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.

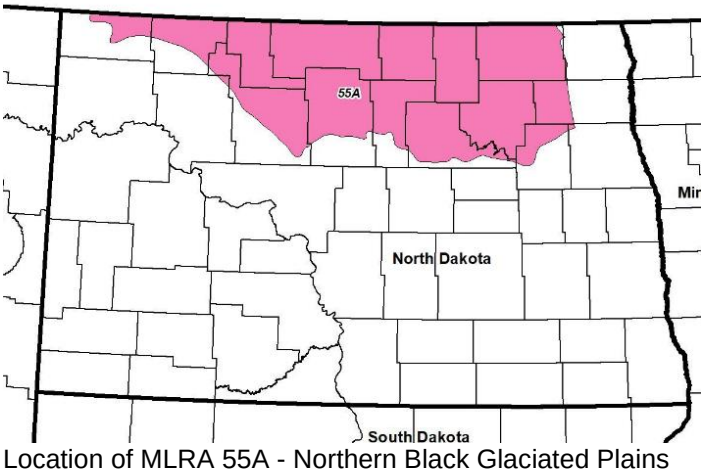
Site Name: Saline Lowland

Site Type: Rangeland

Site ID: R055AY042ND

Major Land Resource Area: 55A - Northern Black Glaciated Plains

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 55A - Northern Black Glaciated Plains within North Dakota

The Northern Black Glaciated Plains MLRA is an expansive and agriculturally important region consisting of 8,200,000 acres and including all or a portion of 16 counties in north-central and northeast North Dakota.

Nearly all MLRA 55A is covered by till: material that was moved and redeposited by the glaciers. Pre-glaciated bedrock (shale) is exposed in some of the deeper valleys and at the edges of some hills; but what covers the bedrock is glacial sediment, known as drift. These areas have the Late Wisconsin age till plain integrated drainage system in contrast to the closed drainage of much of the till plain and moraines. The Drift Prairie Region consists of nearly level to gently rolling glacial till plains dissected by glacial outwash channels. Five rivers flow through parts of the MLRA. The Souris (also known as Mouse) River meanders across the Canadian border through Renville and Ward counties; it then loops east through McHenry County and north

through Bottineau County returning to Canada. The Des Lacs River flows southward from Canada through Burke, southwest Renville, and Ward counties where it joins the Souris River. Along the eastern edge of the MLRA the Pembina River, Park River, and Forest River flow eastward to join the Red River. Some soils along these rivers have weathered shale beds in the substratum.

This region is utilized mostly by farms and ranches; about 80 percent is cropland that is dry-farmed. Cash-grain, bean and oil production crops are the principal enterprise on many farms, but other feed grains and hay are also grown. The vegetation on the steeper slopes and thinner (or sandy) soils is still native rangeland. About 3 percent of this area is forested. The most extensive areas of forest are in the Turtle Mountains, Pembina Gorge, White Horse Hill, and on the moraines in proximity to Devils Lake.

Ecological Site Concept

The Saline Lowland ecological site generally is located on flats and depressions on glaciated uplands, on flood plains, and in drainageways. It is also located on some lakeshores, particularly in the Devils Lake Basin. The soil parent material is very deep; however, some soils have a root-restrictive, dense, claypan subsoil. Salt accumulations are common throughout the rooting zone; soil salinity is moderate or higher (E.C. >8 dS/m) within a depth of 20 inches. Areas within this site can become nearly barren due to the accumulation of salts at the surface. The soils in this site are poorly drained with redoximorphic features within a depth of 18 inches. Soil salinity is the primary factor used in identifying this site. All textures are included in the site. Slopes range from 0 to 3 percent. On the landscape, this site is below the Loamy Overflow and Thin Claypan ecological sites and above the Shallow Marsh sites. The Sodic Subirrigated and Wet Meadow ecological sites occur on similar, poorly drained landscape positions as this site; they are non-saline to slightly saline to a depth greater than 20 inches. Limy Subirrigated ecological sites occur on somewhat poorly drained positions; typically, they are non-saline to slightly saline (E.C. <8), but a Salinized State is recognized. On sandy lake plains, the Sandy Claypan site is slightly higher than Saline Lowland site. **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 on flats and shallow depressions on uplands, on flood plains, and in drainageways; it also occurs on some lake shore areas. As the landforms vary considerably, so do the parent materials. Slopes are typically less than 3 percent.

Landform: flat, floodplain, depression, drainageway, lakeshore

	Minimum	**Maximum**
Elevation (feet):	950	2525
Slope (percent):	0	3
Water Table Depth (inches):	0	18
Flooding:		
Frequency:	None	Frequent
Duration:	None	Long
Ponding:		
Depth (inches):	0	12
Frequency:	None	Frequent
Duration:	None	Very Long
Runoff Class:	None	Medium
Aspect:	No influence on this site	

Climatic Features

MLRA 55A 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 MLRA 55A. The continental climate is the result of the location of this MLRA in the geographic center of North America. There are few natural barriers on the northern Great Plains, so air masses move unobstructed across the plains and account for rapid changes in temperature.

The average annual precipitation is 17 to 19 inches (432 to 483 millimeters). The normal average annual temperature is 36º to 41º F (2º to 5º C). January is the coldest month with an average low temperature of about ⁻ 3º F (⁻19º C). July is the warmest month with an average high temperature of about 80º F (27º C).

About 75 percent of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. Winter precipitation is typically snow. The annual snowfall is 25 to 50 inches (635 to 1,270 millimeters). The frost-free period averages 101 days and ranges from 108 days to 92 days. The freeze-free period averages 124 days and ranges from 128 to 119 days.

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

Long-term climate data is lacking for Turtle Mountain; however, annual precipitation for the International Peace Garden averaged 27.7 inches (704 millimeters) from 1967-1970 while that for Boissevain, Manitoba averaged 17.1 inches (434 millimeters). Turtle Mountain likely has greater precipitation, cooler temperatures, and less evapotranspiration than the adjacent plains.

Climate Station(s) 1981-2010

Station	Name	Location	Elevation	Lat	Long
USC00323963	HANSBORO 4 NNE	Hansboro	1540	48.9989	-99.3464
USC00324958	LANGDON EXP FARM	Langdon	1615.2	48.7622	-98.3447
USC00328913	UPHAM 3 N	Upham	1424.9	48.6147	-100.7264
USC00328990	VELVA 3NE	Velva	1535.1	48.0797	-100.875
USC00329333	WESTHOPE	Westhope	1502	48.9097	-101.0192
USW00024013	MINOT INTL AP	Minot	1665	48.2553	-101.2733
USC00322304	DRAKE 9 NE	Drake	1529.9	48.0475	-100.31
USC00322525	EDMORE 1NW	Edmore	1535.1	48.4267	-98.47
USC00325993	MINOT EXP STN	Minot	1769	48.1803	-101.2964
USC00326025	MOHALL	Mohall	1641.1	48.7603	-101.5089
USC00327704	RUGBY	Rugby	1549.9	48.3542	-99.9925
USC00328792	TOWNER 2 NE	Towner	1480	48.3706	-100.3908
USC00329445	WILLOW CITY	Willow City	1473.1	48.6061	-100.2911
USW00014912	DEVILS LAKE KDLR	Devils Lake	1463.9	48.1069	-98.8681
USC00320941	BOTTINEAU	Bottineau	1619.1	48.8217	-100.4525
USC00323686	GRANVILLE	Granville	1509.8	48.2675	-100.8439
USC00325078	LEEDS	Leeds	1529.9	48.2881	-99.4317
USC00327664	ROLLA 1NE	Rolla	1833	48.8811	-99.5861
USC00321871	CROSBY	Crosby	1952.1	48.9075	-103.2944
USC00320961	BOWBELLS	Bowbells	1961	48.7994	-102.2464

Climate Normals

	Representative		Actual		
	High	Low	High	Low	Average
Mean annual precipitation (in):	19	17	20	17	18
Frost free period (days):	109	92	112	88	101
Freeze free period (days):	128	119	132	116	124

Normal Monthly Precipitation (in)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.6	0.5	0.8	1.2	2.6	3.6	3.1	2.5	1.8	1.5	1.0	0.7
Representative low:	0.5	0.4	0.7	1.0	2.4	3.3	2.7	2.0	1.4	1.2	0.7	0.5
Actual high:	0.6	0.5	1.0	1.3	2.7	3.9	3.4	2.6	1.8	1.6	1.1	0.7
Actual low:	0.4	0.4	0.7	0.9	2.2	3.2	2.5	1.9	1.4	1.2	0.6	0.5

Normal monthly minimum temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.1	4.0	17.1	30.3	42.0	52.2	56.6	54.3	44.0	31.7	17.7	3.9
Representative low:	-4.9	0.2	13.3	27.3	39.4	49.6	54.0	51.8	41.4	28.9	14.6	-0.1
Actual high:	1.8	7.9	19.2	31.8	43.6	53.3	58.0	55.8	46.0	33.9	18.6	6.4
Actual low:	-6.2	-1.6	11.8	26.2	38.1	48.7	53.2	51.0	40.8	27.9	14.1	-0.6
Average:	-2.6	2.3	14.9	28.8	40.6	50.7	55.3	53.1	42.8	30.2	16.0	2.0

Normal monthly maximum temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	18.9	24.1	35.7	55.3	67.6	76.0	81.7	81.2	70.3	55.5	35.9	21.6
Representative low:	15.9	21.1	33.5	53.1	65.6	74.2	79.8	79.3	68.1	53.1	34.4	19.4
Actual high:	20.9	25.7	37.7	56.6	68.3	76.8	82.3	82.1	71.1	56.4	37.9	24.0
Actual low:	13.2	18.7	30.4	49.6	63.5	72.0	76.6	76.5	66.4	51.0	32.2	17.1
Average:	17.4	22.5	34.5	53.9	66.4	74.8	80.4	80.2	69.1	54.2	35.1	20.7

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

1981 D	1982 W	1983 D	1984 D	1985 N	1986 N	1987 N	1988 D	1989 D	1990 D	1991 W	1992 D	1993 W	1994 W	1995 N
15.5	22.9	16.1	16.2	18.5	18.8	17.4	11.6	13.5	16.5	22.7	11.5	21.7	22.1	17.9

1996 W	1997 D	1998 W	1999 W	2000 W	2001 D	2002 N	2003 D	2004 W	2005 W	2006 D	2007 D	2008 W	2009 N	2010 W
19.6	16.2	22.8	21.9	22.9	16.3	17.0	15.0	20.8	22.7	13.4	16.8	21.5	18.4	26.7

Influencing Water Features

This site most commonly occurs as a discharge site with evaporation during the growing season resulting in the accumulation of salts at or near the soil surface. During the growing season, the water table is typically within a depth of 18 inches in the spring months; it may lower to a depth >3 feet during mid-summer. Most areas of this site have endosaturation (the soil is saturated with water in all layers); however, areas of episaturation (perched water table above a subsoil layer with very slow or slow permeability) also occur. Surface infiltration rates range from very slow to moderately rapid; permeability, typically, is slow to moderately rapid. Water loss is through evapotranspiration and percolation below the root zone

Note: Hydrology (e.g., depth/movement of water table) and water chemistry (e.g., salinity/sodicity) are the main drivers for this site. The interactions of these two drivers, coupled with management, can cause vegetation to change quickly or over long periods of time.

Some areas have wetland functions due to prolonged, near-surface saturation which supports salt-tolerant, hydrophytic vegetation. In other areas, under normal climatic conditions, soil saturation is not shallow enough to support hydrophytic vegetation.

Early in the growing season and after heavy rains, areas of this site on flats may pond as deep as 6 inches; this ponding is very brief or brief (<7 days). Areas in depressions may pond as deep as 12 inches for longer periods (>7 to >30 days). On flood plains, this site has rare to frequent flooding of brief to long duration. Areas on lake shores may be inundated periodically for extended periods.

Representative Soil Features

Soils associated with Saline Lowland ES are in the Mollisol, Vertisol, and Entisol orders. The Mollisols are further classified as Typic Calciaquolls, Cumulic Endoaquolls, and Typic Natraquolls. The Vertisols are further classified as Typic Calciaquerts, Typic Endoaquerts, and Typic Natraquerts. The Entisols are further classified as Vertic Fluvaquents and Typic Psammaquents. These soils were developed under prairie or wetland vegetation. They formed in glaciolacustrine sediments, till, or alluvium. The soils on this site are very deep. The common feature of these soils is the presence of soluble salts within the rooting zone. The degree of soil salinity is moderate or higher (E.C. >8 dS/m) within a depth of 20 inches.

Typically, the soils in this site are poorly drained with redoximorphic features within a depth of 18 inches. Since soil salinity is the primary factor used in identifying this site; all textures are included. Therefore, soil physical properties associated with texture vary widely. Some poorly drained soils in this site also have a sodic claypan which restricts rooting depth.

Sodicity is low to high (SAR <3 to >13). Soil reaction is slightly acid strongly alkaline (pH 6.1 to 9.0). Calcium carbonate content ranges from none to high (≤45%).

Areas within this site can become nearly barren due to the accumulation of salts at the surface. The soil surface is stable and intact. Sub-surface soil layers can be restrictive to water movement and root penetration. Salt accumulation strongly influences the soil/water/plant relationship.

Major soil series correlated to the Saline Lowland site are Arveson, Borup, Colvin, Easby, Fossum, Grano, Harriet, Hegne, Lallie, Lowe, Ludden, Manfred, Minnewaukan, Ryan, and Vallers.

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

Parent Material Kind: till, alluvium, glaciofluvial, glaciolacustrine
Parent Material Origin: glacial till, lacustrine, outwash
Surface Texture: loam, clay loam, silt loam, silty clay loam, silty clay, fine sandy loam
Surface Texture Modifier: none
Subsurface Texture Group: loamy, clayey, sandy
Surface Fragments <3" (% Cover): 0-3
Surface Fragments ≥3" (%Cover): 0-1
Subsurface Fragments <3" (% Volume): 0-12
Subsurface Fragments ≥3" (% Volume): 0-2

	Minimum	Maximum
Drainage Class:	poorly	poorly
Permeability Class:	slow	moderately rapid
Depth to first restrictive layer (inches):	2	>80
Electrical Conductivity (dS/m)*:	8	>16

Sodium Absorption Ratio:**	1	25
Soil Reaction (1:1 Water):**	6.1	9.0
Soil Reaction (0.1M CaCl2):	NA	NA
Available Water Capacity (inches):**	0.5	8.0
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 altering plant community structure.

The main drivers for this site are hydrology (e.g., fluctuating depth of the water table) and water chemistry (e.g., salinity/sodicity). Depth to water table can be quite variable on this site due to inter-seasonal or intra-seasonal variations in precipitation and other factors. It is a major factor influencing vegetation on the site. When the water table is near the surface, capillary action tends to bring salts upward to the soil surface. The critical period is during the summer months when evaporation rates are high. Conversely, when the water table is deeper the salts tend to be driven downward in the soil through precipitation. As a result, the changes in salinity within the rooting zone can lead to marked changes in the botanical composition of the site.

Management of the site should focus on moving water downward in the soil. Managerial techniques to move water downward (eventually below the rooting zone) should focus on maintaining soil surface cover, plant vigor, and diversity. Conversely, techniques that facilitate the movement of salts upward to the soil surface can be expected to result in a decreased production with expanding areas of bare salt-encrusted soil. A critical time for management is when the soil is drying out after a period of saturation. Overgrazing during this time may increase surface evaporation and salt accumulation.

Prior to European influence, the historical disturbance regime for MLRA 55B
a 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.

The site developed under Northern Great Plains climatic conditions. The historical disturbance regime for the region included frequent fires, both natural and anthropogenic. 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 elk, whitetail deer, and American bison.

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.

Four vegetative states have been identified for the site (Reference, Native/Invaded, Invaded, and Go-Back). Within each state, one or more community phases have been identified. These community phases are named based on the more dominant 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.

Currently 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 species, as well as other environmental changes, the Reference State is considered to no longer exist. Thus, 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 was inevitable; it often resulted from colonization by exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass) which have been particularly and consistently invasive under extended periods of non-use or very light grazing, and no fire. Other exotics plants (e.g., field sowthistle, Canada thistle, burning bush) 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. This 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 (T2A).

State 3: Invaded State. The threshold for this state is reached when the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass) exceed 30% of the plant community and native grasses represent less than 40% of the community. One 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 which alters 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 may be accomplished with the implementation of long-term prescribed grazing in conjunction with prescribed burning (R3A).

State 4: Go-Back State often results following cropland abandonment and consists of only one plant community phase. This weedy assemblage may include noxious weeds that need control. Over time, the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass) will likely predominate.

Initially, due to extensive bare ground and a preponderance of shallow rooted annual plants, the potentials for soil erosion and increased salinization are 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 (R4A). Following planting, 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 3: Invaded State (R4B).

Woody Invasion. Historically, individual (or small patches of) shrubs and/or trees were not present on this site. However, a marked increase in fire suppression, climate change, increase in non-use, and other factors enabled woody species to colonize and begin to or encroach on the site. These changes have enabled saline tolerant species, such as Russian olive, to expand and become more widespread and impinging on the ecological integrity of the grassland biome. Windbreaks and other tree plantings can contain problematic and invasive species which can contaminate surrounding grasslands. This results in increased long-term costs to maintain or restore this ecological site in native grasses and forbs.

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.

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

Plant Communities and Transitional Pathways

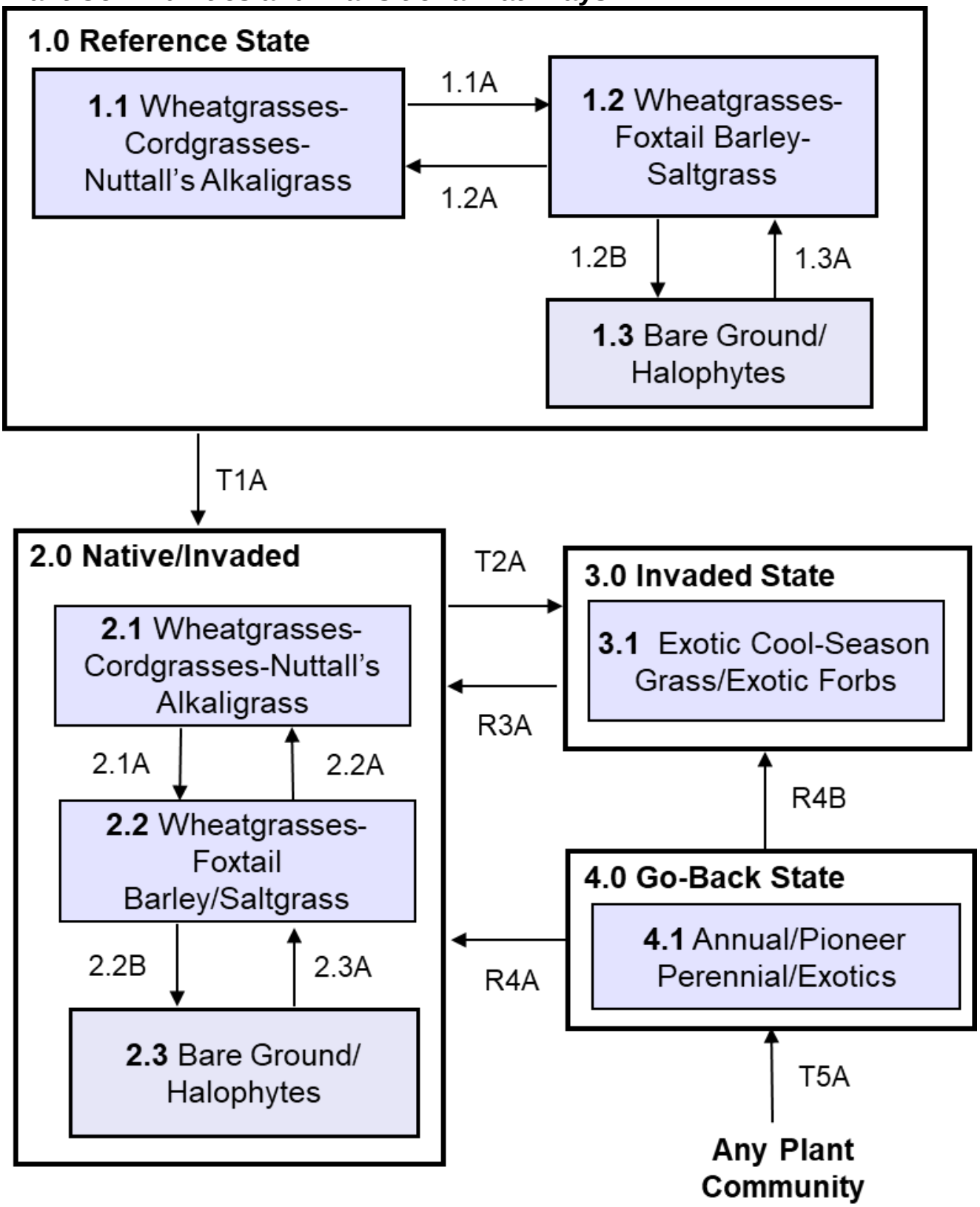


Diagram Legend MLRA 55A - Saline Lowland

T1A	Introduction of exotic cool-season grasses
T2A	Long-term non-use or very light grazing, and no fire
T5A	Cessation of annual cropping
R3A	Long-term prescribed grazing and prescribed burning
R4A	Successful range planting
R4B	Failed range planting and/or secondary succession
CP 1.1 - 1.2 (1.1A)	Multiyear drought with or without heavy long-term grazing
CP 1.2 - 1.1 (1.2A)	Return to average precipitation, light to moderate grazing
CP 1.2 - 1.3 (1.2B)	Multiyear drought with or without heavy long-term grazing
CP 1.3 - 1.2 (1.3A)	Return to average precipitation, light to moderate grazing
CP 2.1 - 2.2 (2.1A)	Multiyear drought with or without heavy long-term grazing
CP 2.2 - 2.1 (2.2A)	Return to average precipitation, long-term prescribed grazing
CP 2.2 - 2.3 (2.2B)	Multiyear drought with heavy grazing
CP 2.3 - 2.2 (2.3A)	Return to average precipitation, long-term prescribed grazing

State 1: Reference State

This state represents the natural range of variability that dominated the dynamics of this ecological site prior to European influence. This state is composed of a co-dominant mixture of warm-season and cool-season grasses and other graminoids. The primary disturbance mechanisms for this site in the reference condition included occasional 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. Today the primary disturbance is from a lack of fire and concentrated livestock grazing. Grasses that are desirable for livestock and wildlife can decline and a corresponding increase in less desirable grasses will occur.

These factors likely caused the community to shift both spatially and temporally between three community phases. Two of these phases were dominated by wheatgrasses with another containing conspicuous and, in some cases, extensive areas of bare ground and an abundance of forbs.

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 condition is contingent upon a monitoring protocol to guide management.

Community Phase 1.1: Wheatgrasses-Cordgrasses-Nuttall's Alkaligrass (*Pascopyrum smithii, Elymus trachycaulus-Spartina* spp.*-Puccinellia nuttallii*)

This community phase was historically the most dominant both temporally and spatially. The major grasses include western wheatgrass, slender wheatgrass, prairie cordgrass, and alkali cordgrass. Other grasses included Nuttall's alkaligrass, saltgrass, scratchgrass, and foxtail barley. Salt tolerant forbs (such as redwool plantain, western dock, seaside arrowgrass, and seepweed) may also be common associates.

Annual production likely varied from about 2800-4800 pounds per acre with graminoids and forbs contributing about 95% and 5%, respectively. Both warm and cool-season grasses were well represented in the community. As a result, production would have been distributed throughout the growing season. 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 Wheatgrasses-Cordgrasses-Nuttall's Alkaligrass		
COMMON/GROUP NAME	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*3420 - 3610*	*90 - 95*
WHEATGRASS		**1**	**570 - 1140**	**15 - 30**
slender wheatgrass	ELTR7	1	190 - 1140	5 - 30
western wheatgrass	PASM	1	190 - 1140	5 - 30
CORDGRASS		**2**	**570 - 1140**	**15 - 30**
prairie cordgrass	SPPE	2	190 - 1140	5 - 30
alkali cordgrass	SPGR	2	190 - 1140	5 - 30
COOL-SEASON GRASSES		**3**	**380 - 950**	**10 - 25**
Nuttall's alkaligrass	PUNU2	3	380 - 760	10 - 20
plains bluegrass	POAR3	3	38 - 304	1 - 8
foxtail barley	HOJU	3	38 - 190	1 - 5
other perennial grasses	2GP	3	0 - 190	0 - 5
WARM-SEASON GRASSES		**4**	**38 - 380**	**1 - 10**
saltgrass	DISP	4	38 - 304	1 - 8
scratchgrass	MUAS	4	38 - 114	1 - 3
mat muhly	MURI	4	0 - 114	0 - 3
other perennial grasses	2GP	4	0 - 190	0 - 5
GRASS-LIKES		**5**	**38 - 190**	**1 - 5**
sedge	CAREX	5	38 - 190	1 - 5
mountain rush	JUARL	5	0 - 114	0 - 3
other grass-likes	2GL	5	0 - 114	0 - 3
FORBS		*6*	*38 - 190*	*1 - 5*
silverleaf cinquefoil	POAR8	6	38 - 76	1 - 2
seepweed	SUAED	6	38 - 76	1 - 2
giant sumpweed	IVXA	6	0 - 76	0 - 2
redwool plantain	PLER	6	0 - 76	0 - 2
western dock	RUAQ	6	0 - 76	0 - 2
Pursh seepweed	SUCA2	6	0 - 76	0 - 2
Cuman ragweed	AMPS	6	0 - 38	0 - 1
silverscale saltbush	ATAR2	6	0 - 38	0 - 1
curlycup gumweed	GRSQ	6	0 - 38	0 - 1
povertyweed	IVXA	6	0 - 38	0 - 1
white prairie aster	SYFA	6	0 - 38	0 - 1
marsh arrowgrass	TRPA28	6	0 - 38	0 - 1
native forbs	2FN	6	0 - 76	0 - 2

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	2765	3686	4585
FORBS	35	114	215
TOTAL	2800	3800	4800

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 occurred with multiyear drought with or without heavy, long-term grazing leading to marked increases in foxtail barley and saltgrass with a corresponding decrease in cordgrasses.

Community Phase 1.2: Wheatgrasses-Foxtail Barley-Saltgrass (*Pascopyrum smithii, Elymus trachycaulus-Hordeum jubatum-Distichlis spicata*)
This community developed with multiyear drought with or without heavy, long-term grazing. Western wheatgrass, slender wheatgrass, prairie cordgrass, alkali cordgrass, and Nuttall's alkaligrass have decreased in comparison to Plant Community Phase 1.1 with corresponding increases in saltgrass and foxtail barley. Forbs (such as silverleaf cinquefoil, western dock, and redwool plantain) also increased.

Community Phase Pathway 1.2A
Community Phase Pathway 1.2 to 1.1 occurred with the return to average precipitation and light to moderate grazing. This resulted in notable decreases in foxtail barley and saltgrass with a corresponding increase in cordgrasses.

Community Phase Pathway 1.2B
Community Phase Pathway 1.2 to 1.3 occurred with multiyear drought with or without heavy long-term grazing. This resulted in the site becoming characterized by increased areas of bare ground and halophytic vegetation.

Community Phase 1.3: Bare Ground/Halophytes
This plant community occurred during multiyear drought with or without heavy long-term grazing. Increased salt accumulation on and near the soil surface resulted in increases in bare, salt encrusted areas which supported largely halophytic vegetation. Common plants included saltgrass, seaside arrowgrass, red swampfire, and Pursh seepweed.

Community Phase Pathway 1.3A
Community Phase Pathway 1.3 to 1.2 occurred with the return to average precipitation with light to moderate grazing resulting in noticeable increases in wheatgrasses, foxtail barley, and saltgrass with corresponding decreases in bare ground and halophytic plants.

Transition T1A
This is the transition from the State 1: Reference State to the State 2: Native/Invaded State due to the introduction and establishment of exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass). The transition was inevitable and corresponded to a decline in native warm-season and cool-season grasses; it may have been exacerbated by chronic season-long or heavy late season grazing. Complete rest from grazing and suppression of fire could also have hastened the transition. The threshold between states was crossed when Kentucky bluegrass, smooth brome, quackgrass, or other exotic species became established on the site.

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 (e.g., Kentucky bluegrass, smooth brome, quackgrass) which are now present in small amounts. Although the state is still dominated by native grasses, an increase in these exotic cool-season grasses can be expected.

These 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 no use 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.

Annual production of this state can be quite variable, in large part due to the amount of exotic cool-season grasses. However, as the exotic cool-season grasses increase, peak production will shift to earlier in the growing season.

Characteristics and indicators (i.e., characteristics and indicators 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 options (e.g., prescribed grazing, prescribed burning) be carefully constructed 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: Wheatgrasses-Cordgrasses-Nuttall's Alkaligrass (*Pascopyrum smithii, Elymus trachycaulus-Spartina* spp.-*Puccinellia nuttallii*)

This plant community is similar to Community Phase 1.1 but has now been colonized by exotic cool-season grasses (e.g., Kentucky bluegrass, quackgrass, smooth brome). Nuttall's alkaligrass often becomes a conspicuous component of the community although western wheatgrass, slender wheatgrass, and cordgrasses may still be present but have declined in importance compared to the Reference State.

Community Phase Pathway 2.1A

Community Phase Pathway 2.1 to 2.2. occurs with multiyear drought with or without heavy, long-term grazing. This results in marked declines in cordgrasses and corresponding increases in foxtail barley and saltgrass.

Community Phase 2.2: Wheatgrasses-Foxtail Barley-Saltgrass (*Pascopyrum smithii, Elymus trachycaulus-Hordeum jubatum-Distichlis spicata*)

This community phase is similar to Reference State Community Phase 1.2 but now supports minor amounts of exotic cool-season grasses (e.g., Kentucky bluegrass, quackgrass, smooth brome).

Figure 1. Community Phase 2.2: Wheatgrasses-Foxtail Barley-Saltgrass, dominated by foxtail barley.

Community Phase Pathway 2.2A

Community Phase Pathway 2.2 to 2.1 occurs with the return to average precipitation and implementation of long-term prescribed grazing. This results in notable decreases in foxtail barley and saltgrass with corresponding increases in cordgrasses.

Community Phase Pathway 2.2B

Community Phase Pathway 2.2 to 2.3 occurs with multiyear drought with or without heavy long-term grazing. This resulted in the site becoming characterized by increased areas of bare ground and halophytic vegetation.

Community Phase 2.3: Bare Ground/Halophytes.

This community phase is similar to Community Phase 1.3 but now includes exotic cool-season grasses (e.g., Kentucky bluegrass, quackgrass, smooth brome). Common plants often include saltgrass, seaside arrowgrass, red swampfire, and Pursh seepweed. Burningbush (aka kochia) and field sowthistle may also be present.

This community phase is often dispersed throughout a pasture in an overgrazed/undergrazed pattern, typically referred to as patch grazing. Some overgrazed areas will exhibit the impacts of heavy use, while the ungrazed areas will have a build-up of litter and increased plant decadence. This is a typical pattern found in properly stocked pastures grazed season long. As a result, Kentucky bluegrass tends to increase more in the undergrazed areas while the more grazing tolerant short statured species, such as blue grama and sedges, increase in the heavily grazed areas. If present, Kentucky bluegrass may increase under heavy grazing.

Increasing amounts of exotic cool-season grasses will be dependent upon salinity levels. Higher salinity levels will limit increase in cool-season exotic grasses. Lower salinity levels will facilitate invasion by exotic cool-season grasses, particularly Kentucky bluegrass. If management does not include measures to control or reduce Kentucky bluegrass, the transition to State 3: Invaded State should be expected.

Community Phase Pathway 2.3A

Community Phase Pathway 2.3 to 2.2 may occur with the return to average precipitation and implementation of long-term prescribed grazing. This results in noticeable decreases in bare ground and halophytes. The wheatgrasses, foxtail barley, saltgrass, and the exotic cool-season grasses are often among the more common plants.

Transition T2A

This transition from the State 2: Native/Invaded State to State 3: Invaded State generally occurs with long-term non-use or very light grazing, and no fire. Studies indicate that a threshold may exist in this transition when the exotic cool-season grasses exceed 30% of the plant community and native grasses represent less than 40% of the plant community composition. This transition may occur under other managerial conditions, for example 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 (e.g., Kentucky bluegrass, smooth brome, quackgrass). Other exotic plants (e.g., field sowthistle, burningbush) may also invade the site. These 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. 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. However, as the exotic cool-season grasses increase, peak production will shift to earlier in the growing season.

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 may be needed to manage noxious weeds.

Community Phase 3.1 – Exotic Cool-Season Grasses/Exotic Forbs

This community phase is often dominated by quackgrass, Kentucky bluegrass, and/or smooth brome. Associated graminoids include foxtail barley, prairie cordgrass, and sedges. Field sowthistle is a common exotic forb. Native forbs may include Norwegian cinquefoil, white panicle aster, as well as the exotic common dandelion. Russian olive is also known to invade the site. 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.

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.

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. 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).

State 4: Go-Back State

This state typically results from the abandonment of cropland or hayland. The site often consists of areas of vegetation and areas of bare ground where salts have accumulated at the soil surface in concentrations that preclude vegetative growth. Vegetation is patchy and variable but often initially consists of a mixture of burningbush (aka kochia) and foxtail barley. Other plants which may be present include Kentucky bluegrass, quackgrass, smooth brome, field sowthistle, Canada thistle, and curlycup gumweed.

Characteristics and indicators (i.e., characteristics and indicators that can be used to distinguish this state from others). Tillage has destroyed the native plant community, altered soil structure and biology, reduced soil organic matter, and resulted in the formation of a tillage induced compacted layer which is restrictive to root growth. Removal of perennial grasses/forbs changes the predominant water movement from downward to upward. As salt-laden water moves upward, soil salinity increases. Successful restoration to Native/Invaded State 2.0 may be hindered by increased soil surface salinity. Noxious weeds, if present, will need to be managed.

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

Community Phase 4.1: Annual/Pioneer Perennial/Exotics

This community phase is highly variable depending on the level and duration of disturbance related to the T5A transitional pathway. In this MLRA, the most probable origin of this phase is secondary succession following cropland abandonment. It can also result from heavy season-long grazing. This plant community will initially include a variety of annual forbs (e.g., burningbush, red swampfire) and grasses (e.g., foxtail barley, quackgrass). Over time, a mixture of native and exotic cool-season perennial grasses may become dominant (often quackgrass and Kentucky bluegrass).

Restoration R4A

This Restoration Pathway from State 4: Go-Back State to the State 2: Native/Invaded State can be accomplished with a successful range planting. Following planting, 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 planting 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; 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 planting 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; 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.

Restoration R4B
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 planting methods, seeded species not adapted to the site, insufficient weed control, herbicide carryover, poor seed quality (purity & germination), and/or improper management.

Transition T5A
This transition from any plant community to State 4: Go-Back State. It is most commonly associated with the cessation of cropping without the benefit of range planting, 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 (e.g., development of a tillage induced compacted layer (plow pan), erosion, fertility, herbicide/pesticide carryover). Thus, soil conditions should be assessed when considering restoration techniques.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

Landscape
The MLRA 55A landscape is characterized by mostly nearly level to gently rolling till plains with some steep slopes adjacent to streams. The MLRA includes areas of kettle holes, kames, and ground moraines. MLRA 55A 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 mid- to tall-grass prairie vegetation with quaking aspen, bur oak, green ash, and willow species growing on the higher elevations in Turtle Mountain, on moraines in proximity of Devils Lake, Pembina River Escarpment and Gorge, and various drainageways throughout the MLRA. Numerous depressional wetlands are ringed with quaking aspen. 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 of the Souris and Pembina Rivers. MLRA 55A is located entirely within North Dakota and within the boundaries of the Prairie Pothole Region. The primary land use is cropland. Glacial Lake Souris and the Devils Lake Basin are known for exceptional fertility with major crops including corn, canola, soybeans, and small grains. Together, these two areas make up 73% of the MLRA (Glacial Lake Souris 5500 mi^2, 43%; and the Devils Lake Basin 3810 mi^2, 30%).

Turtle Mountain (1000 mi^2 of which 405 mi^2 are found in North Dakota), in the north-central part of the MLRA on the Canadian border, is approximately 1,950 to 2,541 feet (595 to 775 meters) in elevation, rising approximately 600 to 800 feet (150 meters) above the adjacent till plain. Home to an extensive forest of quaking aspen, bur oak, green ash, and willows, it has an understory of beaked hazel with associates of

chokecherry, Saskatchewan serviceberry, downy arrowwood, and rose. Turtle Mountain comprises the largest area of quaking aspen forest in North Dakota.

The Pembina Escarpment extends from the Canadian border southeast to Walhalla where the Pembina River enters the floor of the Red River Valley in MLRA 56A. Mainly found on steep slopes along the Pembina River, the Pembina Gorge is in a rugged and sheltered setting with bur oak, green ash, cottonwood, and American elm. Encompassing approximately 12,500 acres, the Pembina Gorge is one of the largest uninterrupted blocks of woodlands in North Dakota. This segment of the Pembina River is the longest segment of unaltered river valley in the North Dakota.

Two major Hydrologic Unit Areas make up this MLRA. 56% of the MLRA drains into the Souris River while 44% drains into the Red River (via the Pembina River) or into Devils Lake (out-letting to Sheyenne River via a pump, pipeline, canal system). The North Dakota portion of the Souris River watershed is in this MLRA. The Souris River basin drains nearly 23,600 square miles and has a long history of flooding.

By the mid-19th century, over 75% of the MLRA had been converted from mid- to tall-grass prairie or woodland 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. Tile drainage systems have been or are being installed extensively throughout MLRA 55A for sub-surface field drainage to enhance annual crop production.

Historic Communities/Conditions within MLRA 55A:

The northern tall- and mixed-grass prairie along with the quaking aspen forest were disturbance-driven ecosystems with fire, herbivory, and climate functions as the primary ecological drivers (either singly or often in combination). American bison roamed MLRA 55A wintering along the Souris River and migrating through MLRA 55A into MLRAs 56A and 55B. Many species of grassland birds, small mammals, insects, reptiles, amphibians, elk, moose, pronghorn, and large herds of American bison 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, American black bear, grizzly 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 is the Rocky Mountain locust.

Present Communities/Conditions within MLRA 55A:

This area supports natural prairie vegetation characterized by western wheatgrass, green needlegrass, needle and thread, and blue grama. Little bluestem is an important species on the more sloping and shallower soils. Prairie cordgrass, northern reedgrass, big bluestem, and wheat sedge are important species on soils with higher water tables. Western snowberry, leadplant, and prairie rose are commonly interspersed throughout the area. Native forests occur in Turtle Mountain, Pembina Gorge, moraines near Devils Lake, woody draws, scattered tracts along the Souris River, and in the sand dunes in west central region of the MLRA.

Over 75% of MLRA 55A has been converted to annual crop production. European influence has impacted remaining grassland, forestland, and shrubland by domestic livestock grazing, elimination of fire, tree harvest, removal of surface and subsurface hydrology via artificial drainage, and other anthropogenic factors influencing plant community composition and abundance.

Hydrological manipulation is extensive throughout the MLRA. Extensive wetland and subsurface tile drainage have taken place. Ephemeral and intermittent streams and the Souris River have been straightened - removing sinuosity, creating isolated oxbows, and converting riparian zones to annual crop production. These anthropogenic impacts have reduced flood water detention and retention on the landscape. The results have

been increasing storm water runoff sediment and nutrient loading impacting the Souris and Des Lacs Rivers and their tributaries along with Devils Lake and other lakes within the MLRA. The installation of instream structures has reduced aquatic species movement within the MLRA. Two large dams in Saskatchewan, Canada (Rafferty on the Souris River and Alameda on Moose Mountain Creek, a major tributary to the Souris River) were built, in part, to reduce flood peaks on the Souris River. In addition, three USFWS National Wildlife Refuges were created by building two low-head dams on the Souris River and one on the Des Lacs River in North Dakota. Numerous low-head dams are located on the Souris and Des Lacs Rivers in North Dakota. The Eaton Irrigation Project low-head dam, located in the vicinity of Towner, North Dakota, provides flood irrigation to approximately 6,700 acres of hayland and pastureland.

The loss of the American 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. 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.

Included in this MLRA are over 121,000 acres of National Wildlife Refuges and over 77,000 acres of waterfowl production areas owned and managed by the United States Fish and Wildlife Service. White Horse Hill National Game Preserve is a 1,674-acre national wildlife refuge sitting on the south shores of Devils Lake, about 10 miles south of the city of Devils Lake. Numerous state-owned parks, state wildlife management areas, North Dakota Forest Service and Department of Trust Lands are found in the MLRA. Wakopa Wildlife Management Area is the largest WMA covering approximately 6,739 acres.

Some characteristic wildlife species in this area are:

Birds: Common loon, common goldeye, bufflehead, ruffed grouse, broad-winged hawk, alder flycatcher, mourning warbler, mallard, blue-winged teal, red-tailed hawk, American kestrel, killdeer, eastern and western kingbird, American crow, common yellowthroat, clay-colored sparrow, vesper sparrow, red-necked grebe, Savannah sparrow, downy and hairy woodpeckers, black-capped chickadee, white-breasted nuthatch, and brown-headed cowbird.

Mammals: Northern short-tailed shrew, water shrew, beaver, muskrat, mink, long-tailed weasel, American martin, fisher, 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, racoon, American badger, striped skunk, white-tailed deer, elk, moose, and woodchuck, red squirrel, porcupine, and northern flying squirrel.

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

Presence of wildlife species is often determined by ecological site characteristics including grass and forb species, tree and shrub species, hydrology, aspect, and other associated ecological sites. The home ranges of a majority species are usually larger than one ecological site or are dependent on more than one ecological site for annual life requisites. Ecological sites offer different habitat elements as the annual life requisites change. Habitat improvement and creation must be conducted within the mobility limits of a known population for the species.

Insects play an important role providing ecological services for plant community development. Insects that are scavengers or aid in decomposition provide the food chain baseline sustaining the carnivorous insects feeding upon them. Many insects provide the ecological services necessary for pollination, keeping plant communities

healthy and productive. Insects provide a protein food source for numerous species including grassland-nesting birds, woodpeckers, and woodland edge and interior species, and their young. Extensive use of insecticides for specialty crops (such as soybeans, corn, and other crops) has greatly reduced insects within this MLRA.

Species of Concern within MLRA 55A:

The following is a list of species considered "species of conservation priority" in the North Dakota State Wildlife Action Plan (2015) and "species listed as threatened, endangered, or petitioned" under the Endangered Species Act within MLRA 55A at the time this section was developed:

Invertebrates: Dakota skipper, monarch butterfly, and regal fritillary. Within the MLRA, the United States Fish and Wildlife Service lists 5 areas (in Rolette and McHenry Counties) as critical habitat for the Dakota skipper.

Birds: American avocet, American bittern, American kestrel, American white pelican, Baird's sparrow, bald eagle, black tern, black-billed cuckoo, bobolink, canvasback, chestnut-collared longspur, ferruginous hawk, Franklin's gull, grasshopper sparrow, horned grebe, LeConte's sparrow, lesser scaup, loggerhead shrike, marbled godwit, Nelson's sparrow, northern harrier, northern pintail, piping plover, sharp-tailed grouse, short-eared owl, Sprague's pipit, Swainson's hawk, upland sandpiper, western meadowlark, whooping crane, willet, Wilson's phalarope, and yellow rail.

Mammals: American martin, Arctic shrew, big brown bat, gray fox, little brown bat, northern long-eared bat, plains pocket mouse, pygmy shrew, Richardson's ground squirrel, river otter, and Townsend's big-eared bat.

Amphibians/Reptiles: Canadian toad, common snapping turtle, plains hog-nosed snake, and smooth green snake.

Fish: Finescale dace, hornyhead chub, largescale stoneroller, logperch, northern pearl dace, and trout-perch.

Mussels: Black sandshell, creek heelsplitter, creeper, mapleleaf, and pink heelsplitter.

Grassland and Woodland Management for Wildlife in the MLRA 55A

Management activities within the community phase pathways impact wildlife but are essential for maintenance of healthy grassland ecosystems. Community phase, transitional, and restoration pathways are keys to long-term management within each State and between States. Timing, intensity, and frequency of these inputs can have dramatic positive or negative effects on local wildlife species. Ranchers and other land managers must always consider the long-term beneficial management effects of grassland and woodland resources in comparison to typically short-term negative effects to the habitats of 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 for wildlife. Conversion to annual cropping and fragmentation due to transportation and electrical transmission corridors and to rural housing are main causes of fragmentation. This MLRA supports ecological sites that are dominated by woody vegetation and can be located adjacent to ecological sites that support tall- to mid-statured grasses (Thin Loamy/Shallow Loamy) or are adjacent to ecological sites that support wetland vegetation (Shallow Marsh and Wet Meadow).

Management of these ecological site complexes challenges managers to properly manage the entire landscape. A management strategy for one ecological site may negatively impact an adjacent site. For example, grazing Upland Hardwood Forest or Loamy Savannah ecological sites along with herbaceous

dominated Loamy Overflow ecological sites may degrade one site by under-use, favoring woody vegetation or increasing exotic cool-season grasses.

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 for targeted species or species guilds. Managers also need to consider vegetative associations provided by adjacent/intermingled ecological sites for species with home ranges or life requisites that may not be provided by one ecological site. Understanding specific grassland species' sensitivity to woody encroachment and preferred vegetative structure enables managers to determine which grassland-nesting bird species will avoid grassland habitats adjacent to Upland Hardwood Forest or Loamy Savannah ecological sites or woody dominated, Plant Community Phase 5, Loamy ecological site.

Many passerine species utilize MLRA 55A as a major migratory travel corridor. Grassland species sensitive to woody associations during nesting and brooding may utilize the woodier fragmented sites, such as the Wooded State 5.0 in the Loamy ecological site, during migration.

Grassland-nesting birds use various grass heights for breeding, nesting, foraging, or winter habitat. While most species use varying heights, many have a preferred vegetative stature height or sensitivity to woody vegetation. Understanding the sensitivity of grassland species to woody vegetation and preferred vegetative structure enables managers to determine which grassland-nesting bird species avoid grassland habitats adjacent to Upland Hardwood Forest or Loamy Savannah ecological sites. The following chart provides sensitivity to woody vegetation and preferred vegetative stature heights.

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.				

Saline Lowland Wildlife Habitat Interpretation:

Saline Lowland ecological sites are poorly drained; soluble salts are present within the rooting zone (typically at the surface) and significantly impact the plant community. The surface can become nearly barren due to the presence of salts. In some soils, subsurface soil layers may be restrictive to water movement and root penetration. Associated ecological sites commonly include Limy Subirrigated, Sodic Subirrigated, Thin Claypan, Shallow Marsh, Wet Meadow, Loamy Overflow, and Sandy Claypan. This complex of ecological sites provides habitat for many edge-sensitive, grassland bird species preferring medium- to tall-statured vegetation.

Saline Lowland habitat features and components commonly support grassland-nesting birds that prefer short- to medium stature vegetation. Low diversity and density of forb species provide limited pollen and nectar resources for pollinating insects. In turn, invertebrate production is low, providing limited protein resources for grassland-nesting birds. Saline Lowland ecological sites provide forage for small and large herbivores.

Saline Lowland ecological sites may be found in four plant community states (1.0 Reference State, 2.0 Native/Invaded State, 3.0 Invaded State, and 4.0 Go-Back State) within a local landscape. Multiple plant community phases exist within States 1.0 and 2.0. Today, these states occur primarily in response to drought, fire, grazing, and non-use and other anthropogenic disturbances.

Because there is no known restoration pathway from State 2.0 to State 1.0, it is important to intensively manage using Community Phase Pathways in State 1.0 to prevent further plant community degradation along the T1A Transitional Pathway to State 2.0. Native wildlife generally benefits from the heterogeneous grasslands found in State 1.0 that include grass and forb species of varying stature and density. As plant communities degrade and transition to State 2.0, foxtail barley increases while native forbs are reduced.

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 enough quality to support a sustainable population density.

1.0 Reference State

Community Phase 1.1 Wheatgrasses-Cordgrasses-Nuttall's Alkaligrass: These plant communities offer quality vegetative cover for wildlife; if found, 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 frequency maintains a grass-dominated plant community providing habitat for bird species that are sensitive to woody vegetation. Predominance of grass species in these communities favors grazers and mixed-feeders (animals selecting grasses as well as forbs and shrubs). The structural diversity provides habitat for a wide array of migratory and resident birds.

Invertebrates: Insects play a role in maintaining the forb community and provide a forage base for grassland birds, reptiles, and rodents. Ecological services, historically provided by bison, are simulated by domestic livestock. These services include putting plant material and dung in contact with mineral soil to be used by lower trophic level consumers (such as invertebrate decomposers, scavengers, shredders, predators, herbivores, dung beetles, and fungal feeders). As salinity levels increase, invertebrate activity may decrease.

Dakota skippers do not prefer this site due to salinity and wetness along with limited host plants, such as little bluestem and prairie dropseed. Regal fritillary habitat is limited due to salinity and wetness and the short stature of this plant community and uncommon Nuttall's and prairie violets. Monarch butterflies may use limited flowering forbs on this site; however, no milkweed species are found on this site to support caterpillar food. Overall nectar and pollen availability are limited due to low forb diversity due the combination of salinity and wetness. Bumblebees and other native bees utilize limited forbs as a nectar source. Although bare ground is common, wetness and salinity will limit nesting.

Birds: This plant community provide limited nesting, foraging, and escape habitats favored by short- to mid-grass-nesting birds. In association with Wet Meadow, this site may provide foraging sites for shore birds. This site provides limited hunting opportunities for grassland raptors.

Mammals: Limited diversity of grasses and forbs provide reduced nutrition levels for small and large herbivores including voles, mice, jackrabbits, and white-tailed deer. This site has less diversity and shorter plant stature compared to associated sites (such as Wet Meadow, Shallow Marsh, Limy Subirrigated and Loamy Overflow). Short- to mid-statured vegetation, wetness, and salinity provide limited food and thermal, protective, and escape cover for small herbivores.

Amphibians and Reptiles: Due to potential high salinity levels and wetness, these ecological sites do not provide suitable habitat for many amphibians and reptiles except during periods of above normal precipitation reducing the effects of high salinity levels. Ponded water during above average precipitation events will provide foraging habitat for the northern leopard frog and Canadian toad, depending upon salinity levels. Ponded water will not be deep enough to provide breeding habitat.

Fish and Mussels: These ecological sites can be located adjacent to streams, rivers, or water bodies. These sites receive run-on hydrology from adjacent ecological sites and provide hydrology to Wet Meadow or Shallow Marsh ecological sites. Management on Saline Lowland sites, in conjunction with neighboring run-on sites, can have a direct effect on aquatic species in streams and/or tributaries receiving water from Saline Lowland and adjacent 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 Wheatgrasses-Foxtail Barley-Saltgrass: Multiyear drought, with or without heavy grazing, with lack of recovery periods gives foxtail barley and other salt tolerant grasses a competitive edge. This plant community is adapted to increased salinity and is relatively stable. Every effort should be made to manage this plant community via Community Pathway 1.2A (prescribed grazing with adequate recovery periods) to move back to Plant Community Phase 1.1. Improper management such as heavy continuous season-long grazing will transition this plant community to State 2.0, increasing abundance of foxtail barley, inland saltgrass, and bare ground. Structural diversity and density reduce habitat for a wide array of migratory and resident birds.

Invertebrates: Provides similar life requisites as Community Phase 1.1. However, heavy continuous grazing with lack of recovery periods further reduces density and diversity of pollinating forb species.

Birds: Heavy continuous grazing with lack of recovery periods gives foxtail barley, inland saltgrass, and other salt tolerant grasses a competitive edge reducing density and stature of grasses. Grassland nesting birds, favoring short statured structure, may use this plant community. Dependent upon water depth and duration, this plant community may be attractive to various shorebirds.

Mammals: This site is no longer favored by large herbivores and provides limited life requests for small herbivores.

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

Fish and Mussels: Provides similar life requisites as Community Phase 1.1; however, increased bare ground will yield additional sediment to nearby water bodies.

Community Phase 1.3 Bare Ground/Halophytes: This plant community phase is characterized by bare ground and halophytes. Continued heavy grazing, repeated drought, or a combination of these disturbances will shift to increased bare ground and halophytes with a reduction in perennial grasses. Moderate perennial forb stature and abundance are being replaced by short-statured halophytes. Bare ground increases and litter amounts and infiltration rates decline while soil surface temperatures increase. Although, this plant community is resilient, retaining sufficient grazing sensitive native plant species to return to the 1.1 community phase (via Community Phase Pathway 1.3A) will take long term management.

Invertebrates: A switch to mainly halophytes will have a significant impact to invertebrates due to the reduction of season-long nectar and pollen. Season-long nectar sources may be found on adjacent plant communities or ecological sites for mobile species. Increased bare ground provides increased nesting sites for bumble bees and other ground-nesting insects but, due to wetness and salinity, will not provide quality nesting sites.

Birds: Bare ground coupled with salinity will not provide adequate habitat for grassland nesting birds. Dependent upon water depth and duration, this plant community may be attractive to various shorebirds.

Mammals: Bare ground and the loss of grasses provides limited food, thermal cover, and escape cover for most mammals.

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

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

2.0 Native/Invaded State

Community Phase 2.1 Wheatgrasses-Cordgrasses-Nuttall's Alkaligrass: Introduction and establishment of exotic cool-season grasses, coupled with chronic season-long or heavy late season grazing without adequate recovery periods (along Transition Pathway T1), causes native forbs to decrease in production, abundance, diversity, and richness. Bare ground has increased due to the presence of alkaligrass.

Invertebrates: Provides similar life requisites as Community Phase 1.1.

Birds: Provides similar life requisites as Community Phase 1.1.

Mammals: Provides similar life requisites as Community Phase 1.1.

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

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

Community Phase 2.2 Wheatgrasses-Foxtail Barley-Saltgrass: Multiyear drought (with or without heavy, long-term grazing) results in a marked decline in cordgrass and corresponding increases in foxtail barley and saltgrass.

Invertebrates: Provides similar life requisites as Community Phase 1.2.

Birds: Provides similar life requisites as Community Phase 1.2.

Mammals: Provides similar life requisites as Community Phase 1.2.

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

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

Community Phase 2.3 Bare Ground/Halophytes: This plant community phase is characterized by bare ground and grazing-tolerant exotic grasses and annual forbs. Continued heavy long-term grazing will shift this plant community to increased bare ground with exotic grasses (such as Kentucky bluegrass, quackgrass, and annual forbs). Native forbs may include silverleaf cinquefoil, western dock, redwool plantain, seaside arrowgrass, red swampfire, and Pursh seepweed. The forbs are mainly wind-pollinated. This plant community is resilient, retaining sufficient grazing sensitive native plant species to return to the 2.1 community phase (via Community Phase Pathway 2.3A).

Invertebrates: Provides similar life requisites as Community Phase 1.3.

Birds: Heavy, long-term grazing increase bare ground and coupled with salinity will not provide adequate habitat for grassland nesting birds.

Mammals: Heavy, long-term grazing increases bare ground; with the loss of grasses, this plant community provides limited food, thermal cover, and escape cover for most mammals.

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

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

3.0 Invaded State

Community Phase 3.1 Exotic Cool-Season Grasses/Exotic Forbs: Extended periods of no use and no fire, or continuous season long grazing (via Transitional Pathway T2A) results in a plant community phase dominated by smooth brome and Kentucky bluegrass with other species difficult to find on the site. Restoration Pathway R3A, through prescribed burning, chemical treatment mechanical replanting, and/or high levels of grazing management, requires remnant amounts of native warm- and cool-season and forbs to be successful. The remnant native community needs frequent prescribed burns and high levels of grazing management targeting the exotic cool-season grasses to improve competitiveness and increase vigor and density. Without intensive management, the remnant native plants will not increase adequately to transition back to State 2.0. Intensified management along the R3A Pathway will have significant short-term negative impacts on wildlife habitat; however, this is necessary to restore long-term native habitat functions.

Invertebrates: Exotic grasses limits use by beneficial insects provided in States 1.0 and 2.0. Increased litter and lack of grazing leads to limited contact between plant material and mineral soil resulting in a cooler micro-climate, which is unfavorable to most insects. Lack of nectar-producing plants and native forb and grass host plants eliminates life requisites for invertebrate species of concern in MLRA 55A. Heavy continuous season-long grazing reduces forb diversity and abundance, limiting nectar and pollen availability.

Birds: The homogeneous community phase, dominated by exotic plant species, provides limited habitat and life requisites for most obligate grassland-nesting birds. Lack of plant diversity and stature (along with increased litter and the tendency of Kentucky bluegrass and smooth brome to lay down) limits use by many grassland-nesting birds. Sharp-tailed grouse may use this plant community for lek sites and nesting cover; however, winter cover must be provided by adjacent ecological sites or plant communities. Heavy continuous season-long grazing reduces or eliminates nesting cover and insect populations for food sources.

Mammals: Litter accumulation and exotic grass cover favors thermal, protective, and escape cover for small rodents. Thermal, protective, or escape cover is limited for large mammals. Heavy continuous season-long grazing reduces or eliminates thermal cover for most mammals.

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

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

4.0 Go-Back State

Community Phase 4.1 Annual/Pioneer Perennial/Exotics: These plant communities are the result of severe soil disturbance (such as cropping, 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. 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 of native species along Transitional Pathway R3A can result in a native grass and forb community in State 2.0. Over time, with no management, the exotic cool-season perennial grasses (Kentucky bluegrass, smooth brome, and/or quackgrass) generally become re-established and dominate the community. Successful range planting, via Transition Pathway R4A, can result in State 2.0. Prescribe grazing and/or fire will be needed to maintain this plant community within State 2.0. Failed native range planting, along Transitional Pathway R4B, will keep this plant community within 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 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.

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

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

Grazing levels are noted within the plant community narratives and pathways in reference to grazing/prescribed grazing management. “Degree of utilization” is defined as the proportion of the current years 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

Available water is the principal factor limiting forage production on this site. Soil salinity significantly reduces the availability of water (hinders osmosis) to plants growing on the site. Under natural conditions, this site is dominated by soils in hydrologic groups B and C, but incudes some soils in groups A and D. Where the natural hydrology has been altered, the soils are predominantly in hydrologic groups B/D and C/D with some soils in group A/D. Infiltration varies from slow to moderately rapid (depending upon surface soil texture and structure); runoff potential varies from negligible to low depending on soil hydrologic group, surface texture, slope and ground cover.

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 salinity is also reduced. Where a vegetation change has occurred; a transition to a completely different ecological site may also 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 planting), 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: Over 113,000 acres of National Wildlife Refuges and over 77,000 acres of Waterfowl Production Areas owned and managed by the United States Fish and Wildlife Service are available for public hunting and bird watching. In addition, over 22,000 acres of North Dakota Wildlife Management Areas (WMAs), approximately 8,000 acres of North Dakota Forest Service, and thousands of acres of Department of Trust Lands are scattered throughout the central and western portions of the MLRA; these areas are available for hunting and bird watching. MLRA 55A provides a unique ruffed grouse hunting opportunity in North Dakota on wildlife management areas managed by the North Dakota Game and Fish Department and forest service lands managed by North Dakota Forest Service within the Turtle Mountain.

Camping: Three state parks are located within the MLRA including Lake Metigoshe State Park (Turtle Mt.), Grahams Island State Park (Devils Lake), and the newly designated Pembina Gorge State Park (formerly Pembina Gorge Recreation Area). These Parks provide hiking, biking, birding, canoeing, and wildlife viewing opportunities. Many local parks and private parks provide modern and primitive camping opportunities. The approximately 8,000 acres of North Dakota Forest Service provides primitive camping (no electric or water hookups) as well as fishing and canoeing access at various lakes. These forests and lakes provide access to swimming beaches, picnicking, and an extensive trail system open to hiking, mountain biking, horseback riding, snowmobiling, and cross-country skiing (not groomed). 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 on North Dakota Forest Service lands (18.6 miles), Upper Souris NWR (4.25 miles), Des Lacs NWR (8.5 miles), J. Clark NWR (3.3 miles), White Horse Hill National Game Preserve (3.6 miles), Lake Metigoshe State Park (16 miles), and Grahams Island State Park (2.1 miles; 3 miles cross country skiing). In addition, extensive biking and walking trails are found in local county and city parks. The Turtle Mountain State Recreation Area (ND Forest Service) is located six miles northwest of Bottineau. This recreation area has over 12 miles of trails open to hiking, biking, snowshoeing, horseback riding, and OHV's.

The Pembina Gorge State Park encompasses over 2,800 acres of public land in the Pembina River Gorge. Steep valley cliffs towering over small, isolated prairies and pocketed wetlands surrounded by the largest continuous, undisturbed forest in North Dakota provide opportunities for canoeing, kayaking, hiking, biking, horseback riding, hunting, wildlife observing, birding, and downhill and cross-country skiing. Thirty miles of trails provide snowmobiling, mountain biking, and off-highway vehicles (OHV) opportunities.

Canoeing/Kayaking: Designated canoe and kayaking trails are available within the MLRA. J. Clark Sayler NWR has 12.75 miles of designated trails on the Souris River and Pembina Gorge State Park has 14.25 miles on the Pembina River. The Pembina Gorge State Park offers kayak rentals along with kayak transportation. Lake Metigoshe State Park offers canoe and kayak rentals along with standup paddleboards, pontoons, cross country skis, snowshoes, etc.

Downhill Skiing: Downhill skiing is available at Bottineau Winter Park within Turtle Mountain and Frost Fire Park at the Pembina Gorge. Full-service rental shops are available along with alpine trails ranging from beginner to expert. Conveyor lifts on the beginner hills to chairlifts are available for skiers.

International Peace Garden: The only peace garden located on the United States/Canada border, the International Peace Garden is a 2,339-acre botanical garden commemorating peace between the United States and Canada along the world's longest unfortified border. It blooms with more than 155,000 flowers and

showcases the Peace Chapel, Peace Towers, and Floral Clock. The North American Game Wardens Museum if also located within the boundaries of the International Peace Garden.

Wood Products
There are no significant wood products found on this site.

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

Site Development and Testing Plan
- Further investigation is needed on the wide range of landforms and soil textures (and associated properties) and their relationship to hydrology/plant dynamics.
- Further investigation is needed on poorly drained claypan soils included in this site as compared to other soils in the site.
- Further investigation is needed on areas of this site associated with drainageways and flood plains. Harriet and Lowe occur in drainageways. Ludden, and Ryan soils occur on flood plains of streams and rivers. The impact of occasional or frequent flooding on these areas needs evaluation.
- Further investigation of areas of this site on lake shores and in shallow lake basins is needed. These areas are periodically inundated for extended periods. When many of the soil surveys were completed, these soils were not inundated; currently many of these sites are inundated and have been for many consecutive years. Major components in this site affected by recent inundation are Grano, Lallie, and Minnewaukan. Some delineations of these soils have been impacted by the construction of a dike along the shores of Devils Lake protecting some areas from flooding while maintaining inundation on other areas. Along with ecological site investigations, an SDJR project is needed for these with some soil spatial data review. Spatial data revisions may be needed. MLRA map units needing investigation are:
    - Lallie silty clay loam, saline, 0 to 1 percent slopes (map unit 2q55j)
    - Mauvais-Minnewaukan, saline complex, 0 to 6 percent slopes (map unit 2q556)
    - Grano silty clay, saline, 0 to 1 percent slopes (map unit 2q55h)
- Further evaluation and refinement of the State-and-Transition model may be needed to identify disturbance driven dynamics. Additional states and/or phases may be required to address grazing response.
- Further documentation may be needed for plant communities in all states. Plant data has been collected in previous range-site investigations, including clipping data; however, this data needs review. If geo-referenced sites meeting Tier 3 standards for either vegetative or soil data are not available, representative sites will be selected for further investigation.
- Site concepts will be refined as the above noted investigations are completed.
- The long-term goal is to complete an approved, correlated Ecological Site Description as defined by the National Ecological Site Handbook.
- NASIS revisions needed:
    - During the recently completed Ecological Site Description update, saline phases of Aeric Calciaquolls were reassigned from Saline Lowland to the Salinized State of Limy Subirrigated. Numerous components of Bearden, Fram, Glyndon, Hamerly, and Wyndmere need to be relinked, as well as one component of Moritz.

- During the recently completed Ecological Site Description update, the Sodic Subirrigated ecological site was developed; all Stirum components need to be relinked from Saline Lowland to Sodic Subirrigated.
- Three components of Harriet and one of Vallers, saline are currently linked to 53A Saline Lowland (Legacy); these need to be revised to 55A Saline Lowland.

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
Limy Subirrigated	R055AY040ND	This site occurs on similar, somewhat poorly drained landscape positions. Redoximorphic features occur at a depth between 18 and 30 inches. The soils are highly calcareous within a depth of 16 inches. Salinity, typically, is none to slight (E.C. <8 dS/m); however, a salinized State is recognized. All textures are included in this site.
Thin Claypan	R055AY050ND	This site typically occurs somewhat higher on the landscape. The depth to redoximorphic features is >18 inches. It has a dense, claypan layer within a depth of 6 inches and has salt accumulations within a depth of 16 inches.
Shallow Marsh	R055AY053ND	This site occurs in deep depressions which have frequent ponding through most of the growing season. It is very poorly drained. All textures are included in this site. Some soils with slight or moderate salt accumulations are included.
Wet Meadow	R055AY055ND	This site occurs on similar, poorly drained landscape positions. Redoximorphic features occur within a depth of 18 inches. Where salts occur, E.C. is <8 dS/m to a depth >20 inches. All textures are included in this site.
Loamy Overflow	R055AY041ND	This site occurs on flood plains and upland swales. The surface and subsoil layers form a ribbon 1 to 2 inches long. It is non-saline and is >30 inches to redoximorphic features.
Sandy Claypan	R055AY056ND	This site occurs on sandy lake plains and is slightly higher on the landscape than Saline Lowland. It is typically moderately well drained. It has a claypan layer starting at a depth between 6 and 20 inches; salt accumulations, where present, are deeper than 16 inches.
Sodic Subirrigated	R055AY058ND	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

Limy Subirrigated	R055AY040ND	This site occurs on similar, somewhat poorly drained landscape positions. Redoximorphic features occur at a depth between 18 and 30 inches. The soils are highly calcareous within a depth of 16 inches. Salinity is none to slight (E.C. <8 dS/m) to a depth >20 inches. All textures are included in this site.
Thin Claypan	R055AY050ND	This site typically occurs somewhat higher on the landscape. The depth to redoximorphic features is >18 inches. It has a dense, claypan layer within a depth of 6 inches and has salt accumulations within a depth of 16 inches.
Wet Meadow	R055AY055ND	This site occurs on similar, poorly drained landscape positions. Redoximorphic features occur within a depth of 18 inches. Where salts occur, E.C. is <8 to a depth >20 inches. All textures are included in this site.

Acknowledgements

Developers

ND NRCS: David Dewald, Jonathan Fettig, Alan Gulsvig, Mark Hayek, Chuck Lura, Jeff Printz, Steve Sieler, and Hal Weiser.

Inventory Data References

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

State Correlation

This site has been correlated with North Dakota.

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 46a – Pembina Escarpment; 46b – Turtle Mountains; 46c – Glacial Lake Basins; 46d – Glacial Lake Deltas; 46f – End Moraine Complex; 46g – Northern Black Prairie; 46i – Drift Plains; and 46j – Glacial Outwash.

Stream Type: DA6 (Rosgen System) on riparian systems.

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

INTERPRETING INDICATORS OF RANGELAND HEALTH, Version 5, REFERENCE SHEET

Ecological site name: _Saline Lowland__ Ecological site code: _RO55AY042ND____
Author(s)/participant(s): _USDA-NRCS North Dakota_____
Contact for lead author: _NRCS State Rangeland Management Specialist___
Date: _Dec. 2021_ **MLRA:** __55A_____ **LRU:** _____
Composition based on (check one): ☐ Cover ☒ Annual Production

Indicators. For each indicator, describe the potential for the site using the reference sheet checklist. Where possible, (1) use quantitative measurements; (2) include expected range of values for above- and below-average years and natural disturbance regimes for each community phase within the reference state, when appropriate; and (3) cite data sources used. Continue descriptions on separate sheet.
1. Rills: Rills are not expected on this site.
2. Water flow patterns: Water flow patterns are not visible.
3. Pedestals and/or terracettes: Neither pedestals nor terracettes are expected.
4. Bare ground: Bare ground is less than 5% occurring as small (less than 2 inches in diameter), scattered, disconnected patches. Slickspots of varying size can occur in complex with this site and will be mostly bare ground with sparse, salt-tolerant vegetation.
5. Gullies: Active gullies are not expected on this site.
6. Wind-scoured and/or depositional areas: No wind-scoured or depositional areas expected on this site.
7. Litter movement: Plant litter movement not expected.
8. Soil surface resistance to erosion: Stability class expected to average averages 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: Mid- and short-statured rhizomatous grasses and tall rhizomatous grasses are dominant and well distributed across the site. Mid- and short-statured bunch grasses and forbs are subdominant.
11. Compaction layer: No compaction layers occur naturally on this site. Naturally occurring platy soil surface structure may be observable.
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	Mid & short C3 rhizomatous grasses (2); Tall C4 rhizomatous grasses (2)		
Subdominant	Mid & short C3 bunch grasses (3); Mid & short C4 rhizomatous grasses (1); Forbs (9)		
Minor	Grass-likes		
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 45 to 65% with a depth of 0.5 to 1.0 inches. Litter is in contact with the soil surface.

15. Annual production: Annual air-dry production is 3900 lbs./ac (reference value) with normal precipitation and temperatures. Low and high production years should yield 2900 lbs./ac to 4900 lbs./ac, respectively.

16. Invasive plants: State and local noxious species, Kentucky bluegrass, smooth bromegrass, crested wheatgrass, quackgrass, Eastern red cedar/juniper, 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** Saline Lowland **Ecol. site code** RO55AY042ND

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
Mid & short C3 rhizomatous grasses	western wheatgrass, plains bluegrass
Tall C4 rhizomatous grasses	prairie cordgrass, alkali cordgrass
Mid & short C3 bunch grasses	slender wheatgrass, Nuttall's alkaligrass, foxtail barley, green needegrass*
Mid & short C4 rhizomatous grasses	saltgrass, scratchgrass*, mat muhly*
Forbs	please see plant community table 1.1
Grass-likes	sedge*, mountain rush*
.	
.	
.	
.	
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	Mid & short C3 rhizomatous grasses > Tall C4 rhizomatous grasses	>	Mid & short C3 bunch grasses > Mid & short C4 rhizomatous grasses > Forbs	>>	Grass-likes	.	
		.		.		.	
		.		.		.	

* 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
Mid & short C3 rhizomatous grasses	
Tall C4 rhizomatous grasses	
Mid & short C3 bunch grasses	
Mid & short C4 rhizomatous grasses	
Forbs	
Grass-likes	
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: