, poor seedbed preparation, improper seeding methods, seeded species not adapted to the site, insufficient weed control, herbicide carryover, poor seed quality (purity & germination), and/or improper management.

Transition T5A

This transition from any plant community to State 4: Go-Back State. Most commonly, it is associated with the cessation of cropping without the benefit of restoration efforts, resulting in a “go-back” situation. Soil conditions can be quite variable on the site, in part due to variations in the management/cropping history - such as development of a tillage induced compacted layer, erosion, fertility (degree of eutrophication), and sedimentation herbicide/pesticide carryover. Thus, soil conditions should be assessed when considering restoration techniques.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

Landscape

The MLRA 54 landscape is characterized by moderately dissected rolling plains with areas of local badlands, buttes, and isolated hills. MLRA 54 is considered to have a continental climate with cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are common and characteristic of the MLRA. This area supports natural mixed-grass prairie vegetation with prairie rose, leadplant, and patches of western snowberry interspersed throughout

the area. Green ash, chokecherry, and buffaloberry occur in draws and narrow valleys creating woody riparian corridors. Complex intermingled ecological sites create diverse grass/shrub land habitats interspersed with varying densities linear, slope, depressional, and in-stream wetlands associated with headwater streams and tributaries to the Missouri River. These habitats provide critical life-cycle components for many wildlife species.

Historic Communities/Conditions within MLRA:

The northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary ecological drivers (either singly or often in combination). Many species of grassland birds, small mammals, insects, reptiles, amphibians, and large herds of roaming American bison, elk, and pronghorn were historically among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to large predators (such as the wolf, mountain lion, and grizzly bear) and smaller carnivores (such as the coyote, bobcat, red fox, and raptors). The black-tailed prairie dog was once abundant and provided ecological services by manipulating the plant and soil community, thus providing habitat for the black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, swift fox, small mammals, and amphibians and reptiles. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, and peregrine falcon (breeding). Extinct from the region is the Rocky Mountain locust.

Present Communities/Conditions within MLRA:

Following European influence, domestic livestock grazing, elimination of fire, energy development, and other anthropogenic factors influenced plant community composition and abundance. Agriculture, transportation corridors, and energy development are the main factors contributing to habitat fragmentation, reducing habitat quality for area-sensitive species. These influences fragmented the landscape; reduced or eliminated ecological drivers (fire); and introduced exotic species including smooth brome, crested wheatgrass, Kentucky bluegrass, and leafy spurge. This further impacted plant and animal communities. The loss of the bison, black-tailed prairie dogs, and fire as primary ecological drivers greatly influenced the character of the remaining native plant communities and the associated wildlife, moving towards a less diverse and more homogeneous landscape.

Included in this MLRA are the isolated Killdeer Mountains (limestone capped residual butte) containing bur oak, quaking aspen, green ash, paper birch, and American elm. Except for floodplain forests within the MLRA, the Killdeer Mountains contain the largest deciduous forest in southwestern North Dakota.

Some wildlife species in this area are mule deer, white-tailed deer, elk, pronghorn, moose, coyote, red fox, bobcat, prairie rattlesnake, American badger, raccoon, North American porcupine, beaver, striped skunk, American mink, white-tailed jackrabbit, black-tailed prairie dog, Eastern and Merriam's turkey, golden eagle, ferruginous hawks, sharp-tailed grouse, black-billed magpie, and numerous species of grassland-nesting birds and pollinating insects.

Presence of wildlife species is often determined by ecological site characteristics including grass and forb species, hydrology, aspect, and other associated ecological sites. The home ranges of a majority species are larger than one ecological site or are dependent on more than one ecological site for annual life requisites. Ecological sites offer different habitat elements as the annual life

requisites change. Habitat improvement and creation must be conducted within the mobility limits of a known population for the species.

Insects play an important role providing ecological services for plant community development. Insects that are scavengers or aid in decomposition provide the food chain baseline sustaining the carnivorous insects feeding upon them. Many insects provide the ecological services necessary for pollination, keeping plant communities healthy and productive. Insects provide a protein food source for numerous species including grassland-nesting birds and their young.

Species unique to MLRA:

Bald eagle: Bald Eagles prefer large rivers, lakes, reservoirs, or wetlands that are bordered by mature stands of trees or a single large tree. Bald eagles use the Missouri River system, including Lakes Sakakawea and Oahe, and associated tributaries. Mature trees, including cottonwoods, provide nesting sites adjacent to aquatic and upland foraging sites.

Dakota skipper: The extreme northern portion of this MLRA provides limited Dakota skipper habitat. Dakota skipper habitat within MLRA 54 is considered Type B habitat. Type B habitat is described as rolling native-prairie terrain over gravelly glacial moraine deposits dominated by bluestems and needlegrasses with the likely presence of bluebell bellflower, wood lily, blacksamson echinacea, upright prairie coneflower, and blanketflower. The United States Fish and Wildlife Service lists two critical habitat units within the MLRA in McKenzie County, North Dakota.

Golden eagle: The Lake Sakakawea breaks, bluffs, and rock outcroppings within the northwest portion of the MLRA are key areas for golden eagle nesting. Grasslands, shrublands, and black-tailed prairie dog towns are used for foraging.

Black-footed ferret: Black-footed ferrets have been reintroduced as an experimental population in the southern portion of the MLRA located on the Cheyenne Sioux Indian Reservation. Since reintroduction between 1991 and 1996, black-footed ferrets have been documented on the Standing Rock Sioux Indian Reservation approximately 20 miles north of the reintroduction site. Black-footed ferrets rely exclusively on prairie dog towns for shelter, breeding, and food sources (prairie dogs and other species within the town).

Least tern (Interior): Least terns are found on the Missouri River system in MLRA 54. Sparsely vegetated sandbars within the free-flowing portions of the Missouri River or shorelines of Lake Oahe and Sakakawea are used for nesting and foraging.

Species of Concern within the MLRA:

The following is a list of species considered “species of conservation priority” in the North Dakota State Wildlife Action Plan (2015); “species of greatest conservation need” in the Montana State Wildlife Action Plan (2015) and the South Dakota State Wildlife Action Plan (2014); and “species listed as threatened, endangered, or petitioned” under the Endangered Species Act within MLRA 54 at the time this section was developed:

Invertebrates: Dakota skipper, little white tiger beetle, monarch butterfly, Ottoe skipper, regal fritillary, yellow-banded bumble bee, and western bumble bee.

Birds: American Kestrel, Baird’s sparrow, bald eagle, black-billed cuckoo, black tern, bobolink, Brewer’s sparrow, burrowing owl, chestnut-collared longspur, ferruginous hawk, golden eagle,

grasshopper sparrow, greater sage-grouse, lark bunting, loggerhead shrike, least tern, long-billed curlew, marbled godwit, McCown's longspur, mountain plover, northern goshawk, northern harrier, northern pintail, peregrine falcon (migration), piping plover, prairie falcon, red knot (migration), red-headed woodpecker, sharp-tailed grouse, short-eared owl, Sprague's pipit, Swainson's hawk, trumpeter swan, upland sandpiper, western meadowlark, willet, Wilson's phalarope, and whooping crane (migration).

Mammals: Big and little brown bats, long-eared bat, long-legged bat, northern long-eared bat, Townsend's big-eared bat, western small-footed bat, black-footed ferret, black-tailed prairie dog, dwarf shrew, gray wolf, hispid pocket mouse, Merriam's shrew, northwestern moose, sagebrush vole, silver-haired bat, and swift fox.

Amphibians/Reptiles: Common snapping turtle, Great Plains toad, false map turtle, greater short-horned lizard, milk snake, northern leopard frog, plains hognose snake, plains spadefoot, smooth green snake, and smooth softshell and spiny softshell turtle.

Fish and Mussels: Blue sucker, burbot, flathead chub, fragile papershell, northern redbelly dace, paddlefish, pallid sturgeon, pearl dace, pink papershell, shortnose gar, sickle-fin chub, sturgeon chub, and sauger.

Grassland Management for Wildlife in the MLRA

Management activities within the community phase pathways impact wildlife. Community phase, transitional, and restoration pathways are keys to long-term management within each state and between states. Significant inputs must occur to cross the threshold between states (e.g., State 3.0 to 2.0) requiring substantial economic inputs and management (mechanical, reseeding, prescribed fire, woody vegetation removal, grazing intensity, etc.). Timing, intensity, and frequency of these inputs can have dramatic positive or negative effects on local wildlife species. Ranchers and other land managers must always consider the long-term beneficial effects of management on the habitat in comparison to potential short-term negative effects to individuals.

Ecological sites occur as intermingled complexes on the landscape with gradual or sometimes abrupt transitions. Rarely do ecological sites exist in large enough acreage to manage independently. Ecological sites that support a dominance of herbaceous vegetation (Loamy/Clayey) can be located adjacent to ecological sites that support medium to tall shrubs (Loamy Overflow). Conversely, ecological sites that are dominated by short- to mid-statured grasses (Claypan) can be adjacent to sites with bare soil only supporting minor amounts of short grasses and forbs (Thin Claypan).

Management of these complex ecological sites can provide a heterogeneous or a homogenous landscape. Grassland bird use declines as the plant community transitions to a homogenous state. Managers should recognize ecological sites and the complexes they occur in to properly manage the landscape. A management regime for one ecological site may negatively impact an adjacent site; for example, alteration of a grazing regime within a Loamy Overflow ecological site to encourage understory growth may encourage exotic cool-season grasses to increase or dominate an adjacent ecological site.

Life requisites and habitat deficiencies are determined for targeted species. Deficiencies must be addressed along community phase, transitional, and restoration pathways as presented in specific state-and-transition models. Ecological sites should be managed and restored within the site's capabilities to provide sustainable habitat. Managers also should consider habitat provided by

adjacent/intermingled ecological sites for species with home ranges or life requisites that cannot be provided by one ecological site.

With populations of many grassland-nesting birds in decline, it is important to maintain these ecological sites in a 1.0 Reference State (rarely found intact) or the 2.0 Native/Invaded. Plant communities optimal for a guild of grassland species serve as a population source where the birth rate exceeds mortality. Species may use marginal plant communities; however, these sites may function as a population sink where mortality exceeds the birth rate.

Understanding preferred vegetative stature and sensitivity to woody encroachment is necessary to manage for the specific grassland species. Various grass heights may be used for breeding, nesting, foraging, or winter habitat. While most species use varying heights, many have a preferred vegetative stature height. The following chart provides preferred vegetative stature heights and sensitivity to woody vegetation encroachment.

Grassland-nesting Bird Species	Preferred Vegetative Stature			Avoids woody vegetation*
	Short < 6 inches	Medium 6 - 12 inches	Tall >12 inches	
Baird's sparrow	x	x		x
Bobolink		x	x	x
Brewer's sparrow	x	x		
Burrowing owl	x			x
Chestnut-collared longspur	x	x		x
Common yellowthroat			x	
Dickcissel		x	x	
Ferruginous hawk	x	x		
Grasshopper sparrow	x	x		x
Horned lark	x			x
Killdeer	x			x
Lark bunting	x	x		
Lark sparrow	x			
Le Conte's sparrow			x	x
Long-bill curlew	x			x
Marbled godwit	x	x		x
McCown's longspur	x	x		x
Mountain plover	x			x
Nelson's sparrow			x	x
Nesting waterfowl		x	x	
Northern harrier		x	x	x
Savannah sparrow		x	x	x
Short-eared owl		x	x	x
Sprague's pipit	x	x		x
Upland sandpiper	x	x		x

Western meadowlark	x	x		
Willet	x	x		x
*Many of the listed species avoid nesting in grassland areas with large amounts of woody vegetation within a grassland or avoid nesting near woody vegetation in adjacent habitats. Although these species avoid areas with woody vegetation, most can tolerate a small amount of woody vegetation within areas dominated by grassland habitat, including short-statured shrubs (e.g., sagebrush, western snowberry) in this MLRA.				

Shallow Marsh Wildlife Habitat Interpretation:

Shallow Marsh ecological sites are very poorly drained soils located in depressions and relict oxbows. Associated ecological sites include Closed Depression, Loamy Overflow, Saline Lowland, and Wet Meadow. Shallow Marsh habitat features, and components commonly support grassland-nesting birds, notably birds utilizing wetland vegetation habitats (such as Nelson's and LeConte's sparrow, sedge wren, and water and wading birds using uplands for nesting). Insects rely on associated forbs and grasses for survival and serve as food sources for birds and their young and as forage for small and large herbivores. Shallow Marsh ecological sites support a diversity of invertebrates important in the diet of water birds.

Shallow Marsh ecological sites may be found in four plant community states within a local landscape. Multiple plant community phases exist within this ecological site dependent upon water levels, saturation, water and soil chemistry, and management. Today, these states occur primarily in response to precipitation (extended periods of above average precipitation or drought), water chemistry, fire, grazing, non-use (lack of management), and other anthropogenic disturbances.

Restoration pathway from State 2.0 back to State 1.0 may occur. The dominant ecological driver for Restoration Pathway R2A is increased water levels above plant height causing plant mortality, downing out exotic forbs and grasses. There is no expected pathway from State 3.0 to 2.0 mainly due to the presence of exotic species, mainly narrow-leaf cattail. Restoration is dependent upon a combination of a successful wetland restoration or seeding, increased water regime, chemical treatment, and/or sediment/nutrient removal. However, maintenance and/or restoration of adjacent upland ecological sites is critical for full restoration of the Shallow Marsh ecological site to Reference.

Non-anthropogenic Community Phase, Transition, and Restoration Pathways rely predominantly on water regime, either increasing or decreasing water depth with associated saturation. While tillage is the main anthropogenic impact to Shallow Marsh ecological sites within MLRA 54, heavy season-long grazing during a drawdown phase can cause saline soils (especially on discharge or flow-through sites). Degree of tillage and the length of time the site is tilled will have a significant impact on the ability of the site to follow Restoration Pathways R3A, R4A, and R4B. The longer the wetland is tilled, the fewer native wetland plant propagules are available to recolonize the wetland. Increased salinity due to tillage will also negatively impact restoration.

Native wildlife, dependent upon shallow wetlands found in the Shallow Marsh ecological site, generally benefit from the heterogeneous grasslands/graminoids found in Community Phases in States 1.0 and 2.0. Plant communities within States 1.0 and 2.0 are dependent upon long-term changes in precipitation and impacted by grazing intensity and frequency.

Management along community phase, transition, or restoration pathways should focus upon attainable changes. Short- and long-term monetary costs must be evaluated against short- and long-term ecological services in creating and maintaining habitat of sufficient quality to support a sustainable population density.

Hydrological manipulation (surface or tile drainage, pumping, surface water diversion, etc.) modifies this ecological site's functions, having a significant negative impact to wetland dependent wildlife such as invertebrates, amphibians, and water birds. Without restoring hydrologic function (which may include range seeding), managers need to reference state and transition models within those sites. Hydrology will need to be fully restored in Wet Meadow and Shallow Marsh ecological sites for these sites to properly function. It is recommended that managers review the appropriate State and Transition Models prior to wetland restoration.

State 1: Reference State

Community Phase 1.1 Normal Emergent Phase: Grasses/Sedges-Spikerushes-Bulrushes: This plant community offers quality vegetative cover for wetland associated wildlife; every effort should be made to maintain this ecological site within this community phase in State 1.0. Water level is the main ecological driver maintaining this plant community. However, this phase retains high functionality through continued maintenance including prescribed grazing with adequate recovery period as well as prescribed burning.

Invertebrates: Shallow Marsh ecological sites provide habitat for a diverse suite of aquatic invertebrates providing an important trophic link between macrophytes and vertebrates that depend upon them as food. The structure provided by vegetated wetlands increases the abundance of aquatic invertebrates compared to less vegetated sites. Maximum invertebrate production occurs when emergent and submergent vegetation are interspersed.

Insects play a role in maintaining the forb community and provide a forage base for grassland birds, wetland birds, and rodents. Early season pollinator plants are limited; however, a variety of forbs provide mid- to late-season pollen and nectar. Wet soil does not provide habitat for ground nesting pollinator species. This site does not provide habitat for Dakota skippers, regal fritillaries, or monarch butterflies. Depending on forb species composition, this site may be visited for nectar.

Birds: This plant community provides quality nesting, foraging, and escape habitats favored by mid- to tallgrass-nesting birds especially those species preferring wetter (hydric) habitats (such as Nelson's sparrow, black tern, northern harrier, sedge wren, waterfowl and other water birds). This site provides waterfowl pair bonding sites, excellent invertebrate food source for egg-laying water bird hens and water bird brood habitat. This plant community provides winter cover and escape for many upland birds. This site provides good hunting opportunities for grassland raptors, especially northern harrier.

Mammals: The diversity of grasses and forbs provide high nutrition levels for small and large herbivores. In addition, it provides foraging opportunities for raccoon, skunks, coyotes, and other mammals that use wetlands and wetland edges for food resources. Tall- to mid-statured vegetation provides suitable food, thermal, protective, and escape cover for small and large herbivores.

Amphibians and Reptiles: This ecological site can provide habitat for the northern leopard frog, Canadian toad, and tiger salamander. Duration of surface water provides for successful egg laying and tadpole development.

Fish and Mussels: This ecological site is directly associated with streams, rivers, or water bodies. As a seasonal wetland, it ponds water into mid-summer or longer. This site receives run-on hydrology from adjacent ecological sites and provides hydrology to shallow ground water and other surface waterbodies. Management on Shallow Marsh sites, in conjunction with neighboring run-off sites, will have a direct effect on aquatic species within the site and in streams and/or tributaries receiving water from Shallow Marsh sites. Optimum hydrological function and nutrient cycling limit potential for sediment yield and nutrient loading to the adjacent aquatic ecosystems from State 1.0.

Community Phase 1.2 Open Water Phase: Submergent Vegetation-Buttercups: This plant community phase occurs during periods of increased water depth, usually associated with prolonged periods of above average precipitation. The increased ponded water depth favors submerged vegetation and may create a mosaic of vegetation in conjunction with Plant Community Phase 1.1 and 1.3. The forb community is limited to submerged vegetation with flowers borne just above the water surface.

Invertebrates: Invertebrate abundance and diversity will increase with submerged vegetation, while pollen and nectar sources for bees and butterflies is limited to mid- to late-season when flowers are borne on submerged vegetation above the water surface.

Birds: Dominated by submerged vegetation, this site provides high protein source for egg laying waterfowl hens. Dependent upon the duration of ponding into the growing season, the site will provide an excellent protein source for waterfowl broods with escape cover when associated with Plant Community Phase 1.1. This site provides good hunting opportunities for grassland raptors, especially northern harrier.

Mammals: Provides similar life requisites as Community Phase 1.1; however, this Plant Community Phase no longer provides thermal, protective, escape, and winter habitat for a big game animals and other small herbivores.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

Community Phase 1.3 Drawdown Phase, Fresh: Grasses/Sedges-Spikerushes: This plant community occurs during the drawdown phase associated with prolonged periods of below average precipitation. The plant community is dominated by short- to mid-statured vegetation. This phase retains high functionality and, with average or above average precipitation via Community Phase Pathway 1.3A, will revert to Plant Community Phase 1.1.

Invertebrates: Insects play a role in maintaining the forb community and provide a forage base for grassland birds, wetland birds, and rodents. This plant community contains a variety of forbs providing season-long pollen and nectar. However, due to wet soils, ground nesting pollinator species do not prefer this site. Dakota skippers, regal fritillaries, or monarch butterflies will use this site when swamp milkweed, New England aster, or goldenrods occupy this site.

A diverse suite of aquatic invertebrates still occurs in this plant community phase; however, abundance is reduced due to loss of emergent vegetation. Rapid warming during spring snowmelt allows the invertebrate population to flourish.

Birds: Provides similar life requisites as Community Phase 1.1; however, a shorter statured plant community favors bird species that prefer short- to mid-statured vegetation.

Mammals: Provides similar life requisites as Community Phase 1.1; however, the shorter statured vegetation limits thermal, protective, and escape cover for small and large herbivores.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1; however, the lack of surface water does not provide the opportunity for successful egg-laying and tadpole development habitat.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

Community Phase 1.4 Drawdown Phase, Brackish: Foxtail Barley/Spikerushes/Dock-Goosefoot: This plant community phase occurs during the drawdown phase caused by long-term, below average precipitation coupled with season-long grazing. Increased salinity occurs allowing grazing tolerant foxtail barley to become one of the dominant species in this plant community. Grazing tolerant spikerush species increase along with weedy native forbs (goosefoot/dock).

Invertebrates: Pollinator friendly forbs decrease as salinity and foxtail barley increase - limiting pollen and nectar availability. Bare ground increases but few ground nesting species, if any within MLRA 54, use saline soils for nesting sites. This shift to drier soil conditions reduces or eliminates aquatic invertebrates.

Birds: This plant community phase does not provide waterfowl brood habitat. Depending on spring moisture conditions, waterfowl may find abundant invertebrate populations during the breeding season. As the site draws down, wading bird habitat increases as shallow water increases and as taller vegetation is replaced with increasing amount of bare ground. Invertebrates remain abundant early in the growing season unless prolonged below average precipitation persists drying of the soil, reducing invertebrate abundance and diversity.

Mammals: A shift to short-grass species, drier soil conditions, and increased salinity reduces habitat for large mammals (such as white-tailed deer) while still providing vegetative cover for small mammals. Thermal, escape, and winter cover is no longer provided for larger ungulates. Foraging opportunities for raccoon, skunks, coyotes, and other mammals becomes limited.

Amphibians and Reptiles: Loss of surface water and increased salinity reduces habitat for amphibians and reptiles. Tiger salamander habitat is lost while saline soils are not favored by frogs and toad species.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

State 2: Native/Invaded State

Community Phase 2.1 Normal Emergent Phase: Grasses/Sedges-Spikerushes-Bulrushes/Exotics: This transition from the State 1: Reference State to State 2: Native/Invaded State results from the colonization and establishment of exotic plants, often exotic strains of reed canarygrass. Exotic forbs that may occur include the hybrid cattail (cross between narrowleaf and broadleaf cattail), Canada thistle, and purple loosestrife.

Heavy season-long grazing, prolonged periods of no use and no fire, and a decrease in the water regime of the site are often involved with this transition. Excessive litter accumulation provides conditions favorable to exotic strains and/or hybrids of reed canarygrass and/or cattails which can quickly spread to form virtual monocultures. As a result, the transition to State 3: Invaded State can

be expected. This plant community phase has a very similar appearance and function to the Plant Community 1.1. Managers should consider management within the State 2.0 Community Phase Pathways to avoid transitioning to State 3.0.

Invertebrates: Provides similar life requisites as Community Phase 1.1.

Birds: Provides similar life requisites as Community Phase 1.1.

Mammals: Provides similar life requisites as Community Phase 1.1.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

Community Phase 2.2 Drawdown Phase, Brackish: Foxtail Barley/Spikerushes/Exotics: This plant community phase occurs with heavy season-long grazing combined with a drawdown phase and increased salinity. Grazing and salt tolerant foxtail barley and assorted forbs dominate the site while wheat sedge and other native grasses decline.

Invertebrates: Provides similar life requisites as Community Phase 1.4. Heavy season-long grazing and saline soils do not allow flowering plants to recover, limiting pollen and nectar resources for bees and other pollinating insects. In addition, a shift from perennial to annual forbs reduces season-long pollen and nectar sources for pollinating insect species. These annual forbs do not provide pollen and nectar resources at the same high level as native forbs provide. Prolonged periods of reduced precipitation favor ground nesting pollinators; however, increased compaction from mechanical impacts or increased livestock presence negatively impacts ground nesting pollinator opportunities. This shift to drier soil conditions reduces or eliminates aquatic invertebrates.

Birds: Provides similar life requisites as Community Phase 1.4.

Mammals: Provides similar life requisites as Community Phase 1.4.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.4.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

Community Phase 2.3 Drawdown Phase, Fresh: Spikerushes/Hybrid Cattail: This plant community phase occurs with heavy season-long grazing combined with a drawdown phase. This combination favors spike rushes and annual forbs.

Invertebrates: Heavy season-long grazing, coupled with reduced to no ponding, favors annual forbs and spikerushes limiting pollen and nectar resources for bees and other pollinating insects. These annual forbs do not provide pollen and nectar resources at the same high level as native forbs provide. Prolonged periods of reduced precipitation favor ground nesting pollinators; however, increased compaction from mechanical impacts or increased livestock presence negatively impacts ground nesting pollinator opportunities. This shift to drier soil conditions reduces or eliminates aquatic invertebrates until the site is inundated again.

Birds: This shorter, drier plant community reduces or eliminates nesting, brooding, or feeding opportunities for waterfowl and other water birds.

Mammals: Short spikerushes and annual forbs provide limited resources for mammals of all sizes.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.3**.**

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

State 3: Invaded State

Community Phase 3.1 Hybrid Cattail or Reed Canarygrass: Eutrophication and sedimentation of the site, often due to tillage on or adjacent to the site, transitions this plant community to one dominated by hybrid cattails or exotic strains/hybrids of reed canarygrass. Monotypic stands of hybrid cattail generally develop and out-compete other grasses, graminoids or forbs. Mechanical treatment, sediment removal, prescribed burning, reseeding, and buffer reestablishment may all be needed to restore this site to State 1.0 (via Restoration Pathway R3A) or State 2.0 (via Restoration Pathway R3B). Extended periods of above average precipitation along with mechanical treatment, sediment removal, prescribed burning, and reseeding (via Restoration Pathway R3A or R3B) can move this plant community back to State 1.0 or 2.0.

Invertebrates: Saturated to ponded soils favor aquatic invertebrates. Monotypic stands of hybrid cattail or reed canarygrass limit forb species, providing a decrease in pollen and nectar sources for insects. Restoration efforts, including prescribed grazing, can reduce hybrid cattail and reed canarygrass while increasing forb diversity. The initial flush of forbs may be Canada thistle and field sowthistle resulting from restoration efforts, especially prescribed grazing.

Birds: Monotypic stands of hybrid cattail or reed canarygrass reduce water bird use. LeConte's and Nelson's sparrow, marsh wren, and yellow rail favor this plant community. American bittern may use this site. Yellow-headed and red-winged black birds use cattail dominated wetlands for roosting, especially in late summer and early fall prior to migration. This plant community can provide winter cover for ring-necked pheasants when located near a winter food source. Restoration efforts, including prescribed grazing, can reduce hybrid cattail and reed canary grass - increasing open water which provides foraging and breeding habitat for dabbling ducks and shore birds including an excellent food source of aquatic invertebrates.

Mammals: Monotypic stands of hybrid cattail or reed canarygrass provide winter cover for large herbivores including white-tailed deer and moose. Depending on degree of ponding or saturation, this plant community may provide season-long escape cover for white-tailed deer. Tall- to mid-statured vegetation provides suitable food, thermal, protective, and escape cover for small and large herbivores.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1.

State 4: Go-Back State

Community Phase 4.1 Annual/Pioneer Perennial/Exotics: Following cropland abandonment, these plant communities are dominated by early pioneer annual and perennial plant species. Plant species composition and production are highly variable and dependent upon water depth and length of time the wetland has been in crop production contributing to eutrophication and sedimentation of wetland basin. Hybrid cattail, Canada thistle, field sowthistle, other annual weeds (dock, smartweed, barnyard grass, etc.), quackgrass, foxtail barley, slough grass, and pioneering spikerush species are

typical pioneer species. Weedy plants can provide pollinator habitat along with spring and summer cover for many mammals and birds, and their young. Dense weed cover can keep soils moist, increasing insect presence. Tall stature provided by some weeds offers thermal cover and seeds throughout winter. The response by wildlife species will be dependent upon ponded water depth, plant community composition, vegetative stature, patch size, and management activities (such as wetland restoration, sediment removal, prescribed grazing, burning, inter-seeding, haying, or noxious weed control).

Successful restoration of native species along Transition Pathway R4A can result in a native grass and forb community in State 2.0. Management activities within State 2.0 are needed to avoid a transition out of State 2.0. Unsuccessful wetland restoration or unsuccessful native forb and grass seeding along Transition Pathway R4B will result in State 3.0.

Animal Community – Grazing Interpretations

Note: When interpreting plant production to determine stocking rate, several things must be taken into consideration. Annual production is highly variable and subject to wide fluctuations, palatability is generally low, seasonally quite variable, and access to the forage can be limited due to water levels. As a result, caution must be exercised so that the stocking rate is based on a realistic on an inventory or a reasonable estimate of usable forage. More accurate stocking rate estimates should eventually be calculated using actual stocking rate information and monitoring data.

NRCS defines prescribed grazing as “managing the harvest of vegetation with grazing and/or browsing animals with the intent to achieve specific ecological, economic, and management objectives”. As used in this site description, the term ‘prescribed grazing’ is intended to include multiple grazing management systems (e.g., rotational grazing, twice-over grazing, conservation grazing, targeted grazing, etc.) provided that, whatever management system is implemented, it meets the intent of prescribed grazing definition.

The basic grazing prescription addresses balancing forage demand (quality and quantity) with available forage, varying grazing and deferment periods from year-to-year, matching recovery/deferment periods to growing conditions when pastures are grazed more than once in a growing season, implementation of a contingency (e.g., drought) plan, and a monitoring plan. When the management goal is to facilitate change from one plant community phase or state to another, then the prescription needs to be designed to shift the competitive advantage to favor the native grass and forb species.

Grazing levels are noted within the plant community narratives and pathways in reference to grazing management. “Degree of utilization” is defined as the proportion of the current year’s forage production that is consumed and/or destroyed by grazing animals (may refer to a single plant species or a portion or all the vegetation). “Grazing utilization” is classified as slight, moderate, full, close, and severe (see the following table for description of each grazing use category). The following utilization levels are also described in the Ranchers Guide to Grassland Management IV. Utilization levels are determined by using the landscape appearance method as outlined in the Interagency Technical Reference “Utilization Studies and Residual Measurements” 1734-3.

Utilization Level	%	Use Description
Slight (Light)	0-20	Appears practically undisturbed when viewed obliquely. Only choice areas and forage utilized.
Moderate	20-40	Almost all of accessable range shows grazing. Little or no use of poor forage. Little evidence of trailing to grazing.
Full	40-60	All fully accessable areas are grazed. The major sites have key forage species properly utilized (about half taken, half left). Points of concentration with overuse limited to 5 to 10 percent of accessible area.
Close (Heavy)	60-80	All accessible range plainly shows use and major sections closely cropped. Livestock forced to use less desirable forage, considering seasonal preference.
Severe	> 80	Key forage species completely used. Low-value forages are dominant.

Hydrology Functions

Under unaltered hydrologic conditions, the site is dominated by soils in hydrologic group D; where significantly impacted by drainage practices, these soils are in hydrologic group A/D, B/D, or C/D depending upon soil texture. Infiltration varies from very slow to very rapid; runoff potential for this site is none to negligible.

Hydrological manipulation (surface or tile drainage, pumping, surface water diversion, etc.) modifies this ecological site. Under natural conditions, this ecological site includes a wide range of soil textures; after hydrologic manipulation, soil texture often becomes a more significant factor in vegetative response. If the degree of manipulation allows soil texture to influence the plant community or if altered soil properties (i.e., salinization or the addition of fill material) results in vegetation change, a transition to a completely different ecological site may have occurred. The transition to an altogether different ecological site will depend upon severity of altered hydrology, soil properties, and corresponding vegetation. Due to the many variables (e.g., hydrology, success and type of drainage, etc.), impacts to the ecological site will be site-specific. As a result, each situation will require field investigation to determine what, if any, change in ecological site designation is necessary and proceed accordingly.

Without restoring hydrologic function (which may include range seeding), managers need to reference state and transition models within those sites. Hydrology will need to be fully restored in Wet Meadow and Shallow Marsh ecological sites for these sites to properly function. It is recommended that managers review the appropriate State and Transition Models prior to wetland restoration.

Recreational Uses

The largest acreage of public land available for recreation in the MLRA is owned and managed by the United States Forest Service (USFS) within the Little Missouri, Grand River, and Cedar River National Grasslands in South Dakota and the Little Missouri National Grasslands in North Dakota (687,398 acres). These areas are available for hunting, fishing, hiking, camping, horse and bike riding, nature viewing, etc. In addition, the Bureau of Land Management (BLM) manages (40,264 acres) in North and South Dakota with the same recreational opportunities as the USFS lands.

The United States Army Corps of Engineers (USAE) owns 496,162 acres of land and water located on and adjacent to Lake Sakakawea and Lake Oahe. The North Dakota and South Dakota Game and Fish Departments manage the fisheries resources. These two Missouri River reservoirs provide excellent fishing and water recreation opportunities. In addition, the United States Fish and Wildlife Service (USFWS) manages a national fish hatchery below Garrison Dam.

The USFWS manages 36,858 acres in the National Wildlife Refuge system while the North Dakota and South Dakota wildlife management agencies manage 72,218 acres as wildlife or game management areas. The North Dakota, South Dakota, and Montana Department of Trust Lands manage 486,482 acres. These areas provide hunting, bird watching, hiking, and other outdoor recreation opportunities. North Dakota Wildlife Management Areas along the shoreline of Lake Sakakawea and the Missouri River account for 60,000 acres of the approximately 72,218 acres of land managed by the states for wildlife habitat in MLRA 54. Located in the northern portion of the MLRA, the Killdeer Mountain WMA is the largest tract of state-owned land managed for wildlife habitat at approximately 7,000 acres.

The largest refuge managed by the United States Fish and Wildlife service is Lake Ilo National Wildlife Refuge totaling approximately 4,000 acres. United States Bureau of Reclamation manages approximately 11,000 acres at Lake Tschida and 8,460 acres at Bowman-Haley Lake for fish and wildlife habitat. The National Park Service manages the Knife River Indian Village National Historic Site; the North Dakota Historical Society manages the Double Ditch Indian Village site.

Bird watching: Public and private grasslands within MLRA 54 provide essential habitat for prairie-dependent bird species such as Sprague's pipits, western meadowlark, and Baird's sparrow along with some of the larger, showy members of the upland prairie include marbled godwits, upland sandpipers, willets, and sharp-tailed grouse. Publicly owned lands provide excellent birding opportunities. MLRA 54 is in the Central Flyway.

Hunting/Fishing: MLRA 54 is a fall destination for thousands of pheasant and upland game bird hunters. This MLRA also provides excellent deer (white-tailed and mule), pronghorn, and coyote hunting opportunities. Lake Sakakawea, Lake Oahe, Lake Tschida, and the Missouri River provide excellent year-round fishing opportunities. The North Dakota Game and Fish Department and South Dakota Game, Fish and Parks manage approximately 40 fishing lakes within the MLRA. Available species include yellow perch, walleye, northern pike, muskellunge, crappie, bluegill, rainbow trout, and smallmouth bass. Chinook salmon are stocked in Lake Sakakawea.

Camping: Numerous state operated campgrounds are located along the shores of Lake Sakakawea, Lake Oahe, Missouri River, and Shadehill Reservoir. Primitive camping is allowed on Grand River and Cedar River National Grasslands in South Dakota and the Little Missouri National Grasslands in North Dakota. Other numerous camping (primitive and improved) sites are available in numerous city and county parks.

Hiking/Biking/Horseback Riding: Hiking is permitted on most state and federally owned lands. Developed hiking and biking trails can be found on Harmon Lake (13.1 miles), Roughrider Trail (Morton County, 16.5

miles), Missouri River State Natural Area (5 miles), Ft. Abraham Lincoln State Park (8 miles), Cross Ranch State Park (14 miles), Grand River National Grasslands (7 miles), Lake Sakakawea State Park (5 miles), and Lewis & Clark State Park (5 miles). In addition, extensive biking and walking trails are found in local county and city parks. Ft. Abraham Lincoln State Park has 6 miles of horseback trails.

Wood Products

No appreciable wood products are found on this site.

Other Products

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

Site Development and Testing Plan

- Further investigation is needed on the range of landforms and soil textures (and associated properties) and their relationship to hydrology/plant dynamics.
- Further evaluation and refinement of the State-and-Transition model may be needed to identify disturbance driven dynamics. Additional states and/or phases may be required to address grazing response.
- Further documentation may be needed for plant communities in all states. Plant data has been collected in previous range-site investigations, including clipping data; however, this data needs review. If geo-referenced sites meeting Tier 3 standards for either vegetative or soil data are not available, representative sites will be selected for further investigation.
- Site concepts will be refined as the above noted investigations are completed.
- The long-term goal is to complete an approved, correlated Ecological Site Description as defined by the National Ecological Site Handbook.
- NASIS revisions needed:
    - One major component of McKeen, very poorly drained should be relinked form Non-site to Shallow Marsh.
    - One very poorly drained, frequently flooded, major component of Banks should be relinked from Shallow Mash to Riparian Complex. Consider changing the component name to Psammaquent.
    - Consider relinking frequently flooded Lallie from Shallow Marsh to Riparian Complex
    - Consider relinking Mckeen components from Wet Meadow and Shallow Mash to Riparian Complex.
    - One major Mckeen component needs to be relinked from Non-site to ether Riparian Complex or Shallow Marsh.
    - Consider relinking Minnewaukan components from Shallow Marsh to Riparian Complex.

This ESD is the best available knowledge. The site concept and species composition table have been used in the field and tested for more than five years. It is expected that as additional information becomes available revisions may be required.

Supporting Information

Associated Sites

Ecological Site Name	Site ID	Narrative
Closed Depression	R054XY022ND	This site occurs in poorly drained depressions and basins. Commonly, the surface layer is grayish colored with platy structure. Where a dark-colored surface layer occurs, it is <6 inches thick. The subsoil is clayey (forms a ribbon ≥2 inches long).
Loamy Overflow	R054XY023ND	This site occurs in upland swales and on floodplains. The surface and subsoil layers form a ribbon 1 to 2 inches long. It is >42 inches to redoximorphic features.
Saline Lowland	R054XY024ND	This site is poorly drained or somewhat poorly drained and occurs on rims of depressions and adjacent flats. It has an accumulation of salts in the surface and subsoil layer (E.C. >8 dS/m). Typically, this site does not have a claypan layer, but one is allowed if the soil is poorly drained. All textures are included in this site.
Wet Meadow	R054XY037ND	This site is in shallow depressions and on low-lying flats. It is poorly drained - a seasonal high-water table is typically within a depth of 1.5 feet during the months of April through June; in depressions, it is frequently ponded (typically ≤1.5 feet deep) in April and May. It typically has redoximorphic features within a depth of 18 inches. Some soils are highly calcareous. It is non-saline to slightly saline (E.C. <8 dS/m) in the surface and subsoil layers. All textures are included in this site.

Similar Sites

Ecological Site Name	Site ID	Narrative
Wet Meadow	R054XY037ND	This site is in shallow depressions and on low-lying flats. It is poorly drained - a seasonal high-water table is typically within a depth of 1.5 feet during the months of April through June; in depressions, it is frequently ponded (typically ≤1.5 feet deep) in April and May. It typically has redoximorphic features within a depth of 18 inches. Some soils are highly calcareous. It is non-saline to slightly saline (E.C. <8 dS/m) in the surface and subsoil layers. All textures are included in this site.

Acknowledgements

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Developers

ND NRCS: David Dewald, Jonathan Fettig, Jody Forman, Mike Gerbig, Alan Gulsvig, Mark Hayek, Jeanne Heilig, John Kempenich, Chuck Lura, Jeff Printz, Steve Sieler, and Hal Weiser.

all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident. Persons with disabilities who require alternative means of communication for program information (e.g.,,, Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English. To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:(1) mail: U.S. Department of Agriculture Office of the Assistant Secretary for Civil Rights 1400 Independence Avenue, SW Washington, D.C. 20250-9410;(2) fax: (202) 690-7442; or(3) email: program.intake@usda.govUSDA is an equal opportunity provider, employer, and lender.

Inventory Data References

Information presented here has been derived from NRCS and other federal/state agency clipping and inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field-tested by various private, state and federal agency specialists.

State Correlation

This site has been correlated with North Dakota, Montana, and South Dakota.

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 43a – Missouri Plateau; 43c – River Breaks; 43j – Moreau Prairie.

Wetland Description:	**System**	**Subsystem**	**Class**	**Sub-class**	**Water Regime**
Cowardin, et. al., 1979	Palustrine	N/A	Emergent	Persistent	Seasonal

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Site Description Approval

ND, State Rangeland Management Specialist	Date	SD, State Rangeland Management Specialist	Date
MT, State Rangeland Management Specialist	Date		

INTERPRETING INDICATORS OF RANGELAND HEALTH, Version 5, REFERENCE SHEET

Ecological site name: _Shallow Marsh_ Ecological site code: _RO54XY036ND___
Author(s)/participant(s): M. Hayek, S. Boltz, J. Printz
Contact for lead author: _NRCS State Rangeland Management Specialist__
Date: _Nov. 2021__ **MLRA:** __54_____ **LRU:** _____
Composition based on (check one): ☐ Cover ☒ Annual Production

Indicators. For each indicator, describe the potential for the site using the reference sheet checklist. Where possible, (1) use quantitative measurements; (2) include expected range of values for above- and below-average years and natural disturbance regimes for each community phase within the reference state, when appropriate; and (3) cite data sources used. Continue descriptions on separate sheet.
1. Rills: Rills are not expected on this site.
2. Water flow patterns: Water flow patterns are not visible.
3. Pedestals and/or terracettes: Neither pedestals nor terracettes are expected.
4. Bare ground: Bare ground is less than 5%. Amount of bare ground may increase for a short time following periods of inundation.
5. Gullies: Active gullies are not expected on this site.
6. Wind-scoured and/or depositional areas: No wind-scoured or depositional areas expected on this site.
7. Litter movement: Plant litter movement not expected on this site.
8. Soil surface resistance to erosion: Stability class averages 6.
9. Soil surface loss and degradation: Use soil series description for depth, color, and structure of A-horizon.
10. Effects of plant community composition and distribution on infiltration: Grass-likes and tall-statured grasses are dominant and subdominant.
11. Compaction layer: No compaction layers occur naturally on this site.
12. Functional/structural groups: : Due to differences in phenology, root morphology, soil biology relationships, and nutrient cycling Kentucky bluegrass, smooth brome, and crested wheatgrass are included in a new Functional/structural group, mid- and short-statured early cool-season grasses (MSeC3), **not expected for this site**.

Dominance Category[1]	**Relative dominance of F/S groups for community phases in the *Reference State*** *Minimum expected number of species for dominant and subdominant groups is included in parentheses.*		
	Dominance based on[1]: Annual Production _X_ or Foliar Cover __		
	Phase 1.1_	**Phase 1. __**	**Phase 1. __**

Dominant	**Grass-likes (7); Tall C3 rhizomatous grasses (3)**		
Subdominant	**Tall C4 rhizomatous grasses (1)**		
Minor	**Mid & short C3 bunch grasses; Mid & short C3 rhizomatous grasses; Forbs**		
Trace			

[1]Biological soil crust dominance is determined based on cover, rather than production. If biological soil crusts are an expected dominant or subdominant group, the number of expected life forms (e.g., lichen, moss) is listed, rather than number of individual species.

13. Dead or dying plants or plant parts: Rare to not occurring on this site.

14. Litter cover and depth: Plant litter cover is 80 to 90% with a depth of 1.0 to 1.5 inches. Plant litter is in contact with the soil surface.

15. Annual production: Annual air-dry production is 5900 lbs./ac (reference value) with normal precipitation and temperatures. Low and high production years should yield 5400 lbs./ac to 6400 lbs./ac, respectively.

16. Invasive plants: State and local noxious species, reed canarygrass, redtop, smooth bromegrass, quackgrass, and Kentucky bluegrass.

17. Vigor with an emphasis on reproductive capability of perennial plants: Noninvasive species in all functional/structural groups are vigorous and capable of reproducing annually under normal weather conditions.

Site Type: Rangeland
MLRA: 54-Rolling Soft Shale Plain

October 2024

Functional/Structural Groups Sheet

State_____ **Office**_____ **Ecological site** Shallow Marsh **Ecol. site code** R054XY036ND

Observers_____ **Date**_____

Evaluation site ID and/or name: _____
Dominance in ESD based on: Foliar Cover Annual Production Biomass

Species list of functional/structural groups in the **Reference State**	
Functional/Structural Group	Species List
Grass-likes	slough sedge, woolly sedge, spikerush, Baltic rush, river bulrush, burreed, cattail
Tall C3 rhizomatous grasses	whitetop, reed canarygrass, American managrass
Tall C4 rhizomatous grasses	prairie cordgrass
Mid & short C3 bunch grasses	American sloughgrass
Mid & short C3 rhizomatous grasses	northern reedgrass
Forbs	please see plant community table 1.1
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.	
Biological soil crust[1]	

Reference State - Relative dominance of functional/structural groups for each community phase

Relative dominance annotations: *Use the following annotations in the narrow columns to describe the relative dominance of the listed functional/structural groups: = "equal"; > "greater than"; >> "much greater than"*

Phase	Dominant **	>> > =	Subdominant **	>> > =	Minor **	>> > =	Trace **
1.1	Grass-likes > Tall C3 rhizomatous grasses	>>	Tall C4 rhizomatous grasses	>>	Mid & short C3 bunch grasses = Mid & short C3 rhizomatous grasses = Forbs	.	
		.		.		.	
		.		.		.	

* Indicates species that may or may not be present on the site. Absence of these species may not constitute a departure.
** See IIRH Version 5 page 70.

Circle the community phase that most closely matches the evaluation area. *Revise functional/structural groups relative dominance for the community phase circled to represent changes in dominance given the time since disturbance(s) (see page 1 of site evaluation sheet).

Species list of functional/structural groups in the **Evaluation Area**	
Functional/Structural Group	Species List
Grass-likes	
Tall C3 rhizomatous grasses	
Tall C4 rhizomatous grasses	
Mid & short C3 bunch grasses	
Mid & short C3 rhizomatous grasses	
Forbs	
Groups not expected:	
Mid & short early C3 grasses	
Biological soil crust[1]	

Evaluation Area - Relative dominance of functional/structural groups

Dominant **	>> > =	Subdominant **	>> > =	Minor **	>> > =	Trace **

Biological soil crust [1] - dominance is evaluated solely on cover, not composition by weight

** See IIRH Version 5 page 70.

Notes: