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.

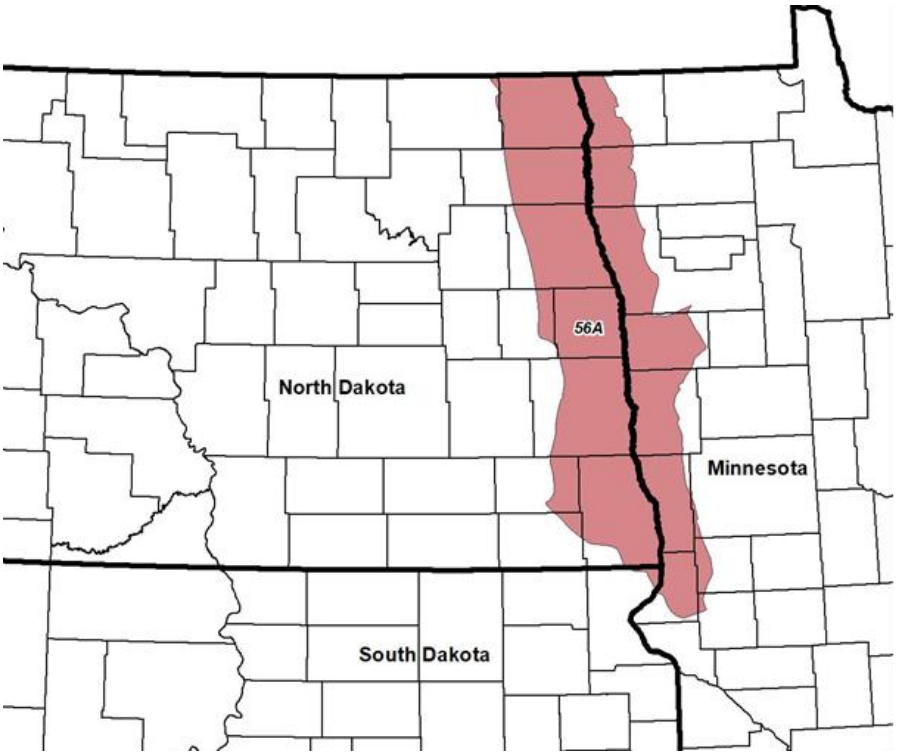
Site Name: Wet Meadow

Site Type: Rangeland

Site ID: R056AY102ND

Major Land Resource Area: 56A – Red River Valley of the North

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 56A within Minnesota, North Dakota, and South Dakota

The Red River Valley of the North MLRA is an expansive and agriculturally important region consisting of 10,400,000 acres and including a portion of 25 counties in eastern North Dakota and northwestern Minnesota along with a small portion of the northeast corner (Roberts County) of South Dakota.

Although MLRA 56A is currently called the Red River Valley of the North, the landscape does not fit the common understanding of "valley" as the transition out of the Valley is very gradual in most places. The extent of the MLRA corresponds to the area covered by Glacial Lake Agassiz including lacustrine sediments, beach ridges, and deltas where rivers flowed into the glacial lake. Also included are island areas of glacial till which were surrounded by the lake waters. Some of the lacustrine deposits are very deep and some have glacial till within a few feet of the surface. The glaciolacustrine materials range from clayey to sandy.

The primary river in the MLRA is the Red River of the North flowing northward into Canada where it empties into Lake Winnipeg. The river is formed by the confluence of the Bois de Sioux River (flowing from northeastern South Dakota) and the Ottertail River flowing from west-central Minnesota. Numerous tributaries in MLRA 56A contribute additional water to the Red River. In Minnesota these include the Two Rivers, Snake, Marsh, Middle, Red Lake, Wild Rice, and Buffalo. In North Dakota, the Pembina, Tongue, Park, Forest, Turtle, Goose, Elm, Rush, Maple, Sheyenne, and Wild Rice are tributaries to the Red River. There are also smaller streams and coulees along with many legal drains.

The relative flatness of much of the MLRA contributes to a flooding hazard for large areas of agricultural land in the spring months. Soil salinity, while variable, also impacts land management on many areas within the MLRA. Extensive surface and subsurface (tile) drainage systems have been constructed/installed to manage excess water and/or salinity on cropland. This extensive drainage has apparently reduced ground water recharge regionally, thus impacting seasonal water table level/fluctuation and its influence on plant communities. Soils that were poorly drained prior to wide-spread drainage may now function as somewhat poorly drained or even moderately well drained soils. For example, undrained Fargo soils are Wet Meadow ecological sites; with surface drainage they may function as Subirrigated sites; and with tile drainage, they commonly function as Clayey sites. Because of the extensive alteration of the hydrology, restoration to the natural conditions of the reference state dynamics would not be possible.

MLRA 56A is an ecotone between grassland dominated MLRAs 55A and 55B to the west and forest dominated MLRAs 56B and 102A to the east. This region is utilized mostly by farms; about 80 percent is non-irrigated cropland, but some irrigated fields exist on the beach areas. Cash-grain, bean, sugar beets, potatoes, and oil production crops are the principal enterprise on many farms, but other feed grains and hay are also grown. Currently, about 6 percent of this area is forested, mostly in areas along rivers that are difficult to access with farm equipment. Another 6 percent is grassland used for ranching and/or wildlife habitat. Grazing lands occur primarily in the Sand Hills area of the Sheyenne River delta, on beach areas, and on other areas too wet, saline, sodic, steep, or inaccessible to be productive cropland.

Ecological Site Concept

The Wet Meadow ecological site is generally located in depressions and on low-lying flats and swales on lake plains, till-floored lake plains, delta plains, outwash plains, and eolian sand plains; however, it also occurs on flood plains. The soil is very deep. 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 $\leq$1.5 feet) from March into July. Generally, redox features are within a depth of 18 inches. Very slight or slight salinity (E.C. <8 dS/m) is allowable on this site.

Effervescence ranges from none to violent. Hydrology (surface and sub-surface) is the primary factor used in identifying this site. All textures are included in the site. Slope is typically less than 2 percent but ranges from 0 to 3 percent. On the landscape, this site is below the Clayey, Loamy, Limy Subirrigated, and Subirrigated Sands, and Choppy Sands ecological sites and above the Shallow Marsh site. The Loamy Overflow site is somewhat higher, occurring on flood plain steps. The Subirrigated ecological site occurs in slight depressions and on flats; it has redoximorphic features at a depth of 18 to 30 inches. The Saline Lowland site is on similar landscape positions; it has moderate or strong soil salinity (E.C. >8 dS/m). The Sodic Subirrigated site occurs on similar landscape positions on some sand plains; it has a sodic claypan layer. **Note: Some frequently flooded soils may be included in this site. The Riparian Complex ecological site should be considered for such soils.**

Physiographic Features

This site typically occurs in depressions and on low-lying flats and swales on lake plains, till-floored lake plains, delta plains, outwash plains, and eolian sand plains; it also occurs on flood plains. The parent materials vary widely. Slope is typically less than 2 percent but ranges from 0 to 3 percent.

Landform: depression, pothole, swale, flat, flood plain

	Minimum	**Maximum**
Elevation (feet):	750	1475
Slope (percent):	0	3
Water Table Depth (inches):	0	42
Flooding:		
Frequency:	None	Frequent
Duration:	None	Long
Ponding:		
Depth (inches):	0	18
Frequency:	Rare	Frequent
Duration:	Brief	Very Long
Runoff Class:	Negligible	High
Aspect:	No influence on this site	

Climatic Features

MLRA 56A is considered to have a continental climate – cold winters and relatively hot summers, low to moderate humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 18 to 23 inches per year. The average annual temperature is about 40°F. January is the coldest month with average temperatures ranging from about 1°F (Pembina, North Dakota (ND) to about 11°F (Wheaton, Minnesota (MN). July is the warmest month with temperatures averaging from about 68°F (Pembina, ND) to about 73°F (Wheaton, MN). The range of normal average monthly temperatures between the coldest and warmest months is about 65°F. This large annual range attests to the continental nature of this area's climate. Winds are estimated to average about 13 miles per hour annually, ranging from about 15 miles per hour during the spring to about 11 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

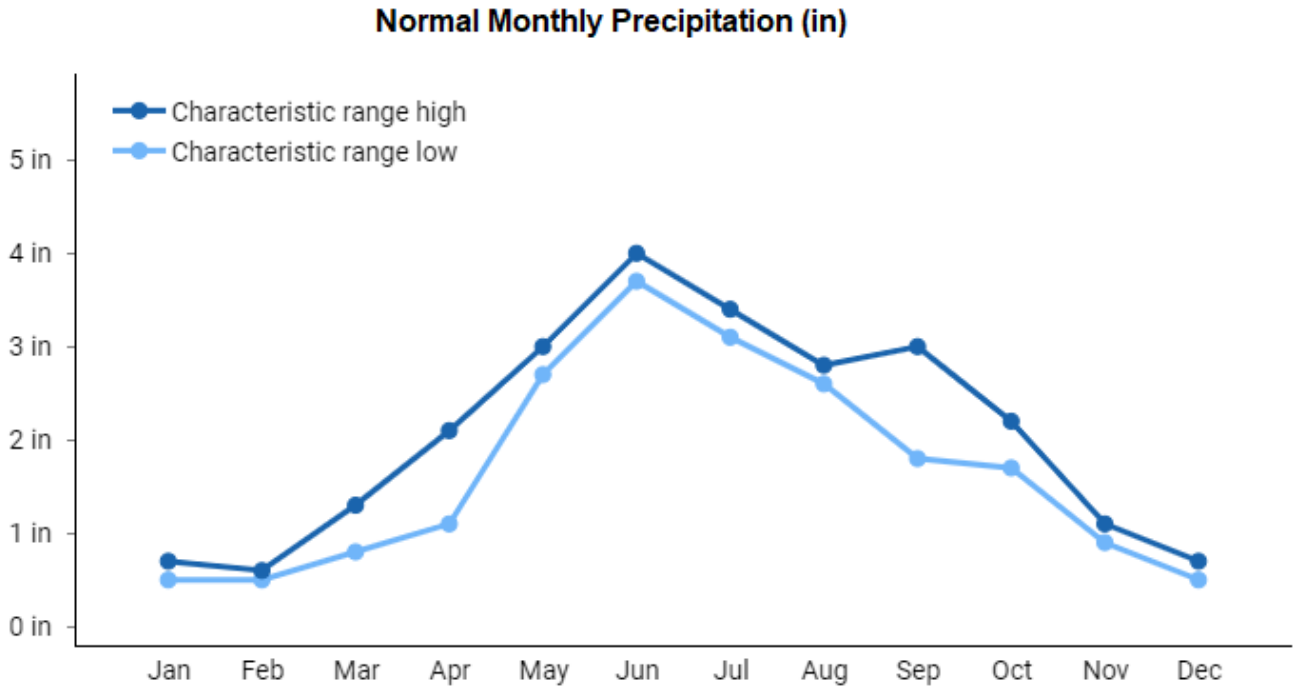
Growth of cool season plants begins in early to mid-March, slowing or ceasing in late June. Warm season plants begin growth about mid-May and continue to early or mid-September. Greening up of cool season plants may occur in September and October when adequate soil moisture is present.

Climate normals

	Representative High	Representative Low	Actual High	Actual Low	Average
Mean annual precipitation (in):	24	21	25	20	22
Frost free period (days):	126	102	131	87	112
Freeze free period (days):	145	132	150	126	138

Normal monthly precipitation (in)

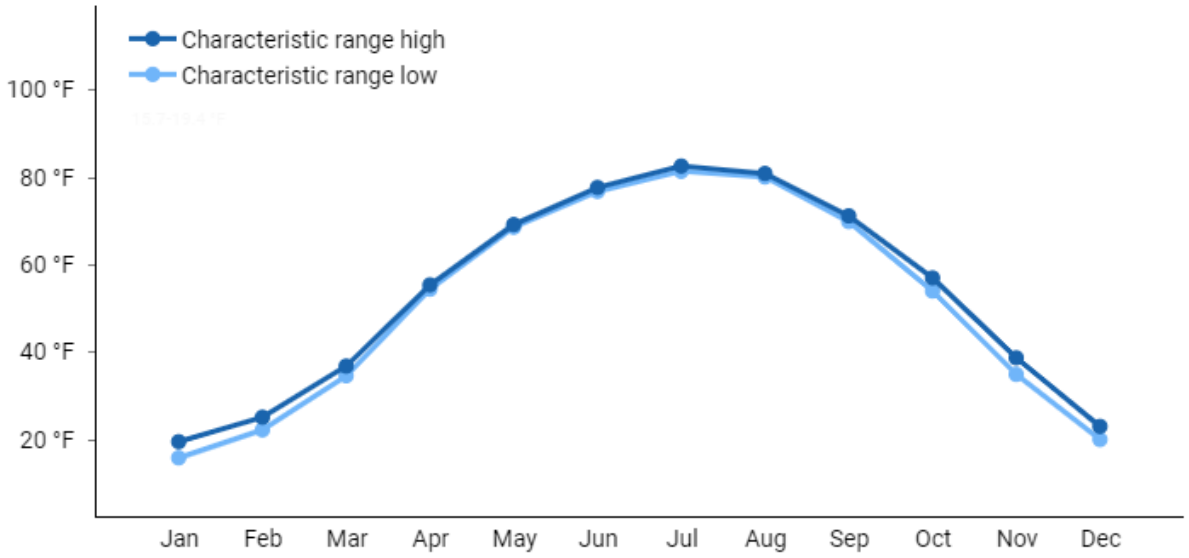
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.7	0.6	1.3	2.1	3	4	3.4	2.8	3	2.2	1.1	0.7
Representative low:	0.5	0.5	0.8	1.1	2.7	3.7	3.1	2.6	1.8	1.7	0.9	0.5
Actual high:	0.8	0.7	1.5	2.2	3.2	4.1	3.4	3	3.1	2.3	1.2	0.8
Actual low:	0.5	0.4	0.8	1	2.7	3.6	3	2.5	1.8	1.6	0.8	0.5



Normal monthly maximum temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	19.4	25	36.7	55.3	69.1	77.6	82.5	80.8	71.1	56.9	38.6	22.9
Representative low:	15.7	22.1	34.5	54.3	68.5	76.7	81.3	80	69.8	53.9	34.8	19.9
Actual high:	19.9	25.1	36.8	55.9	69.7	77.7	82.7	80.8	71.4	57	38.6	23.9
Actual low:	13.4	19.3	32	51.8	65.8	74.5	79.1	78.4	67.9	52.3	33.1	18.1
Average:	17	23	35.2	54.5	68.3	76.7	81.5	80.1	70.2	55.1	36.1	21.1

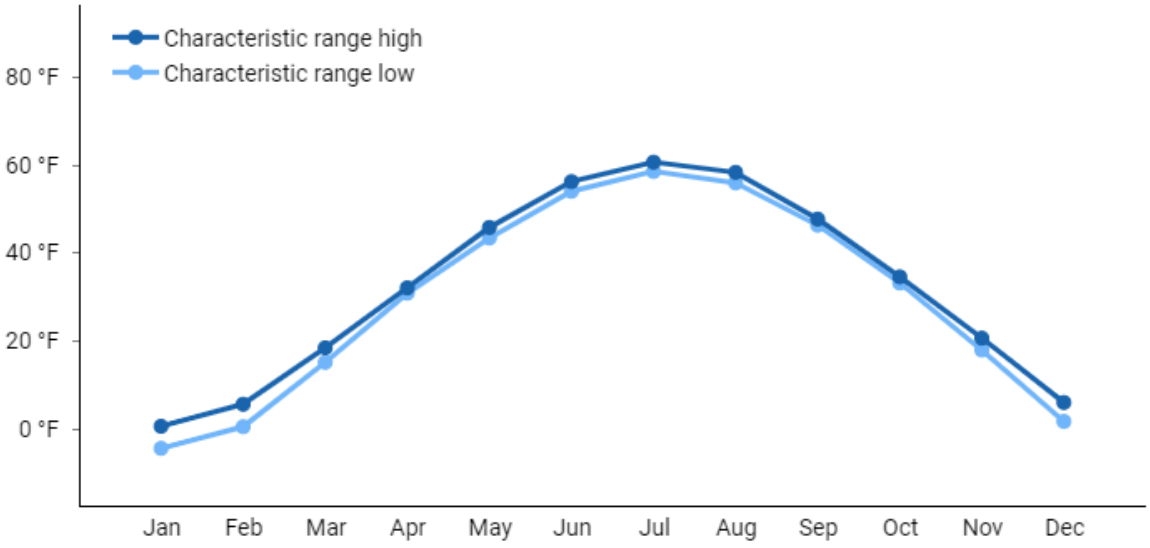
Normal Monthly Maximum Tempurature (F°)



Normal monthly minimum temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.6	5.6	18.4	32	45.7	56.1	60.5	58.2	47.6	34.5	20.6	6
Representative low:	-4.4	0.5	15.1	30.8	43.3	53.9	58.4	55.8	46.2	33.1	17.9	1.7
Actual high:	0.6	5.7	18.9	33.3	46.1	56.2	60.7	58.4	48.4	35.6	20.7	6.3
Actual low:	-5.4	-0.5	13.9	29.7	41.9	52.4	56.6	53.8	43.8	31.5	16.9	1.2
Average:	-1.5	3.6	16.9	31.5	44.2	54.5	58.9	56.3	46.5	33.9	19.4	4.3

Normal Monthly Minimum Temperature (F°)



Climate stations used

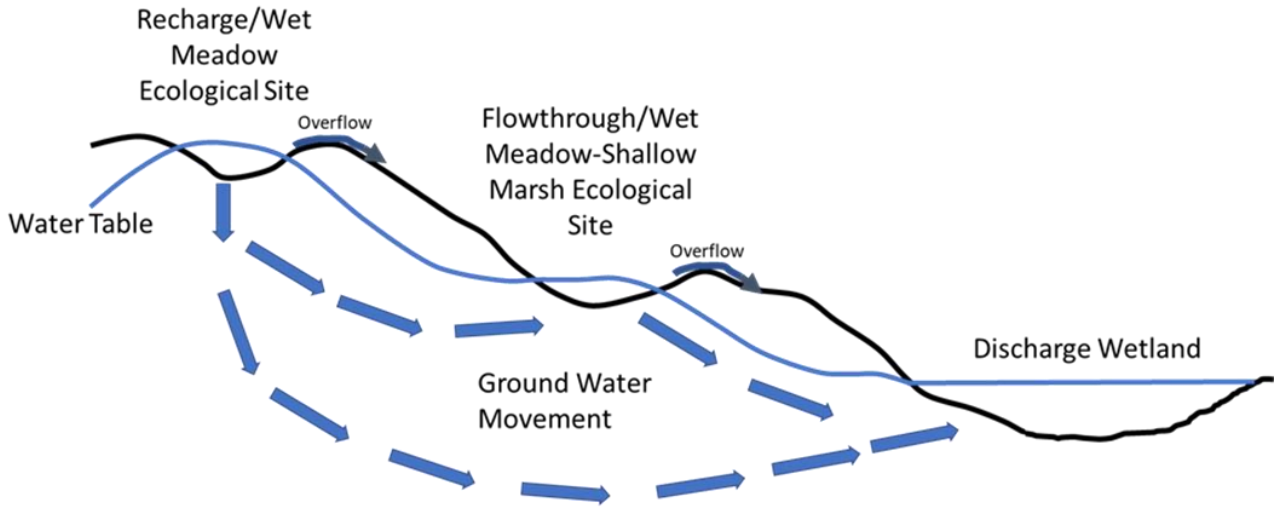
(1) VICTOR 4 NNE [USC00398652], Rosholt, SD
(2) PARK RIVER [USC00326857], Park River, ND
(3) GRAFTON [USC00323594], Grafton, ND
(4) WHEATON [USC00218907], Wheaton, MN
(5) AGASSIZ REFUGE [USC00210050], Grygla, MN
(6) PEMBINA [USW00014924], Pembina, ND

Influencing Water Features

This site is poorly drained. Many areas of this site receive additional water as surface runoff from adjacent uplands. Under normal climatic conditions, the soils in depressions are frequently ponded in April through June (into July for some soils). Depth of ponding typically is less than 1.5 feet during these months. In mid and late summer, ponded water commonly is not evident except after heavy rains. Ponding is typically rare or occasional on flats and swales; where present, ponding is less than 1 foot deep. Soils in this site occurring on flood plains have occasional, brief to frequent, long flooding.

When not ponded, a seasonal high-water table typically fluctuates with precipitation events between the surface and a depth of 1.5 feet during the months of April through June and is typically within a depth 3.5 feet through the remainder of the growing season. Some of the soils in this site have endosaturation (apparent water table) and some have episaturation (perched water table above a subsoil layer with slow permeability).

Surface infiltration ranges from slow to rapid. Permeability typically ranges from very slow to rapid; some soils have a coarser-textured substratum with very rapid permeability.



Surface/Subsurface Water Flow Diagram (Adapted from Seelig and DeKeyser 2006)

Wetlands receive water from different sources including ground water movement. Recharge wetlands (Wet Meadow) have groundwater flow predominantly away from the wetland moving toward or into a

discharge wetland basin. Flowthrough wetlands have groundwater flowing away from the wetland basin but is balanced with water flowing into the basin.

Due to the potential high rate of surface evaporation, areas of this site without frequent ponding are at risk of becoming saline if vegetative cover is reduced or removed.

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, especially in sandy soils. 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**).

Fluctuations in specific conductance are less pronounced during average or normal water conditions than during periods of excessive water depth or extreme drought. The approximate normal and extreme range in specific conductance (micromhos/cm3) of surface water in plant communities that are indicators of differences in average salinity are as follows:

Plant Community	Normal Range (micromhos/cm^3	Electroconductivity (dS/m)
Fresh	<40 - 500	< 0.5
Slightly brackish	500 - 2,000	0.5 to 2.0
Moderately brackish	2,000 - 5,000	2.1 to 5.0
Brackish	5,000 - 15,000	5.1 to 15.0
Sub-saline	15,000 - 45,000	15.1 to 45.0
Saline	45,000 -100,000	> 45.0

These depressions are considered temporary wetlands; however, during wetter than normal climate cycles, these soils may have seasonal ponding.

Representative Soil Features

Soils associated with Wet Meadow ES are predominantly in the Mollisol, Entisol, and Vertisol orders. The Mollisols are classified further as Argiaquic Argialbolls, Typic Argiaquolls, Typic Calciaquolls, Typic Endoaquolls, Cumulic Endoaquolls, Vertic Endoaquolls, Typic Epiaquolls, and Cumulic Vertic Epiaquolls. The Entisols are classified further as Mollic Endoaquents and Mollic Psammaquents. The Vertisols are further classified as Typic Calciaquerts, Typic Endoaquerts, and Typic Epiaquerts. These soils were developed under wetland vegetation. They formed in glaciolacustrine sediments, glaciolacustrine sediments over till, glaciofluvial deposits, deltaic deposits, eolian deposits, or flood plain alluvium.

The common feature of soils in this site are inundation or near-surface saturation in the early part of the growing season. The soils are very deep and poorly drained. Some are in depressions and potholes that are ponded from April through June (some soils into July); some are on low-flying flats which have prolonged saturation in the spring; and some are on flood plains with occasional or frequent flooding with brief or long duration. Since hydrology (surface and sub-surface) is the primary factor used in identifying this site, all textures are included. Therefore, soil physical properties associated with texture vary widely.

Soil salinity is none to slight (E.C. <8 dS/m) to a depth of >20 inches; in some soils it may increase to moderate (E.C. 8-16 dS/m) in the lower subsoil and substratum. Sodicity is none to moderately low

(SAR ≤7). Soil reaction typically is moderately acid to moderately alkaline (pH 5.6 to 8.4); but in a few soils may be strongly alkaline (pH 8.5 to 9.0) in the subsoil and/or substratum. The calcium carbonate content is none too high.

The soil surface is stable and intact. In some soils, sub-surface layers are non-restrictive to water movement; in other soils a layer of clay accumulation slows water movement and prolongs surface ponding. The soil/water/plant relationship is strongly influenced by ponded/and or saturated conditions.

Major soil series correlated to the Wet Meadow site are Arveson, Augsburg, Borup, Clearwater, Colvin, Cormant, Eaglepoint, Enloe, Espelie, Fargo, Flom, Grano, Hamar, Hegne, Kratka, Lamoure, Lindaas, Lowe, Ludden, Marysland, Mavie, McDonaldsville, Nielsville, Northcote, Perella, Reis, Rockwell, Roliss, Rosewood, Thiefriver, Tiffany, Tonka, Vallers, and Winger.

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

Parent Material Kind: glaciolacustrine, glaciofluvial, deltaic, eolian, alluvium
Parent Material Origin: glacial till, lacustrine, outwash
Surface Texture: clay to sand
Surface Texture Modifier: NA
Subsurface Texture Group: loamy, clayey, sandy
Surface Fragments >3" (% Cover): 0-5
Surface Fragments ≥3" (%Cover): 0-60
Subsurface Fragments <3" (% Volume): 0-15
Subsurface Fragments ≥3" (% Volume): 0-3

	Minimum	Maximum
Drainage Class:	poorly	poorly
Permeability Class:**	very slow	rapid
Depth to first restrictive layer (inches):	80	>80
Electrical Conductivity (mmhos/cm)*:	0	8
Sodium Absorption Ratio:**	0	7
Soil Reaction (1:1 Water):**	5.6	8.4
Soil Reaction (0.1M CaCl2):	NA	NA
Available Water Capacity (inches):**	1.5	12
Calcium Carbonate Equivalent (percent):**	0	45

*This attribute represents from 0-20 inches. Electrical Conductivity (E.C.) values are based on Saturated Paste method; the commonly used 1:1 field method will have E.C. values <4.
**These attributes represent from 0-40 inches.

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). The application of various management actions, combined with weather variables, impact the ecological processes which influence the competitive interactions, thereby maintaining or alter plant community structure.

Prior to European influence, the historical disturbance regime for MLRA 56A included frequent fires, both anthropogenic and natural in origin. Most fires, however, were anthropogenic fires set by Native Americans. Native Americans set fires in all months except perhaps January. These fires occurred in two peak periods, one from March-May with the peak in April and another from July-November with the peak occurring in October. Most of these fires were scattered and of small extent and duration. The grazing history would have involved grazing and browsing by large herbivores (such as American bison, elk, and whitetail deer). Herbivory by small mammals, insects, nematodes, and other invertebrates are also important factors influencing the production and composition of the communities. Grazing and fire interaction, particularly when coupled with drought events, influenced the dynamics discussed and displayed in the following state and transition diagram and descriptions.

Following European influence, this ecological site generally has had a history of grazing by domestic livestock, particularly cattle, which along with other related activities (e.g., fencing, water development, fire suppression) has changed the disturbance regime of the site. Changes will occur in the plant communities due to these and other factors.

Weather fluctuations coupled with managerial factors may lead to changes in the plant communities and may, under adverse impacts, result in a slow decline in vegetative vigor and composition. However, under favorable conditions the botanical composition may resemble that prior to European influence.

Five vegetative states have been identified for the site (Reference, Native/Invaded, Invaded, Invaded Wooded, and Go-Back). Within each state, one or more community phases have been identified. These community phases are named based on the more dominant 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. 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. Dynamics of the state were largely determined by variations in climate and weather (e.g., drought), as well as that of fire (e.g., timing, frequency) and grazing by native herbivores (e.g., frequency, intensity, selectivity). Due to those variations, the Reference State is thought to have shifted temporally and spatially between three plant community phases. These communities were generally dominated by herbaceous vegetation (i.e., graminoids); willows, bog birch, and other shrubs were often present in small amounts, however.

Presently the primary disturbances include widespread introduction of exotic plants, concentrated livestock grazing, lack of fire, and perhaps long-term non-use or very light grazing, and no fire. Because of these changes, particularly the widespread occurrence of exotic plants, as well as other environmental changes, the Reference State is becoming increasingly rare, but may still be found within tracts of intact natural vegetation (i.e., rangeland). The presence of exotic plants 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).

State 2: Native/Invaded State. Colonization of the site by exotic plants results in a transition from State 1: Reference State to State 2: Native/Invaded State (T1A). This transition is inevitable; it often results from colonization by exotic cool-season grasses (such as Kentucky bluegrass, smooth brome, quackgrass, and/or redtop) which have been particularly and consistently invasive under long-term non-use and very light grazing, and no fire. Forbs (e.g., field sowthistle, leafy spurge, Canada thistle) are also known to invade the site.

Three community phases have been identified for this state; they are similar to the community phases in the Reference State but have now been invaded by exotic cool-season grasses. These exotic cool-season grasses can be expected to increase. As that increase occurs, plants more desirable to wildlife and livestock may decline. A decline in forb diversity can also be expected. Under non-use or minimal use management, mulch increases and may become a physical barrier to plant growth. It also changes the micro-climate near the soil surface and may alter infiltration, nutrient cycling, and biological activity near the soil surface. As a result, these factors coupled with shading cause desirable native plants to have increasing difficulty remaining viable and recruitment declines.

To slow or limit the invasion of these exotic grasses or other exotic plants, it is imperative that managerial techniques (e.g., prescribed grazing, prescribed burning) be carefully constructed, monitored, and evaluated with respect to that objective. If management does not include measures to control or reduce these exotic plants, the transition to State 3: Invaded State should be expected (T2B). Small and scattered willows may also be on the site. These willows may become dominant, particularly under long-term non-use or very light grazing and no fire which may lead to a transition to State 4: Invaded Wooded State (T2A).

Maintenance of ecological sites on the periphery of the Wet Meadow 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 plants can be expected. For more information on buffer widths please refer to the Gilbert et.al. (2006) cited in the references section.

State 3: Invaded State. The threshold for this state is reached when both the exotic cool-season grasses exceed 30% of the plant community and native grasses represent less than 40% of the community. One plant community phase has been identified for this state.

The exotic cool-season grasses can be quite invasive and often form monotypic stands. As they increase, both forage quantity and quality of the annual production becomes increasingly restricted to late spring and early summer, even though annual production may increase. Forb diversity often declines. Under non-use or minimal use management, mulch can increase and become a physical barrier to plant growth, altering nutrient cycling, infiltration, and soil biological activity. As such, desirable native plants become increasingly displaced.

Once the state is well established, prescribed burning and prescribed grazing techniques have been largely ineffective in suppressing or eliminating the exotic cool-season grasses, even though some short-term reductions may appear successful. However, assuming there is an adequate component of native grasses to respond to treatments, a restoration pathway to State 2: Native/Invaded State (R3A) may be accomplished with the implementation of long-term prescribed grazing in conjunction with prescribed burning. Shrubs (e.g., willows, bog birch) may become dominant on this site, particularly under long-term non-use or very light grazing and no fire which may lead to a transition to State 4: Invaded Wooded State (T3A).

State 4: Invaded Wooded State. This state historically existed as small amounts of willows/bog birch scattered across the site when precipitation, fire frequency, and other factors enabled them to colonize or encroach on the site. A marked increase in non-use management and active fire suppression since European influence has enabled this state to expand and become more widespread. One community phase has been identified and often results from long-term non-use or very light grazing, and no fire (T2A, T3A). Brush control, perhaps followed by a successful range planting, may lead to State 2: Native/Invaded State (R4A).

State 5: Go-Back State often results following cropland abandonment and consists of one plant community phase. This weedy assemblage may include noxious weeds that need control. Over time, the exotic cool-season grasses (Kentucky bluegrass, smooth brome, quackgrass, and/or redtop) will likely predominate.

Initially, due to extensive bare ground and a preponderance of shallow rooted annual plants, infiltration is low and the potential for soil erosion is high. Plant species richness may be high, but overall diversity (i.e., equitability) is typically low, with the site dominated by a relatively small assemblage of species. Due to the lack of native perennials and other factors, restoring the site with the associated ecological processes is difficult. However, a successful range planting may result in something approaching State 2: Native/Invaded State (R5A). Following seeding, prescribed grazing, prescribed burning, haying, and the use of herbicides will generally be necessary to achieve the desired result and control weeds, some of which may be noxious weeds. A failed range planting and/or secondary succession will lead to State 4: Invaded State (R5B).

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 management practices (e.g., prescribed grazing, prescribed fire, 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.

When the management goal is to maintain an existing plant community phase or restore to another phase within the same state, modification of existing management to ensure native species have the competitive advantage may be required. To restore a previous state, the application of two or more management practices in an ongoing manner will be required. Whether using prescribed grazing, prescribed burning, or a combination of both with or without additional practices (e.g., brush management), 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 to track changes and adjust management inputs to ensure desired outcome will be necessary.

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

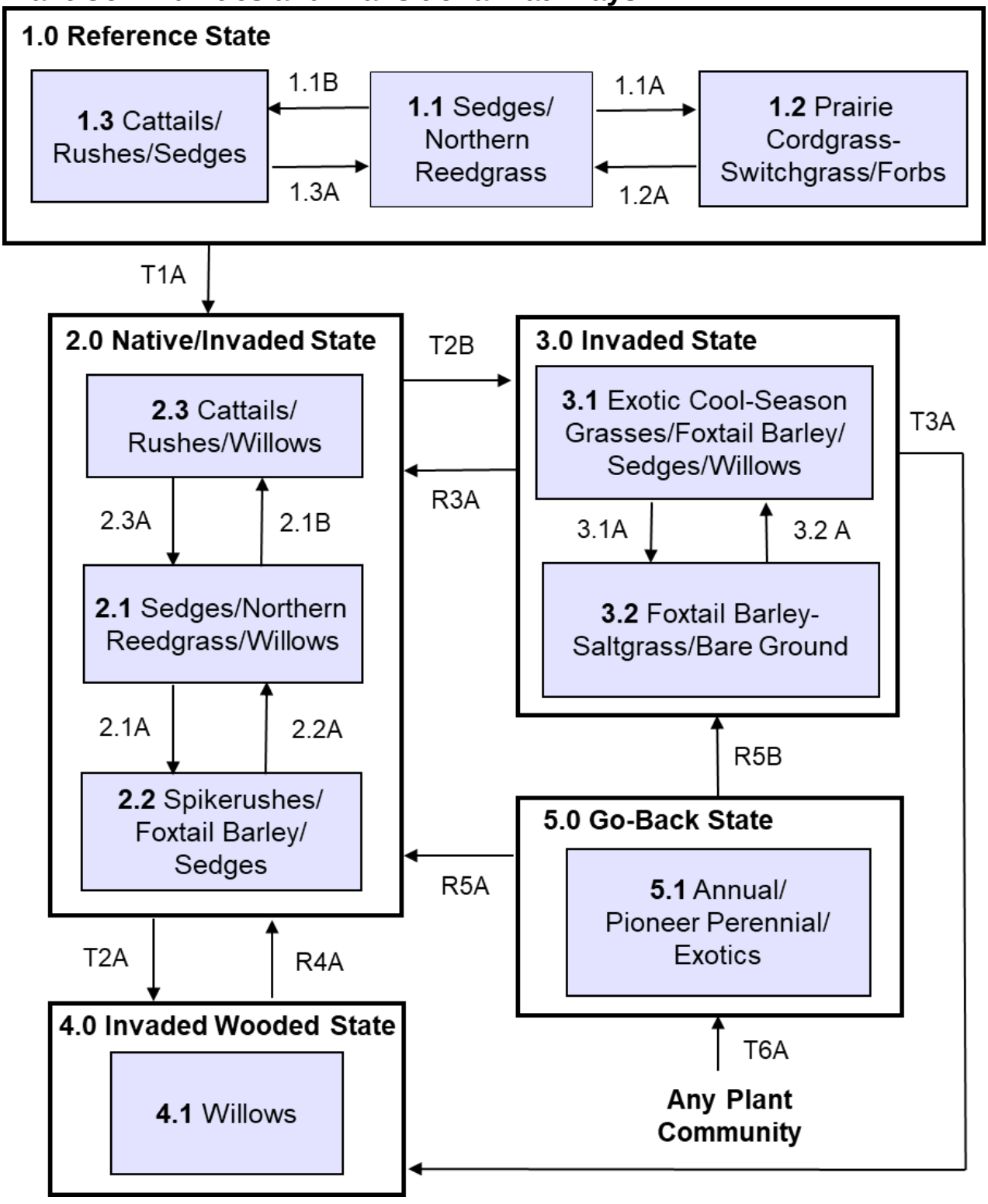


Diagram Legend - MLRA 56A Wet Meadow

T1A	Colonization by exotic plants
T2A	Long-term non-use or very light grazing and no fire
T2B	Increase and extent of exotic plants
T3A	Long-term non-use or very light grazing and no fire
T4A	Long-term non-use or very light grazing and no fire
T6A	Cessation of annual cropping
R3A	Long-term prescribed grazing and prescribed burning
R4A	Brush control, perhaps followed by range planting
R5A	Successful range planting
R5B	Failed range planting and/or secondary succession
CP 1.1 - 1.2 (1.1A)	Multiyear drought
CP 1.1 - 1.3 (1.1B)	Multiyear periods of above average precipitation
CP 1.2 - 1.1 (1.2A)	Return to average precipitation and historic disturbance regime
CP 1.3 - 1.1 (1.3A)	Return to average precipitation and historic disturbance regime
CP 2.1- 2.2 (2.1A)	Multiyear drought and increased grazing and/or mechanical disturbance
CP 2.1 - 2.3 (2.1B)	Multiyear periods of above average precipitation
CP 2.2 - 2.1 (2.2A)	Return to average precipitation and historic disturbance regime
CP 2.3 - 2.1 (2.3A)	Return to average precipitation and historic disturbance regime
CP 3.1 - 3.2 (3.1A)	Long-term heavy grazing, with or without drought
CP 3.2 - 3.1 (3.2A)	Long-term prescribed grazing

State 1: Reference State

This state is typically dominated by cool-season grass-likes and grasses with minor amounts of warm-season grasses in association with a variety of forbs and a few small, scattered shrubs, particularly willows. It represented the natural range of variability that dominates the dynamics of this ecological site prior to European influence. The primary disturbance mechanisms for this site in the reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing, coupled with weather events, dictated the dynamics that occurred within the natural range of variability. These factors cause the community to shift both spatially and temporally between three community phases.

Today the primary disturbance is a lack of fire, physical impacts of livestock grazing, mechanical harvest, and water level fluctuations including hydrological manipulations. In some instances, the mechanical harvest (haying) of these sites has similar impacts on the willows as fire, limiting their size and extent within the plant community. Because of the changes in disturbances, invasion by exotic species, and other factors, the reference state is becoming increasingly rare, but may be encountered within tracts of native vegetation.

Small and scattered willows (e.g., sandbar, Bebb), bog birch, and other shrubs may be present in communities of this state, particularly in the eastern portions of this MLRA under extended periods of non-use and no fire management. Unless brush control methods are implemented (e.g., prescribed burning intervals of 3-5 years), the willows may become dominant. Left unchecked, this may lead to State 2: Native/Invaded State (e.g., Community Phases 2.1 or 2.3) and perhaps on to State 4: Invaded Wooded State.

Characteristics and indicators (i.e., characteristics and indicators that can be used to distinguish this state from others). Because of changes in disturbances and other environmental factors

(particularly the widespread occurrence of exotic species), the Reference State is considered to no longer exist.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). If intact, the reference state should probably 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: Sedges/Northern Reedgrass (*Carex* spp./*Calamagrostis stricta*)

This community evolved with grazing by large herbivores, occasional prairie fires, and relatively frequent ponding events; it can be found on areas that are properly managed with grazing and/or prescribed burning and (sometimes) on areas receiving occasional short periods of rest. Woolly sedge is typically the dominant grass-like species, while northern reedgrass is the dominant grass. A variety of sedges and rushes occur throughout this community, as well as switchgrass and fowl bluegrass. Key forbs include rough bugleweed, western dock, Canada germander, and mints. Small, scattered willows, bog birch, and perhaps other shrubs are also often present.

This plant community phase is diverse, stable, and productive. The high water table/shallow ponding (ponding <18 inches) supplies much of the moisture for plant growth. The diversity in plant species allows for the variability of both the fluctuations of water table and reoccurring ponding. Annual production will vary from about 4200-6200 pounds per acre with grasses and grass-likes, forbs, and shrubs contributing about 80%, 15% and 5%, respectively. This community represents the plant community phase upon which interpretations are primarily based 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 Sedges/Northern Reedgrass		
COMMON/GROUP NAME	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*3640 - 4160*	*70 - 80*
GRASS-LIKES		**1**	**2080 - 2600**	**40 - 50**
woolly sedge	CAPE42	1	1560 - 2080	30 - 40
shortbeak sedge	CABR10	1	780 - 1300	15 - 25
wheat sedge	CAAT2	1	780 - 1300	15 - 25
Sartwell's sedge	CASA8	1	52 - 260	1 - 5
Bicknell's sedge	CABI3	1	52 - 260	1 - 5
bottlebrush sedge	CAHY4	1	52 - 260	1 - 5
fox sedge	CAVU2	1	52 - 260	1 - 5
smoothcone sedge	CALA12	1	52 - 260	1 - 5
upright sedge	CAST8	1	52 - 260	1 - 5
water sedge	CAAQ	1	52 - 260	1 - 5
rigid sedge	CATE6	1	52 - 260	1 - 5
limestone meadow sedge	CAGR3	1	52 - 260	1 - 5
COOL-SEASON GRASSES		***2***	***1040 - 1560***	**20 - 30**
northern reedgrass	CASTI3	2	780 - 1560	15 - 30
American sloughgrass	BESY	2	0 - 104	0 - 2
reed canarygrass	PHAR3	2	0 - 104	0 - 2
fowl bluegrass	POPA2	2	52 - 260	1 - 5
prairie wedgescale	SPOB	2	0 - 156	0 - 3
WARM-SEASON GRASSES		**3**	**260 - 780**	**5 - 15**
prairie cordgrass	SPPE	3	52 - 260	1 - 5
switchgrass	PAVI2	3	52 - 156	1 - 3
Mexican muhly	MUME2	3	0 - 52	0 - 1
mat muhly	MURI	3	0 - 52	0 - 1
green muhly	MUGL3	3	0 - 52	0 - 1
other native grasses	2GP	3	0 - 104	0 - 2
OTHER GRASS-LIKES		**4**	**52 - 260**	**1 - 5**
mountain rush	JUARL	4	52 - 260	1 - 5
spikerush	ELEOC	4	52 - 156	1 - 3
spikesedge	KYLLI2	4	52 - 156	1 - 3
common threesquare	SCPUB	4	0 - 52	0 - 1
Torry's rush	JUTO	4	0 - 52	0 - 1
pale rush	SCPA8	4	0 - 52	0 - 1
Dudley rush	JUDU2	4	0 - 52	0 - 1
Other grass-likes	2GL	4	0 - 52	0 - 1
FORBS		**5**	***520 - 780***	***10 - 15***
Canadian anemone	ANCA8	5	52 - 104	1 - 2
flat-top goldenrod	EUGRG	5	52 - 104	1 - 2
hempnettle	GALEO	5	52 - 104	1 - 2
American water horehound	LYAM	5	52 - 104	1 - 2
rough bugleweed	LYAS	5	52 - 104	1 - 2
field mint	MEAR4	5	52 - 104	1 - 2
panicled aster	SYLAL4	5	52 - 104	1 - 2
Canada germander	TECA3	5	52 - 104	1 - 2
American bog violet	VINE	5	52 - 104	1 - 2
dogbane	APOCY	5	0 - 52	0 - 1
swamp milkweed	ASIN	5	0 - 52	0 - 1
smooth horesetail	EQLA	5	0 - 52	0 - 1
western prairie fringed orchid	PLPR4	5	0 - 52	0 - 1
water knotweed	POAM8	5	0 - 52	0 - 1
tall cinquefoil	POAR7	5	0 - 52	0 - 1
swamp smartweed	POHY2	5	0 - 52	0 - 1
alkalai buttercup	RACY	5	0 - 52	0 - 1
western dock	RUAQ	5	0 - 52	0 - 1
blue skullcap	SCLA2	5	0 - 52	0 - 1
hedgenettle	STACH	5	0 - 52	0 - 1
narrowleaf cattail	TYAN	5	0 - 52	0 - 1
swamp verbena	VEHA2	5	0 - 52	0 - 1
other native forbs	2FN	5	0 - 52	0 2 1
SHRUBS		***6***	***0 - 260***	***0 - 5***
sandbar willow	SAIN3	6	0 - 52	0 - 1
willow	SALIX	6	0 - 52	0 - 1
Bebb willow	SABE2	6	0 - 52	0 - 1
meadow willow	SAPE5	6	0 - 52	0 - 1
bog birch	BENA	6	0 - 52	0 - 1
white meadowsweet	SPAL2	6	0 - 52	0 - 1
other shrubs	2SHRUB	6	0 - 52	0 - 1

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	3980 -	4420 -	5275
FORBS	220 -	650 -	650
SHRUBS	0 -	130 -	275
TOTAL	4200 -	5200 -	6200

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 Pathway 1.1 to 1.2 occurs during multiyear drought leading to a drop in the water table, resulting in marked increases in spikerush and foxtail barley along with corresponding decreases in sedges and northern reedgrass.

Community Phase Pathway 1.1B
Community Phase Pathway 1.1 to 1.3 occurs during multiyear periods of above average precipitation, leading to a rise in the water table and increased ponding frequency and duration. This results in marked decreases in sedges and northern reedgrass along with corresponding increases in cattail, rushes, and willows.

Community Phase 1.2: Prairie Cordgrass-Switchgrass/Forbs (*Spartina pectinata-Panicum virgatum*/Forbs)
This plant community phase occurs during prolonged drought; it is characterized by a shift from the mid-statured grass-likes and grasses (such as woolly sedge and Northern reedgrass) to species which would more often be associated with slightly drier sites (such as prairie cordgrass, switchgrass, and mat muhly in the Subirrigated ecological site). Spikerush and mountain rush are the dominant grass-like species. Common forbs include blackeyed Susan, goldenrods, Canada anemone, ragworts and swamp verbena. Small, scattered willows along with bog birch and other shrubs may also be present.

Community Phase Pathway 1.2A
Community Phase Pathway 1.2 to 1.1 occurs with a return to average precipitation and historic disturbance regime leading a rise in the water table. This results in marked increases in sedges and northern reedgrass along with corresponding decreases in prairie cordgrass and switchgrass.

Community Phase 1.3: Cattails/Rushes/Sedges (*Typha* spp./*Schoenoplectus* spp./*Carex* spp.)
This plant community phase is characterized by an increase in the more flood tolerant species, such as cattails and rushes. Small areas of open water may be present. Dominant species would include broadleaf cattail, common threesquare, softstem bulrush, common spikerush, duckweed, knotweed, and bladderwort. Woolly sedge and northern reedgrass are still present but in reduced amounts scattered across the site.

Small and scattered willows (e.g., sandbar willow), bog birch, and perhaps other shrubs may also be present in this community, particularly under extended periods of non-use and no fire management. Unless brush control techniques are implemented (e.g., burn interval of 3-5 years), the willows may become dominant. Left unchecked, this may lead to State 4: Invaded Wooded State via State 2: Native/Invaded State (Community Phases 2.1 or 2.3).

Community Phase Pathway 1.3A
Community Phase Pathway 1.3 to 1.1 occurs with the return to average (or below) precipitation and historic disturbance regime over several years leading to a drop in the water table and decreased ponding duration and frequency. As a result, the community shifts from cattails, rushes, and sedges to sedges and northern reedgrass.

Transition T1A
This is the transition from the State 1: Reference State to the State 2: Native/Invaded State. This is often due to the introduction and establishment of exotic cool-season grasses (typically Kentucky bluegrass, smooth brome, quackgrass, and/or redtop). Canada thistle and field sowthistle are also known to invade the site. This transition was inevitable and corresponded to a decline in native warm-

season and cool-season grasses. The threshold between states is crossed when exotic plants became established on the site.

This transition may be exacerbated by chronic season-long or heavy late season grazing. Extended periods of non-use and no fire is often associated with a marked increase in willows which may become dominant. If no action is taken to limit the increase in willows, a further transition to State 4: Invaded Wooded State may be expected.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). Current knowledge and technology will not facilitate a successful restoration to Reference State.

State 2: Native/Invaded State

This state is similar to State 1: Reference State but has now been colonized by the exotic cool-season grasses (commonly Kentucky bluegrass, smooth brome, quackgrass, and/or redtop) which are now present in small amounts. Field sowthistle, leafy spurge, and Canada thistle are also known to invade the site. Although the state is still dominated by native grasses, an increase in these exotic cool-season grasses can be expected.

The exotic cool-season grasses can be quite invasive on the site and are particularly well adapted to heavy grazing. They also often form monotypic stands. As these exotic cool-season grasses increase, both forage quantity and quality become increasingly restricted to late spring and early summer due to the monotypic nature of the stand, even though annual production may increase. Native forbs generally decrease in production, abundance, diversity, and richness compared to that of State 1: Reference State.

These exotic cool-season grasses have been particularly and consistently invasive under extended periods of non-use or very light grazing, and no fire. To slow or limit the invasion of these exotic grasses, it is imperative that managerial techniques (e.g., prescribed grazing, prescribed burning) be carefully constructed, monitored, and evaluated with respect to that objective. If management does not include measures to control or reduce these exotic cool-season grasses, the transition to State 3: Invaded State should be expected.

Small and scattered willows (e.g., sandbar, Bebb) may also be present, particularly under long-term non-use or very light grazing, and no fire. Unless brush control methods are implemented (e.g., prescribed burning of 3-5 year intervals), the willows may become invasive and the eventual transition to State 4: Invaded Wooded State can be expected (T2A).

Annual production of this state can be quite variable, in large part due to the amount of exotic cool-season grasses. Annual production may, however, range from 4600-5800 pounds per acre.

Characteristics and indicators (i.e., characteristics that can be used to distinguish this state from others). The presence of trace amounts of exotic cool-season grasses indicates a transition from State 1 to State 2. The presence of exotic biennial or perennial leguminous forbs (i.e., sweet clover, black medic) may not, on their own, indicate a transition from State 1 to State 2 but may facilitate that transition.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). To slow or limit the invasion of these exotic grasses, it is imperative that managerial techniques (e.g., prescribed grazing, prescribed burning) be carefully constructed, monitored, and evaluated with respect to that objective.

Grazing management should be applied that enhances the competitive advantage of native grass and forb species. This may include: (1) grazing when exotic cool-season grasses are actively growing and native cool-season grasses are dormant; (2) applying proper deferment periods allowing native grasses to recover and maintain or improve vigor; (3) adjusting overall grazing intensity to reduce excessive plant litter (above that needed for rangeland health indicator #14 – see Rangeland Health Reference Worksheet); (4) incorporating early heavy spring utilization which focuses grazing pressure on exotic cool-season grasses and reduces plant litter, provided that livestock are moved when grazing selection shifts from exotic cool-season grasses to native grasses.

Prescribed burning should be applied in a manner that maintains or enhances the competitive advantage of native grass and forb species. Prescribed burns should be applied as needed to adequately reduce/remove excessive plant litter and maintain the competitive advantage for native species. Timing of prescribed burns (spring vs. summer vs. fall) should be adjusted to account for differences in annual growing conditions and applied during windows of opportunity to best shift the competitive advantage to the native species.

Community Phase 2.1: Sedges/Northern Reedgrass/Willows (*Carex* spp./*Calamagrostis stricta*/*Salix* spp.)

This community phase is similar to Community Phase 1.1 but has been colonized by exotic cool-season grasses (often Kentucky bluegrass, smooth brome, redtop, and/or quackgrass). However, these exotics are present in smaller amounts with the community still dominated by native grasses. Field sowthistle, leafy spurge, and Canada thistle are also known to invade the site.

Figure 1. Example of Plant Community Phase 2.1, Sedge/Northern Reedgrass

Small and scattered willows (e.g., sandbar willow) are also present, particularly under non-use and no fire management. Unless a brush control program is implemented (e.g., prescribed burning at 3-5 year intervals), the willows may become invasive, eventually leading to the transition to State 4: Invaded Wooded State (T2A).

Annual production can be quite variable, in part due to variations in the invasion by exotic cool-season grasses. However, annual production may be in the range of 4600-5800 pounds per acre.

Figure 2. Example of Plant Community Phase 2.1, Sedge/Northern Reedgrass/Willow

Community Phase Pathway 2.1A

Community Phase Pathway 2.1 to 2.2 occurs during multiyear drought and increased grazing pressure and associated disturbances. This lowers the seasonal water table, potentially shifting the plant community to those species more often associated with a Subirrigated ecological site and may increase soil salinity. This shift may be further compounded by an increase in grazing intensity and frequency due to the decline in available forage on adjacent upland sites. The shift in the plant community is driven as much by the actual physical impact of the grazing animals (e.g., root shearing, trampling) as it is from the grazing itself. This pathway can also be initiated on smaller areas by the physical disturbance of motorized vehicle traffic or concentrated livestock activities (such as that associated with dugouts, creep feeders, etc.)

Community Phase Pathway 2.1B

Community Phase Pathway 2.1 to 2.3 occurs during multiyear periods of above average precipitation which raises the water table and increases ponding frequency and duration. This shifts the plant community to the more flood tolerant species (such as cattails, rushes, and willows).

Community Phase 2.2: Spikerushes/Foxtail Barley/Sedges (*Eleocharis* spp./*Hordeum jubatum*/*Carex* spp.)

Increased grazing and associated disturbances (e.g., trampling) have resulted in increased bare ground compared to Community Phase 2.1. The community can be characterized by an increase in disturbance tolerant species (such as spikerush, foxtail barley, muhly, Mountain rush, curly dock, verbena and annual forbs). Sedges and northern reedgrass are still present but in reduced amounts. Willows, if present, may become more conspicuous. Redtop, if present, will increase in this phase.

Community Phase Pathway 2.2A
Community Phase Pathway 2.2 to 2.1 occurs with the return to average precipitation and historic disturbance regime. This leads to marked increases in sedge, northern reedgrass, and willow with corresponding decreases in spikerush and foxtail barley.

Community Phase 2.3: Cattails/Rushes/Willows (*Typha* spp./*Schoenoplectus* spp./*Carex* spp.)
This plant community phase is characterized by an increase in the more flood tolerant species, such as cattails and rushes. Dominant species would include broadleaf cattail, American threesquare, softstem bulrush, common spikerush, duckweed, knotweed, and bladderwort. Exotic species such as narrowleaf cattail and hybrid cattail are also present. Woolly sedge and northern reedgrass are still present but in reduced amounts scattered across the site. Small areas of open water may also be present.


Figure 3. Community Phase 2.3: Cattails/Rushes/Willows

Small and scattered willows (e.g., sandbar, Bebb) are often present, particularly under non-use and no fire management. Unless a brush control program is implemented (e.g., prescribed burning at 3-5 year intervals), the willows may become invasive, eventually leading to the transition to State 4: Invaded Wooded State (T2A).

Community Phase Pathway 2.3A
Community Phase Pathway 2.3 to 2.1 occurs with the return to average (or below) precipitation and disturbance regime. Reduced ponding duration and frequency shifts the plant community from cattails, rushes, and willows to sedges, northern reedgrass, and willows. An increase in grazing and fire frequency can lead to greater declines in cattails.

This pathway is initiated by a return to normal or below normal precipitation regime over a period of several years. Reduced ponding duration and frequency shifts the plant community to sedge/ northern reedgrass. Increased fire along with grazing will negatively impact cattails, favoring sedge/northern reedgrass.

Transition T2A

This transition from State 2: Native/Invaded State to State 4: Invaded Wooded State occurs during long-term non-use or very light grazing and no fire. This enables the willows (e.g., sandbar, Bebb) to increase in the size and extent. The transition may be facilitated by periods of above average precipitation.

Sporadic attempts to shift the plant community back to the Reference State through the use of prescribed burning and/or mechanical treatment causes the willow to re-sprout with multiple stems and, ultimately, may hasten the transition.

Experience would indicate the threshold occurs when willows attain a height of greater than 30 inches and become multi-stemmed. At this point, the willows begin to suppress herbaceous production and limit fire intensity. If a fire does occur, it does not generate adequate heat to kill the willow or, if it top-kills the willow, re-sprouting results in an even thicker stand.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). The extended fire interval may make recovery doubtful due to the abundance of exotic cool-season grasses and lack of native grasses. Fire intensity along with consumption of available fuels may cause incomplete or patchy burns. Continued recruitment of tree seeds from adjacent sites will hamper site restoration.

Reticence to undertake tree removal and the perception that trees may be a desirable vegetation component for wildlife habitat, carbon sequestration, aesthetics, etc. are some of the constraints to recovery. Managers wanting to manage the site for deer, livestock, or grassland nesting birds will need to consider the intensive management required to restore and maintain the site in State 2. The disturbance regime necessary to restore this site to State 2: Native/Invaded State is very labor intensive and costly; therefore, addressing woody removal earlier in the encroachment phase is the most cost-effective treatment for woody control.

Transition T2B

This transition from the State 2: Native/Invaded State to State 3: Invaded State generally occurs as exotic plants expand and begin to dominate the site. This is often due to exotic cool-season grasses (such as quackgrass, Kentucky bluegrass, redtop, and/or smooth brome). However, hybrid cattail, exotic strains and hybrids of reed canarygrass, Canada thistle, field sowthistle, and leafy spurge are also known to invade the site.

Studies indicate that a threshold may exist in this transition 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 other exotic species. This transition may occur under a wide range of managerial conditions ranging from non-use and no fire to heavy season-long grazing (primarily Kentucky bluegrass).

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). Variations in growing conditions (e.g., cool, wet spring) will influence effects of various management activities on exotic cool-season grass populations.

State 3: Invaded State

This state is the result of invasion and dominance by the exotic cool-season grasses (commonly Kentucky bluegrass, smooth brome, redtop, and/or quackgrass). Canada thistle, field sowthistle, leafy spurge, and exotic strains or hybrids of reed canarygrass and hybrid cattail are also known to invade the site. The exotic cool-season grasses can be quite invasive on the site and are particularly well adapted to heavy grazing. They also often form monotypic stands. As these exotic cool-season grasses increase, both forage quantity and quality become increasingly restricted to late spring and early summer due to the monotypic nature of the stand, even though annual production may increase. Native forbs generally decrease in production, abundance, diversity, and richness compared to that of State 1: Reference State. Common forbs often include goldenrod, sunflower, and Indian hemp. Willows and white meadowsweet may also be present. Once the state is well established, prescribed burning and grazing techniques have been largely ineffective in suppressing or eliminating these species, even though some short-term reductions may appear successful.

Annual production of this state may vary widely, in part due to variations in the extent of invasion by exotic cool-season grasses.

Characteristics and indicators (i.e., characteristics that can be used to distinguish this state from others). This site is characterized by exotic cool-season grasses constituting greater than 30 percent of the annual production and native grasses constituting less than 40 percent of the annual production.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). Light or moderately stocked continuous, season-long grazing or a prescribed grazing system which incorporates adequate deferment periods between grazing events and proper stocking rate levels will maintain this State. Application of herbaceous weed treatment, occasional prescribed burning, and/or brush management may be needed to manage noxious weeds and increasing shrub (e.g., western snowberry) populations.

Plant Community Phase 3.1 Exotic Cool-Season Grasses/Foxtail Barley/Sedges/Willows (Exotic Cool-Season Grasses/*Hordeum jubatum*/*Carex* spp./*Salix* spp.)

This community phase is characterized by an increase in disturbance tolerant exotic grasses (such as Kentucky bluegrass, quackgrass, redtop, and/or smooth brome) in association with foxtail barley, sedges, and willows (e.g., sandbar, Bebb). Exotic strains and/or hybrids of reed canarygrass may also increase and become the dominant species. If soil salinity increases due to lack of plant cover and increased bare ground, foxtail barley may be a major component. Native species (such as spikerush, muhly, mountain rush, curly dock, and other native forbs) are often present. Canada thistle, leafy spurge, and field sowthistle are exotic forbs known to invade the site.

Community Phase Pathway 3.1A

Community Phase Pathway 3.1 to 3.2 occurs with the long-term heavy grazing with or without drought. This results in a marked increase in the upward movement of salts leading to increases in foxtail barley, saltgrass, and bare ground and corresponding decreases in the exotic cool-season grasses, sedges, willows, and other less salt tolerant plants.

Plant community Phase 3.2 Foxtail Barley-Saltgrass/Bare Ground (*Hordeum jubatum-Distichlis spicata*/Bare Ground)

This community phase results from long-term heavy grazing with or without drought which causes an increased movement of salts in the soil. Compared to Community Phase 3.1 there has been marked

increases in foxtail barley and saltgrass with corresponding decreases in the exotic cool-season grasses, sedges, willows, and other less salt tolerant plants.

Community Phase Pathway 3.2A

Community Phase Pathway 3.2 to 3.1 occurs with the implementation of long-term prescribed grazing. This results in a downward movement of salts leading to increases in the exotic cool-season grasses, sedges, willows, and other less salt tolerant plants with corresponding decreases in foxtail barley, saltgrass, and bare ground.

Transition T3A

This transition from State 3: Invaded State to State 4: Invaded Wooded State is characterized by long-term non-use or very light grazing, and no fire. This enables willows (e.g., sandbar, Bebb) to increase in density and size, and eventually dominate the vegetation of the site.

Constraints to recovery (i.e., variables or processes that preclude recovery of the former state). The extended fire interval may make recovery doubtful due to the abundance of exotic cool-season grasses and lack of native grasses. Fire intensity along with consumption of available fuels may cause incomplete or patchy burns. Continued recruitment of tree seeds from adjacent sites will hamper site restoration.

Constraints to recovery include the reticence to undertake tree removal and the perception that trees may be a desirable vegetation component for wildlife habitat, carbon sequestration, aesthetics, etc. Managers wanting to manage the site for deer, livestock, or grassland nesting birds will need to consider the intensive management required to restore and maintain the site in State 2. The disturbance regime necessary to restore this site to State 2: Native/Invaded State is very labor intensive and costly; therefore, addressing woody removal earlier in the encroachment phase is the most cost-effective treatment for woody control.

Restoration R3A

This restoration pathway from State 3: Invaded State to State 2: Native/Invaded State may be accomplished with the implementation of long-term prescribed grazing and prescribed burning, assuming there is an adequate component of native grasses to respond to the treatments. Successful restoration along this pathway is dependent upon management of the buffer or adjacent upland eliminating sedimentation and nutrient loading to the Wet Meadow ecological site and limiting invasive species movement from the adjacent upland sites.

Both prescribed grazing and prescribed burning are likely necessary to successfully initiate this restoration pathway, the success of which depends upon the presence of a remnant population of native grasses in Community Phase 3.1. That remnant population, however, may not be readily apparent without close inspection. The application of several prescribed burns may be needed at relatively short intervals in the early phases of this restoration process, in part because thew willows will resprout following one burn. Early season prescribed burns have been successful; however, fall burning may also be an effective technique.

The prescribed grazing should include adequate recovery periods following each grazing event and stocking levels which match the available resources. If properly implemented, this will shift the competitive advantage from the exotic cool-season grasses to the native cool-season grasses.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Grazing management should be applied in a manner that enhances/maximizes the competitive advantage of native grass and forb species over the exotic

species. This may include the use of prescribed grazing to reduce excessive plant litter accumulations above that needed for rangeland health indicator #14 (see Rangeland Health Reference Worksheet). Increasing livestock densities may facilitate the reduction in plant litter provided length and timing of grazing periods are adjusted to favor native species.

Grazing prescriptions designed to address exotic grass invasion and favor native species may involve earlier, short, intense grazing periods with proper deferment to improve native species health and vigor. Fall (e.g., September, October) prescribed burning followed by an intensive, early spring graze period with adequate deferment for native grass recovery may shift the competitive advantage to the native species, facilitating the restoration to State 2: Native/Invaded.

Prescribed burning should be applied in a manner that enhances the competitive advantage of native grass and forb species over the exotic species. Prescribed burns should be applied at a frequency which mimics the natural disturbance regime, or more frequently as is ecologically (e.g., available fuel load) and economically feasible. Burn prescriptions may need adjustment to: (1) account for change in fine fuel orientation (e.g., “flopped” Kentucky bluegrass); (2) fire intensity and duration by adjusting ignition pattern (e.g., backing fires vs head fires); (3) account for plant phenological stages to maximize stress on exotic species while favoring native species (both cool- and warm-season grasses).

The longer this community phase exists, the more resilient it becomes. Natural or management disturbances that reduce the cover of Kentucky bluegrass or smooth brome are typically short-lived.

State 4: Invaded Wooded State

This state is characterized by a dominance (both visually and in production) of willow species and a greatly reduced herbaceous understory. Remnant sedges still dominate the herbaceous portion of the state but shade tolerant invasive species, such as Kentucky bluegrass and/or redtop, may also be present.

Characteristics and indicators (i.e., characteristics and indicators that can be used to distinguish this state from others). The dominance of woody species (by cover and production) distinguishes this state from other herbaceously dominated states.

Resilience management (i.e., management strategies that will sustain a state and prevent a transition). This state is resistant to change in the long-term absence of fire. Restoration efforts would require the use of prescribed fire, mechanical treatment, and prescribed grazing. Considerable time and effort will be required to restore to other States.

Community Phase 4.1: Willows (*Salix* spp.)

This plant community phase is dominated by sandbar and Bebb willow. Other shrubs (e.g., white meadowsweet) may also be present. Herbaceous production is greatly reduced due to shading, with various sedges and rushes still dominating the remnant herbaceous community. Willow height may exceed six feet. As willows mature, herbaceous production may decline to less than 500 pounds per acre. Bare ground is minimal (less than 2%) due to plant litter accumulation from willow leaves.

Figure 4. Community Phase 4.1: Willows

Once established, this plant community is very resilient and resistant to change. The lack of fine fuels in the understory and high degree of shading makes the application of prescribed fire very difficult, if not impossible, without some type of mechanical pretreatment a year to two prior to the burn. Some type of treatment which would reduce the willow canopy and allow the remnant herbaceous community to produce adequate fine fuel loads to permit the repeated application of prescribed fire may begin to shift the plant community toward State 2: Native/Invaded State.

Restoration R4A

This restoration pathway from State 4: Invaded Wooded State to State 2: Native/Invaded State can be accomplished with brush control. Initial use of herbicides and/or mechanical brush control to reduce willows will permit adequate fine fuel loads to establish, permitting the application of prescribed fire to further control sprouting. However, depending upon level of remnant native grasses and forbs, a range planting may also be necessary to re-establish the herbaceous plant community.

A combination of mechanical brush management, chemical treatment, and prescribed burning is necessary to remove the willows and, if necessary, to prepare the seedbed for a successful range planting. Once this is accomplished, it may be possible using selected plant materials and agronomic practices to approach something very near the functioning of State 2: Native/Invaded State. Application of chemical herbicides and the use of mechanical seeding methods using adapted varieties of the dominant native grasses are possible and can be successful. The application of several prescribed burns may be needed at relatively short intervals in the early phases of this restoration process, in part because of sprouting of the willows following one burn. After establishment of the native plant species, management objectives must include the maintenance of those species, the associated reference state functions, and continued treatment of exotic grasses. Due to the resprouting nature of willows, repeated treatments may be necessary to complete the restoration.

Figure 5. Restoration R4A – Note: spring burn resulted in top kill of willows, vigorous resprouting will need repeated fire coupled with prescribed grazing.

Following the removal of woody species, other restoration practices such as range planting, prescribed burning, and prescribed grazing may be necessary to complete the restoration. The prescribed grazing should include adequate recovery periods following each grazing event and stocking levels which match the available resources. If properly implemented, this will help suppress any exotic cool-season grasses on the site.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Prescribed burning should be applied in a manner that enhances the competitive advantage of native grass and forb species over the exotic species. Prescribed burns should be applied at a frequency which mimics the natural disturbance regime or more frequently as is ecologically (e.g., available fuel load) and economically feasible. Burn prescriptions may need adjustment to: (1) account for change in fuel type (herbaceous vs. shrub vs. tree), fine fuel amount and orientation ; (2) fire intensity and duration by adjusting ignition pattern (e.g., backing fires vs head fires); (3) account for plant phenological stages to maximize stress on woody and exotic species while favoring native species (both cool- and warm-season grasses).

The method of brush management will be site specific but generally the goal would be to apply the pesticide, mechanical control or biological control (either singularly or in combination) in a manner that shifts the competitive advantage from the targeted species to the native grasses and forbs. The control method(s) should be as specific to the targeted species as possible to minimize impacts to non-target species.

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. Adding non-native species can impact the above and below ground biota. Some evidence suggests the addition of exotic legumes to the seeding mixture may favor exotic cool-season grass expansion/invasion.

State 5: Go-Back State

This state is highly variable depending on the level and duration of disturbance related to the T6A transitional pathway. In this MLRA, the most probable origin of this state is plant succession following cropland abandonment. This plant community will initially include a variety of annual forbs and grasses, some of which may be noxious weeds and need control. Over time, the exotic cool-season grasses (Kentucky bluegrass, smooth brome, quackgrass, and/or redtop) will likely predominate.

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 and water infiltration. 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 5.1: Annual/Pioneer Perennial/Exotics

This community phase is highly variable depending on the level and duration of disturbance related to the T6A transitional pathway. In this MLRA, the most probable origin of this phase is secondary succession following cropland abandonment. This plant community will initially include a variety of annual forbs and grasses, including noxious weeds (e.g., Canada thistle, leafy spurge) which may need control. Over time, the exotic cool-season grasses (Kentucky bluegrass, smooth brome, quackgrass, and/or redtop) will likely predominate.

Restoration R5A

This restoration from State 5: Go-Back State to State 2: Native/Invaded State can be accomplished with a successful range planting. Following seeding, prescribed grazing, prescribed burning, haying, or use of herbicides will generally be necessary to achieve the desired result and control any noxious weeds.

It may be possible using selected plant materials and agronomic practices to approach something very near the functioning of State 2: Native/Invaded State. Application of chemical herbicides and the use of mechanical seeding methods using adapted varieties of the dominant native grasses are possible and can be successful. After establishment of the native plant species, prescribed grazing should include adequate recovery periods following each grazing event and stocking levels which match the available resources, and management objectives must include the maintenance of those species, the associated reference state functions, and continued treatment of exotic grasses.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). 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. Adding non-native species can impact the above and below ground biota. Elevated soil nitrogen levels have been shown to benefit smooth brome and Kentucky bluegrass more than some native grasses. As a result, fertilization, exotic legumes in the seeding mix, and other techniques that increase soil nitrogen may promote smooth brome and Kentucky bluegrass invasion.

The method or methods of herbaceous weed treatment will be site specific to each situation; generally, the goal would be to apply the pesticide, mechanical control, or biological control (either singularly or in combination) in a manner that shifts the competitive advantage from the targeted species to the native grasses and forbs. The control method(s) should be as specific to the targeted species as possible to minimize impacts to non-target species.

Restoration R5B

A failed range planting and/or secondary succession will lead to State 3: Invaded State.

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). 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 T6A

This transition from any plant community to State 5: 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), sedimentation, and/or herbicide/pesticide carryover. Thus, soil conditions should be assessed when considering restoration techniques.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

Landscape

The MLRA 56A landscape is characterized by a nearly level glacial lake plain bordered on the east and west by outwash plains, till plains, gravelly beaches, and dunes. MLRA 56A 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 tall-grass prairie vegetation with bur oak, green ash, and willow growing in drainageways. This area is formed in silty and clayey lacustrine sediments from the former Glacial Lake Agassiz. Complex intermingled ecological sites create diverse grass/shrub land habitats interspersed with varying densities of linear, slope, depressional, and in-stream wetlands associated with headwater streams and tributaries to the Red River of the North. MLRA 56A is located within the boundaries of the Prairie Pothole Region and is an ecotone between the humid east and the sub-humid west regions. The primary land use is annual cropland (~80%). The Red River Valley is known for its exceptional fertility with major crops including corn, soybeans, small grains, and sugar beets.

By the mid-19th century, the majority of the Red River Valley had been converted from tall-grass prairie to annual crop production. To alleviate crop production loss from wetlands and overland

flow, a system of shallow surface ditches, judicial ditches, and road ditches removes surface water in spring and during high rainfall events. The major soils are poorly drained with extensive areas of saline soils. Tile drainage systems have been or are being extensively installed throughout MLRA 56A for sub-surface field drainage to enhance annual crop production.

The east and west side of the Red River Valley formed in a complex pattern of sandy beach material, stratified inter-beach material, lacustrine silts, and lake washed glacial till. The soils vary from excessively drained on ridges to very poorly drained organic basins. Surface ditches serve to drain some of the area, although much of the area lacks adequate drainage for maximum crop production. Calcareous fens and saline seeps can occur at the base of beach ridges and result in rare plant communities. Native vegetation was mixed- and tall-grass prairie with scattered woodland and brush.

Historic Communities/Conditions within MLRA 56A:

The northern tall- and 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). Frequent and expansive flooding along the Red River and its tributaries provided abundant opportunities for Native Americans to harvest wild rice. American bison roamed MLRA 56A wintering along the Red River and migrating west into MLRA 55A and 55B for parts of the season. 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 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 and American black bear) and smaller carnivores (such as the coyote, bobcat, red fox, and raptors). Extirpated species include free-ranging American bison and gray wolf (breeding). Extinct from the region is the Rocky Mountain locust.

Present Communities/Conditions within MLRA 56A:

MLRA 56A has the most conversion to cropland of any MLRA within Region F-Northern Great Plains. European influence has impacted remaining grassland and shrubland by domestic livestock grazing, elimination of fire, removal of surface and subsurface hydrology via artificial drainage, and other anthropogenic factors influencing plant community composition and abundance.

Extensive drainage has taken place. Streams have been straightened (removing sinuosity) and riparian zones have been converted to annual crop production. These anthropogenic impacts have reduced flood water detention and retention on the landscape, increasing storm water runoff, sediment, and nutrient loading to the Red River and its tributaries. The installation of instream structures has reduced aquatic species movement within the MLRA.

Annual cropping is the main factor 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, Kentucky bluegrass, and leafy spurge which further impacted plant and animal communities. The loss of the bison 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 approximately 70,000 acres of the United States Forest Service, Sheyenne National Grassland (southern portion of MLRA) with an additional 65,000 acres of intermingled privately owned land of sandy soils providing a large tract of intact tall grass prairie within the MLRA. United Fish and Wildlife Service refuges and waterfowl production areas, along with and state wildlife management areas cover approximately 67,000 acres within the MLRA. Two of three largest cities in North Dakota are located within the MLRA.

USDA conservation programs have seeded thousands of cropland acres in riparian zones to native herbaceous vegetation. Natural succession is replacing the planted native herbaceous vegetation to native woody vegetation re-establishing native wooded riparian areas on previously cropland. Most of the plantings have been along the Red River and its tributaries in the northern portions of the MLRA within the United States. These areas are privately owned and protected from annual agricultural production with perpetual conservation easements.

Some characteristic wildlife species in this area are:

Birds: Mallard, blue-winged teal, red-tailed hawk, American kestrel, ring-necked pheasant, western meadowlark, killdeer, eastern and western kingbird, American crow, common yellowthroat, downy and hairy woodpecker, clay-colored sparrow, vesper sparrow, Savannah sparrow, and brown-headed cowbird.

Mammals: Northern short-tailed shrew, white-tailed jackrabbit, snowshoe hare, Franklin's ground squirrel, thirteen-lined ground squirrel, northern pocket gopher, plains pocket gopher, western harvest mouse, deer mouse, meadow vole, meadow jumping mouse, western jumping mouse, coyote, red fox, raccoon, American badger, striped skunk, white-tailed deer, North American beaver, and moose.

Reptiles/Amphibians: American toad, Great Plains toad, northern leopard frog, chorus frog, tree frog, tiger salamander, plains garter snake, and common garter snake.

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 most species are usually larger than one ecological site or are dependent upon 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. Extensive use of insecticides for specialty crops (such as potatoes, sugar beets, and other crops) has greatly reduced insects within this MLRA.

Species of Concern within MLRA 56A:

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 Minnesota State Wildlife Action Plan, Conservation Focus Areas, Target Species (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 56A at the time this section was developed:

Invertebrates: Arogos skipper, Assiniboia skipper, Dakota skipper, dusted skipper, Leonard's skipper, monarch butterfly, Poweshiek skippering, red-tailed leafhopper, regal fritillary, and Uhler's Arctic.

Birds: American kestrel, American bittern, bobolink, American white pelican, bald eagle, black-billed cuckoo, chestnut-collared longspur, Dickcissel, grasshopper sparrow, greater prairie-chicken, Henslow's sparrow, LeConte's sparrow, loggerhead shrike, marbled godwit, Nelson's sparrow, northern harrier, northern pintail, red-headed woodpecker, sharp-tailed grouse, short-eared owl, Swainson's hawk, upland sandpiper, western meadowlark, willet, Wilson's phalarope, and yellow rail.

Mammals: Arctic shrew, big brown bat, eastern spotted skunk, gray fox, little brown bat, northern grasshopper mouse, plains pocket mouse, prairie vole, pygmy shrew, Richardson's ground squirrel, and river otter.

Amphibians/Reptiles: Canadian toad, common snapping turtle, northern prairie skink, and plains hognose snake.

Fish: Blacknose shiner, blue sucker, burbot, chestnut lamprey, finescale dace, hornyhead chub, largescale stoneroller, logperch, northern pearl dace, northern redbelly dace, pearl dace, shortnose gar, sickle-fin chub, sliver chub, silver lamprey, trout-perch, and yellow bullhead.

Mussels: Black sandshell, creek heelsplitter, creeper, mapleleaf, pink heelsplitter, pink papershell, threeridge, and Wabash pigtoe.

Grassland Management for Wildlife in MLRA 56A:

Management activities within the community phase pathways have both short and long term positive and negative impacts on 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 (grazing intensity, reseeding, prescribed fire, woody vegetation removal, etc.). Timing, intensity, and frequency of these inputs can have dramatic positive or negative effects on vegetative structure impacting local wildlife species' habitats. 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 individual species.

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 supporting a dominance of herbaceous vegetation (Wet Meadow, Subirrigated Sands) can be located adjacent to ecological sites that support trees (Choppy Sands and Loamy Overflow).

Management of these complex ecological sites can provide a heterogeneous or a homogenous landscape. Grassland bird use reduces as the plant community transitions to a homogenous state or increases in woody vegetation. Managers need to 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 (e.g., alteration of a grazing regime within

a Choppy Sands 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 need to 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 must 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 or the 2.0 Native/Invaded State. 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, or foraging 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., western snowberry) in this MLRA.				

Wet Meadow Wildlife Habitat Interpretation:

Wet Meadow ecological sites are poorly drained soils located in depressions, on low-lying flats, and on floodplains. Associated ecological sites include Clayey, Limy Subirrigated, Loamy Overflow, Saline Lowland, Loamy, Sodic Subirrigated, Subirrigated, Subirrigated Sands, Shallow Marsh, and Choppy Sands. This complex of ecological sites provides habitat for many edge-sensitive, grassland bird species preferring medium- to tall-statured vegetation.

Wet Meadow habitat features and components commonly support grassland-nesting birds, notably birds utilizing wetland vegetation habitats such as Nelson's sparrow and sedge wren. Sharp-tailed grouse and greater prairie chicken use this site for wintering and escape cover. 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. Wet Meadow sites support Great Plains white fringed orchids. However, extended periods of high moisture will result in some Wet Meadow sites being ponded for a sustained period. This results in the site being too wet to support Great plains white fringed orchids (i.e., 1.3 and 2.3 phases).

Wet Meadow ecological sites may be found in five plant community states (1.0 Reference State, 2.0 Native/Invaded State, 3.0 Invaded State 4.0 Invaded Wooded State, and 5.0 Go-Back State) within a local landscape. Multiple plant community phases exist within State 1.0 and 2.0. Today, these states occur primarily in response to precipitation (extended periods of above normal precipitation and drought), fire, grazing, non-use, and other anthropogenic disturbances.

Since there is no known restoration pathway from State 2.0 to State 1.0, it is important to intensively manage using tools in State 1.0 and State 2.0 Community Phase Pathways to prevent further plant community degradation along the T2B Transitional Pathway to State 3.0 or the T3A Transitional Pathway to State 4.0. Native wildlife generally benefits from the heterogeneous grasslands found States 1.0 and 2.0 that include diverse grass and forb species of varying stature and density. Plant communities within State 2.0 are dependent upon long-term changes in precipitation, compounded by grazing intensity and frequency and mechanical treatment. The transition to wetter or drier conditions results in a plant community that is either taller (wetter) in stature (such as Plant Community Phase 2.3 Cattails/Rushes/Willows) or shorter (drier) in stature (such as 2.2 Spikerushes/Foxtail Barley/Sedges).

Success along Restoration Pathway R3A from State 3.0 to State 2.0 and R4A from State 4.0 to State 2.0 is very difficult and is dependent upon presence of a remnant native grass population and degree of management treatments applied. Return to State 2.0 will also be very dependent on the wet or dry cycles during restorations treatments.

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.

1.0 Reference State

Community Phase 1.1 Sedges/Northern Reedgrass: This plant community offers quality vegetative cover for wetland wildlife; every effort should be made to maintain this ecological site within this community phase. This phase retains high functionality through continued maintenance including prescribed grazing with adequate recovery period, as well as prescribed fire. Prescribed fire maintains a grass-dominated plant community providing habitat for wetland bird species sensitive to woody vegetation.

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 or tall or meadow blazing star occupy this site.

During long-term periods of above normal precipitation, this Wet Meadow ecological site provides habitat for a diverse suite of aquatic invertebrates providing an important trophic link between macrophytes and vertebrates that depend upon them as food. The vegetative structure provided by shallow, heavily vegetated wetlands increases the abundance of aquatic invertebrates compared to less vegetated sites.

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, northern harrier, sedge wren, willet, etc). During multiyear periods of above normal precipitation, this site will provide waterfowl and shorebird habitat. Prescribed burning maintains a grass-dominated plant community providing habitat for bird species sensitive to woody vegetation. This plant community does not provide suitable areas for sharp-tailed grouse or greater prairie chicken lek sites or nesting habitat. However, it does provide winter cover and escape and brood-rearing habitat. 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. Tall- to mid-statured vegetation provides 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 and Canadian toad. Depending on the duration of surface water, this site may provide breeding habitat. Successful egg laying and tadpole development habitat is dependent upon depth and duration of ponded water.

Fish and Mussels: This ecological site can be directly associated with streams, rivers, or water bodies. This site receives run-on hydrology from adjacent ecological sites and provides hydrology to shallow ground water and other surface waterbodies. Management on Wet Meadow sites, in conjunction with neighboring run-on sites, will have a direct effect on aquatic species in streams and/or tributaries receiving water from Wet Meadow sites. Optimum hydrological function and nutrient cycling limit potential for sediment yield and nutrient loading to the adjacent aquatic ecosystems from Community Phase 1.1.

Community Phase 1.2 Prairie Cordgrass/Switchgrass/Forbs: This plant community phase occurs during periods of below average precipitation lowering the water table. The lower water table allows the plant community to shift towards upland species (such as switchgrass and mid-statured grass-likes, mountain rush and spikerushes). The forb community remains robust favoring pollinator insects. This plant community provides a quality food source for grassland nesting birds.

Invertebrates: Provides similar life requisites as Community Phase 1.1. However, drying of the soil during periods of prolonged below average precipitation allows for increases in forbs which provides increased pollen and nectar sources and increased bare ground for ground-nesting insects.

Birds: Provides similar life requisites as Community Phase 1.1. In addition, the drying of the soil during periods of prolonged below average precipitation provides additional opportunities for grassland nesting birds that use mid-to tall-statured herbaceous vegetation found in a mesic vs. hydric habitats.

Mammals: A mix of wetland and tall-statured vegetation provides quality thermal, protective, escape, and winter habitat for big game animals and other, smaller herbivores. Depending on the degree of saturation and/or ponding, use may be limited by some species. Tall- to mid-statured vegetation provides suitable food for small and large herbivores.

Amphibians and Reptiles: Drying of the soil during periods of prolonged, below normal precipitation removes saturated soil and/or ponded water. Use by northern leopard frog and Canadian toad will decrease. This plant community may provide forage but breeding habitat will be lost for egg laying and tadpole development without ponded water.

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

Community Phase 1.3 Cattails/Rushes/Sedges: This plant phase is a result of a community pathway initiated during several years of above average precipitation which raises the water table and increases ponding frequency and duration. The resultant wetland plant community (with some open water) favors water birds, including waterfowl. The forb community decreases as cattails and high-statured rushes dominate the plant community. Willow species may begin to invade the site.

Invertebrates: Saturated or ponded soils reduce forb species, resulting in a decrease in pollen and nectar sources for insects and a total loss of ground nesting habitat. A potential increase in willow species provides an early season pollinator source. Saturated soils and ponded water favor aquatic invertebrates.

Birds: Increases in ponded water provides habitat for dabbling ducks and shore birds, including a quality food source of aquatic invertebrates.

Mammals: Provides similar life requisites as Community Phase 1.2. However, wetting of the soils removes all habitat for subterranean mammals, such as the plains pocket gopher, inhabiting MLRA 56A.

Amphibians and Reptiles: Several years of above average precipitation raises the water table and increases ponding frequency and duration. Use by northern leopard frog and Canadian toad will increase. Breeding habitat will be dependent upon the depth and duration of ponded water for egg laying and tadpole development.

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

2.0 Native/Invaded State

Community Phase 2.1 Sedges/Northern Reedgrass/Willows: This plant community develops through Transition Pathway T1A, due to changes in management and the presence of exotic species (such as redtop, Kentucky bluegrass, field sowthistle, and Canada thistle). This plant community phase has a very similar appearance and function to the Plant Community 1.1 with a wide array of forbs providing nectar and pollen sources for pollinating species. Except for the increase of willow species, this phase functions at a high level for native wildlife. However, managers need to recognize the invasiveness of willow species and develop management strategies to avoid moving to State 3.0 dominated by willow. 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. Depending on the degree of willow invasion, bird species that avoid woody vegetation will not find suitable habitat.

Mammals: Provides similar life requisites as Community Phase 1.1. Willow species will provide deer and moose browse and escape, thermal, and winter cover for large mammals.

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

Community Phase 2.2 Spikerushes/Foxtail Barley/Sedges: This plant community phase occurs during periods of below average precipitation, lowering the water table. The lower water table allows the plant community to shift towards wetland species tolerant of drier conditions; grazing/mechanical impact favors species (such as foxtail barley, spikerushes, mountain rush and curly dock). The forb community shifts to annual forbs, reducing pollinator habitat.

Invertebrates: A shift from perennial to annual forbs reduces season long pollen and nectar sources for pollinating insect species. Prolonged periods of reduced precipitation favor ground nesting pollinators. However, areas of 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 1.2. In addition, the drying of the soil during periods of prolonged below average precipitation provides additional opportunities for grassland nesting birds that use mid-to short-statured herbaceous vegetation found in a mesic vs. hydric habitat.

Mammals: A shift to mid- to short-grass species and drier soil conditions reduces habitat for large mammals (such as white-tailed deer, elk, and moose) while still providing vegetative cover for small mammals. Depending on forb availability and dryness of the site, the plains pocket gopher may occupy this site. Thermal, escape, and winter cover is no longer provided for larger ungulates.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1, dependent on degree of salinity. Extended periods of drought may increase salinity levels, decreasing use by amphibians and reptiles.

Fish and Mussels: Provides similar life requisites as Community Phase 1.2.

Community Phase 2.3 Cattails/Rushes/Willows: This plant phase is a result of a community pathway initiated during several years of above average precipitation which raises the water table and increases ponding frequency and duration. The resultant wetland plant community (with some open water) favors water birds, including waterfowl. Reduced fire frequency favors willow species.

Invertebrates: Provides similar life requisites as Community Phase 1.3.

Birds: Provides similar life requisites as Community Phase 1.3. However, depending on the degree of willow invasion, use by grassland nesting birds and waterbirds will decrease as willow species invasion increases.

Mammals: Provides similar life requisites as Community Phase 1.3 with increased thermal, escape, and winter cover for large mammals due to the increased presence of willow species.

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

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

3.0 Invaded State

Community Phase 3.1 Exotic Cool-Season Grasses/Foxtail Barley/Sedges/Willows: This plant community phase occurs during periods of below average precipitation lowering the water table, coupled with increased animal impact and/or mechanical disturbance. This combination favors disturbance-tolerant non-native species (such as quackgrass, foxtail barley, redtop, Canada thistle, leafy spurge, and Kentucky bluegrass). Management along Restoration Pathway R3A will require prescribed burning and prescribed grazing and extensive time to bring forb and grass diversity back to this plant community phase. The resultant plant community may resemble Community Phase 2.1 in appearance.

Invertebrates: Amount and availability of pollen is limited to willows, providing only an early season source of pollen. Aquatic invertebrates become very limited due to the lack of saturated soils or ponded water. This plant community will not provide life requisites for Dakota skippers, Regal fritillary, or monarch butterflies.

Birds: The drying of the soil during periods of prolonged below average precipitation provides additional opportunities for grassland nesting birds that use mid-to short-statured herbaceous vegetation found in a mesic vs. hydric habitat. Waterfowl use will be limited; shorebirds may find some forage opportunities during precipitation events.

Mammals: Provides similar life requisites as Community Phase 2.2.

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 3.2 Foxtail Barley/Saltgrass/Bare Ground: This community phase results from long-term heavy grazing with or without drought which causes an increased movement of salts in the soil. Compared to Community Phase 3.1, there has been marked increases in foxtail barley and saltgrass with corresponding decreases in the exotic cool-season grasses, sedges, willows, and other less salt tolerant plants.

Invertebrates: Salinizing sites will have limited pollen and nectar available but may provide adequate bare soil for ground nesting bees, dependent upon degree of a salinity. During periods of drought, aquatic invertebrates become limited due to the lack of saturated soils or ponded water and increase in salinity. This plant community will not provide life requisites for Dakota skippers, Regal fritillary, or monarch butterflies.

Birds: Heavy grazing along with increased salinity (via Community Pathway 3.1A) results in mid-to short-statured herbaceous vegetation found in a mesic, saline vs. fresh water, hydric habitat. Waterfowl use will be limited; shorebirds may find some forage opportunities during precipitation events.

Mammals: Provides similar life requisites as Community Phase 2.2.

Amphibians and Reptiles: Increase salinity levels decrease use by amphibians and reptiles.

Fish and Mussels: Increased salinity levels may lead to an increase of salinized water leaving this site negatively impacting adjacent water bodies.

4.0 Invaded Wooded State

Community Phase 4.1 Willows: The elimination of fire via Transitional Pathway T2A allows for sandbar and Bebb willow to dominate this site. Shade tolerant sedges and rushes dominate the understory. Restoration to State 2.0 via Restoration Pathway R4A requires a combination of mechanical and herbicide application, coupled with repeated prescribed burns.

Invertebrates: The invasion of woody vegetation reduces habitat for pollinator insects within MLRA 56A. Season-long pollen and nectar availability becomes limited on this site. However, willows provide an early season pollen source for native bees and honeybees. Overall, pollinator plant diversity is low, limiting season-long nectar and pollen production.

Birds: Depending on degree of invasion by willows, grassland nesting birds that are sensitive to woody vegetation encroachment will discontinue use of this community phase. Bird species preferring woodland edge may begin to use this site.

Mammals: Shrubs will provide increased year-round cover for white-tailed deer, moose, and elk. Mammals, such as porcupines, that prefer woody habitat will use this site.

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

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

5.0 Go-Back State

Community Phase 5.1 Annual/Pioneer Perennial/Exotics: These plant communities are the result of severe soil disturbance (such as cropping, drainage recreational activity, or concentrated livestock activity for a prolonged period). Following cessation of disturbances, the resulting plant community is dominated by early pioneer annual and perennial plant species. Plant species composition and production are highly variable. 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 the presence of insects. Milkweed can be an early pioneering pollinator species and host plant for monarch butterflies. Tall stature provided by some annual weeds offers thermal cover and seeds throughout winter for deer, small mammals, and over-wintering birds. The response by wildlife species will be dependent upon plant community composition, vegetative stature, patch size, and management activities (such as prescribed grazing, burning, inter-seeding, haying, or noxious weed control).

Successful restoration cannot be accomplished without full restoration of hydrology. Successful restoration of native species along Transition Pathway R5A can result in a native grass and forb community in Native/Invaded State 2.0. Over time (with no management), the exotic cool-season perennial grasses (Kentucky bluegrass, smooth brome, and/or quackgrass) generally become established and dominate the community. Failed range planting, via Transition Pathway R4B, can result in an invaded plant community Invaded State 3.0.

Animal Community – Grazing Interpretations

This site is well adapted to managed grazing by domestic livestock. The predominance of herbaceous plants across all plant community phases best lends these sites to grazing by cattle, but other domestic grazers with differing diet preferences may also be a consideration depending upon management objectives. Often, the current plant community does not entirely match any particular plant community (as described in the ecological site description). Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of this inventory data will permit the establishment of a safe, initial stocking rate for the type and class of animals and level of grazing management. More accurate stocking rate estimates should eventually be calculated using actual stocking rate information and monitoring data.

When interpreting plant production in regard to 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 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 prescribed 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 rapid; runoff potential varies from negligible too high for this site depending on surface texture, slope percent, slope shape, and ground

cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where shortgrasses form a dense sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

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, type and success 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

Hunting and Bird Watching: The United States Fish and Wildlife Service manages approximately 4,000 acres of National Wildlife Refuges for hiking and bird watching and approximately 24,000 acres of Waterfowl Production Areas for public hunting, hiking, and bird watching. States within MLRA 56A manage approximately 39,000 acres of wildlife management areas for multiple use including hunting, fishing, hiking, birdwatching, berry picking, and other non-motorized uses. Of the 39,000 acres, approximately 21,400 are in Minnesota with approximately 16,000 acres in North Dakota and approximately 1,700 acres in South Dakota.

In North Dakota, the United States Forest Service manages 70,000 acres on the Sheyenne National Grassland for multiple uses including camping, hunting, photography, backpacking birdwatching, biking, horseback riding, and other non-motorized recreation. The Sheyenne National Grassland is also managed for livestock grazing. The Choppy Sands and Sands ecological sites dominate the Grassland. It is the only National Grassland in the tallgrass prairie region of the United States. The grassland provides habitat for greater prairie chickens as well as several other sensitive species, such as the Dakota skipper and regal fritillary. It also contains one of largest populations of the western prairie fringed orchid which is listed as a threatened species by the U.S. Fish and Wildlife Service.

Fishing: Approximately 20 lakes are managed for public fishing MLRA 56A. Most of these lakes offer boat docks and ramps. These lakes contain various sport fish including walleye, northern pike, yellow perch, crappie, and bluegill. The Red River runs from south to north through the center of the MLRA. The Red River is best known for channel catfish but also has walleye, sauger, northern pike, and smallmouth bass. The Red River is 550 miles long from its source in the southern end of the MLRA near Breckenridge, Minnesota to Lake Winnipeg in Manitoba, Canada. Between North Dakota and Minnesota, there are 32 public access points along the Red River with 18 having boat ramps.

Camping: Four state parks or recreation areas provide of modern and primitive camping facilities. Minnesota hosts the Buffalo River State Park and Red River State Park. North Dakota hosts the

Icelandic State Park and Turtle River State Park. These Parks provide hiking, biking, birding, canoeing, and wildlife viewing opportunities. Many local parks and private parks provide modern and primitive camping opportunities. Limited primitive camping is also available on North Dakota Game and Fish Department Wildlife Management Areas.

Hiking/Biking/Horseback Riding: Hiking is permitted on most state and federally owned lands. Developed hiking and biking trails can be found the four state parks. The Grand Forks Greenway has over 22 miles of trails while municipalities along the Red River have extensive walking and hiking trails. A 30-mile segment of the North Country National Scenic Trail leads hikers through the Sheyenne National Grassland's unique landforms and plant communities. This trail has three trailheads along its route; it is a graveled, marked trail. The entire North Country National Scenic Trail stretches from Crown Point, New York to Lake Sakakawea near Garrison, North Dakota.

Canoeing/Kayaking: The Red River has six designated canoe/kayaking trails. Public access, with limited rentals, is available at these segments. Sheyenne River Water Trail has a segment within the MLRA Sheyenne National Grasslands. Canoe/kayak rentals are available at Icelandic State Park.

Wood Products

No appreciable wood products are present on the site.

Other Products

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

Site Development and Testing Plan

- A few areas mapped as Arveson soils (I309A and I310A) are forested in Pembina County. These areas need investigation to determine if the soils are correctly mapped. These soils are likely not poorly drained and may better fit the Limy Subirrigated ecological site. If confirmed as poorly drained, some discussion of the forested state should be added to the Wet Meadow ESD.
- Further investigation is needed on the wide range of landforms and soil textures (and associated properties) and their relationship to hydrology/plant dynamics.
- 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, most of this data is from areas of Typic Calciaquolls; a unique, provisional ESD (Limy Wet Meadow) has been proposed for these highly calcareous soils. Vegetative data for non-calcareous soils in Wet Meadow needs review and more data likely needs to be collected. 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.
- Further investigation may be needed on the 'Aspen Parkland' phases of soil map units included in this site. The presence of aspen is not discussed in the site narratives. 'Aspen Parkland' map units occur in the eastern part of the MLRA:
    - Hamar loamy fine sand, Aspen Parkland, 0 to 1 percent slopes (map unit prn9)
    - Rosewood fine sandy loam, Aspen Parkland, 0 to 1 percent slopes (map unit prpb)
- Further investigation is needed on areas of this site associated with flood plains. Lamoure and Ludden soils occur on flood plains of the rivers. Lowe soils occur in drainageways. The impact of occasional or frequent flooding on these areas needs evaluation.

- 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.
- 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:
    - Currently, numerous poorly drained components are linked to the Clayey ES. Ecological sites are supposed to reflect unaltered hydrologic conditions; therefore, these components should be linked to Wet Meadow. Soil series to review and relink are:
        - Clearwater
        - Eagepoint
        - Fargo
        - Foxlake
        - Hegne
        - McDonaldsville
        - Mustinka
        - Northcote
        - Noyes
        - Reis
        - Ryan, thick solum
        - Viking

      Care is required in relinking as some of these soils have moderately saline components, also.
    - Nineteen components (1 major) of Dovray, very poorly drained are currently linked to Wet Meadow; these need to be relinked to Shallow Marsh.
    - Two major components of Endoaquolls, moderately saline occur in a borrow area map unit. If these are disturbed soils, they should probably be relinked from Saline Lowland to Non-site.
    - Two components (1 major) of Flom, very poorly drained are currently linked to Wet Meadow; these need to be relinked to Shallow Marsh.
    - Two components (1 major) of Kratka, very poorly drained are currently linked to Wet Meadow; these should be relinked to Shallow Marsh. Both components occur in the Minnesota part of MLRA 56A.
    - Three components (1 major) of Lallie, very poorly drained are currently linked to Wet Meadow; these should be relinked to Shallow Marsh.
    - Two components (1 major) of non-saline Ludden soils are currently linked to Saline Lowland; these need to be relinked to Wet Meadow. One component of Ludden is not linked to an ecological site; it should be linked to Wet Meadow.
    - Five components (1 major) of Northcote, very poorly drained are currently linked to Wet Meadow in NASIS; these should be relinked to Shallow Marsh.
    - Four components (3 major) of Roliss, very poorly drained are currently linked to Wet Meadow; these should be relinked to Shallow Marsh.
    - One minor component of Strathcona, very poorly drained is currently linked to Wet Meadow; this should be relinked to Shallow Marsh.

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
Clayey	R056AY084ND	This site occurs on higher, linear slopes on lake plains. The surface layer and subsoil layers form a ribbon >2 inches long. It is >30 inches to redoximorphic features.
Limy Subirrigated	R056AY087ND	This site occurs on rims of Wet Meadow sites and adjacent flats. The soils range in texture from sandy to clayey. All textures are included in the site. They are highly calcareous within a depth of 16 inches and have redoximorphic features at a depth of 18 to 30 inches.
Loamy Overflow	R056AY088ND	This site occurs on flood plains steps. The surface and subsoil layers form a ribbon 1 to 2 inches long. It is deeper than 30 inches to redoximorphic features.
Saline Lowland	R056AY089ND	This site occurs on similar landform as Wet Meadow sites. It has an accumulation of salts in the surface and subsoil layers (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.
Loamy	R056AY094ND	This site occurs on higher, linear slopes on lake plains. The surface layer and subsoil layers form a ribbon 1 to 2 inches long. It is >30 inches to redoximorphic features.
Subirrigated	R056AY095ND	This site occurs on flats and in slight depressions with occasional, brief ponding. It has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.
Subirrigated Sands	R056AY096ND	This site occurs somewhat higher on the landscape on sand plains. The subsoil does not form a ribbon. It is >30 inches to redoximorphic features.
Shallow Marsh	R056AY101ND	This site occurs in deep depressions which have frequent ponding through most of the growing season. All textures are included in this site.
Choppy Sands	R056AY104ND	This site occurs in areas of sand dunes. The soil is excessively drained with slopes >15%.
Sodic Subirrigated	R056AY104ND	This site occurs on similar, poorly drained landscape positions on sand plains. Redoximorphic features occur within a depth of 18 inches. The soil has a dense, sodic claypan. The surface layer and upper part of subsoil do not have significant salt accumulations (E.C. <8 dS/m).

Similar Sites

Ecological Site Name	Site ID	Narrative
Subirrigated	R056AY095ND	This site occurs on flats and in slight depressions with occasional, brief ponding. It has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.
Shallow	R056AY101ND	This site occurs in deep depressions which have frequent ponding

Marsh		through most of the growing season. All textures are included in this site.

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State Correlation

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

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 48a Glacial Lake Agassiz Basin; 48b Beach Ridges and Sand Deltas; 48c Saline Area; 48d Lake Agassiz Plains.

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

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Site Description Approval

ND, State Range Management Specialist	Date	MN, State Range Management Specialist	Date
SD, State Range Management Specialist	Date		

October 2024

INTERPRETING INDICATORS OF RANGELAND HEALTH, Version 5, REFERENCE SHEET

Ecological site name: _Wet Meadow__ Ecological site code: _RO56AY102ND_____
Author(s)/participant(s): _USDA-NRCS North Dakota_____
Contact for lead author: __NRCS State Rangeland Management Specialist___
Date: _Dec. 2021___ **MLRA:** _56_____ **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 1% or less. Bare ground may be higher for a short period of 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 are expected on this site.
7. Litter movement: Plant litter movement not expected on this site.
8. Soil surface resistance to erosion: Stability class averages 5.5 or greater.
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, mid- and short-statured rhizomatous grasses and a diverse forb component are dominant and well distributed across the site. Mid- and short-statured bunch grasses are 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 (14); Mid & short C3 rhizomatous grasses (1); Forbs (9)**		
Subdominant	**Mid & short C3 bunch grasses (1)**		
Minor	**Tall C4 rhizomatous grasses; Shrub; Mid & short C4 rhizomatous grasses; Tall C3 rhizomatous grasses**		
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 85 to 95% with a depth of 1.0 to 2.0 inches. Litter is in contact with soil surface.

15. Annual production: Annual air-dry production is 5200 lbs./ac (reference value) with normal precipitation and temperatures. Low and high production years should yield 4200 lbs./ac to 6200 lbs./ac, respectively.

16. Invasive plants: State and local noxious species, quackgrass, creeping foxtail, reed canarygrass, smooth bromegrass, Kentucky bluegrass, redtop, narrow-leaf cattail, hybrid cattail, and Russian olive.

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.

Functional/Structural Groups Sheet

State ND **Office** _____ **Ecological site** Wet Meadow **Ecol. site code** RO56AY102ND

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	please see plant community table 1.1
Mid & short C3 rhizomatous grasses	northern reedgrass
Forbs	please see plant community table 1.1
Mid & short C3 bunch grasses	American sloughgrass*, fowl bluegrass, prairie wedgescale*
Tall C4 rhizomatous grasses	prairie cordgrass, switchgrass
Shrub	willow*, Bebb willow*, sandbar willow*, white meadowsweet*, meadow willow*
Mid & short C4 rhizomatous grasses	Mexican muhly*, mat muhly*, green muhly*
Tall C3 rhizomatous grasses	reed canarygrass*
.	
.	
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 >> Mid & short C3 rhizomatous grasses > Forbs	>	Mid & short C3 bunch grasses	>	Tall C4 rhizomatous grasses > Shrub > Mid & short C4 rhizomatous grasses > Tall C3 rhizomatous grasses	.	
		.		.		.	
		.		.		.	

* 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	
Mid & short C3 rhizomatous grasses	
Forbs	
Mid & short C3 bunch grasses	
Tall C4 rhizomatous grasses	
Shrub	
Mid & short C4 rhizomatous grasses	
Tall C3 rhizomatous grasses	
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: