United States Department of Agriculture
Natural Resources Conservation Service

Ecological Site Description

Site Stage: Provisional

Provisional: an ecological site description (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: R058CY090ND

Major Land Resource Area (MLRA): 58C Northern Rolling Plains, Northeastern Part
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 58C - Northern Rolling Plains, Northeastern Part in North Dakota and Montana

MLRA 58C covers 2,320 square miles and encompasses approximately 1.8 million acres. MLRA 58C spans two states, with 96 percent located in North Dakota and the remaining 4 percent is in Montana. The MLRA 58C landscape is characterized by steeply sloping dissected badlands along the Little Missouri River and its tributaries. Primary land uses are of rangeland for grazing and wildlife habitat. Microclimates inherent in badlands landscapes influence both variety and abundance of vegetation in MLRA 58C. South- and west-facing exposures are dry, hot, and sparsely vegetated. More humid and cooler north- and east-facing exposures are favorable for abundant forage and woody vegetation.

MLRA 58C is known as the Little Missouri Badlands, which formed when the Little Missouri River was diverted along a shorter, steeper course by Pleistocene glaciers. Due to the resulting increased gradient after its eastward diversion by the glaciers, the Little Missouri River began rapidly downcutting into the soft, calcareous sedimentary shale, siltstone, and sandstone of the Fort Union and Hell Creek geological formations. This rapid downcutting eroded and carved the badlands of the MLRA. This cycle of erosion and deposition continues today.

Most of the soils in MLRA 58C developed from residuum weathered in place. As a result of constant erosion and deposition, the majority of soils in MLRA 58C are Entisols and Inceptisols. Mollisols formed on the high, stable drainageway divides and plateaus above the steeper, dissected hillslopes and fans that define the Little Missouri Badlands. Elevation ranges from 1,835 feet (560 meters) to 3,400 feet (1,036 meters). The Little Missouri River flows through the entire length of MLRA 58C and empties into Lake Sakakawea that was formed by the Garrison Dam on the Missouri River.

Ecological Site Concept

The Saline Lowland site is comprised of poorly drained, alluvial soils on drainageways, floodplains, and alluvial flats. Flooding is none to frequent. This site has soils with high concentrations of salts and sodium. Typically, the soils for this site have carbonates and visible salts or gypsum crystals at depths of 4 to 11 inches, but they can be throughout the soil profile. The soil is moderately to strongly saline (E.C. >8 dS/m). Somewhat higher on the landscape are the Clayey, Claypan, and Thin Claypan ecological sites. The Wet Meadow site is on similar landscape positions; it is non-saline to slightly saline (E.C. <8 dS/m). Slope ranges from 0 to 2 percent. **Note: Some frequently flooded soils may be included in this site. The Riparian Complex ecological site should be considered for such soils.**

Physiographic Features

The Saline Lowland sites are on low-lying terraces, drainageways, and bottom lands along streams. Slopes range from 0 to 2 percent.

Landform: floodplain, drainageway, alluvial flat

	Minimum	Maximum
Elevation (feet):	1835	3400
Slope (percent):	0	2
Water Table Depth (inches):	0	18
Flooding:		
Frequency:	None	Frequent
Duration:	None	Brief
Ponding:		
Depth (inches):	0	6
Frequency:	None	Occasional
Duration:	None	Brief
Runoff Class:	Negligible	High

Aspect: No influence on this site

Climatic Features

MLRA 58C is considered to have a continental climate with cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are common and characteristic of the MLRA. The continental climate is the result of 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.

Annual precipitation ranges from 14 to 17 inches per year. The normal average annual temperature is about 41° F. January is the coldest month with an average temperature of about 17° F. July is the warmest month with an average temperature of about 70° F. The range of normal average monthly temperatures between the coldest and warmest months is 53° F. This large temperature range attests to the continental nature of the MLRA 58C climate. Wind speeds average about 11 miles per hour, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime wind speeds are generally stronger than nighttime wind speeds, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

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

Climate Station(s) 1981 - 2010

Station	Name	Location	Elevation	Lat	Long
USC00328812	TROTTERS 3 SSE	Beach	2419.9	47.2842	-103.9006
USC00329246	WATFORD CITY 14S	Grassy Butte	2026.9	47.6	-103.2597
USW00094080	MEDORA 7 E	Fairfield	2771	46.8947	-103.3769
USC00320209	AMIDON	Amidon	2910.1	46.4819	-103.3222
USC00241518	CARLYLE 13 NW	Wibaux	3140.1	46.7447	-104.3080

Climate Normals

	Representative		Actual		
	High	Low	High	Low	Average
Mean annual precipitation (in):	16	15	16	14	15
Frost free period (days):	100	91	102	84	95
Freeze free period (days):	123	119	123	116	121

Normal monthly precipitation (in)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.4	0.4	0.8	1.4	2.4	3.0	2.3	1.6	1.4	1.4	0.6	0.5
Representative low:	0.4	0.3	0.7	1.1	2.3	2.8	2.1	1.4	1.4	1.3	0.5	0.4
Actual high:	0.5	0.4	0.9	1.6	2.4	3.0	2.3	1.7	1.5	1.4	0.7	0.6
Actual low:	0.3	0.3	0.6	1.0	2.2	2.6	2.0	1.3	1.4	1.1	0.5	0.4

Normal monthly minimum temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	8.2	11.8	21.2	31.9	42.3	51.9	57.7	55.9	45.6	33.7	21.1	9.3
Representative low:	5.8	10.4	20.2	31.0	41.3	50.5	56.6	55.0	44.5	32.3	19.7	7.6
Actual high:	9.9	13.4	21.7	32.0	42.8	52.0	58.3	56.3	45.7	33.9	22.2	11.3
Actual low:	3.8	9.3	19.9	30.9	41.2	50.5	56.4	55.0	44.4	32.3	19.1	6.3
Average:	6.9	11.1	20.7	31.4	41.8	51.1	57.1	55.5	44.9	33.0	20.4	8.6

Normal monthly maximum temperature (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	27.7	32.0	43.3	57.5	67.6	77.1	85.8	85.6	73.8	58.9	41.2	29.1
Representative low:	26.0	31.1	41.3	55.1	65.0	74.3	82.6	82.8	70.7	56.1	40.2	27.5
Actual high:	28.7	33.6	43.5	58.0	68.4	77.5	85.9	85.7	74.1	59.1	42.3	30.4
Actual low:	25.5	31.1	41.3	54.4	64.2	73.3	82.1	82.3	70.3	55.9	39.9	27.5
Average:	27.1	31.8	42.4	56.4	66.5	75.7	84.3	84.2	72.2	57.3	40.8	28.6

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

1981 D	1982W	1983 D	1984 D	1985 N	1986 W	1987 D	1988 D	1989 N	1990 D	1991 W	1992 D	1993 W	1994 N	1995 N
12.6	22.8	12.3	12.0	15.7	20.7	13.8	8.3	15.1	11.1	18.3	13.5	19.5	15.2	15.9

1996 W	1997 N	1998 W	1999 W	2000 N	2001 N	2002 D	2003 N	2004 D	2005 W	2006 N	2007 D	2008 N	2009 W	2010 W
16.9	14.1	18.5	13.5	15.1	15.4	12.7	14.3	12.2	20.7	15.1	13.9	14.8	16.4	22.1

Influencing Water Features

A seasonal water table, typically, is within a depth of 18 inches during the months of April through June; in some soils. In some soils, the water table may continue at this depth into mid-summer while in other soils, it may drop to 40 inches or deeper in mid to late summer. The water table and (on most soils) flooding have some influence on the kinds and amounts of vegetation on this site. However, the benefit of this influence is significantly diminished by the degree soil salinity. Surface infiltration is moderate or moderately slow. Permeability through the profile is very slow to moderately slow. Water loss is primarily through evapotranspiration.

Representative Soil Features

Soils associated with the Saline Lowland ES are in the Mollisol and Entisol orders. The Mollisols are classified further as Typic Endoaquolls and Typic Natraquolls. The Entisols are classified further as Typic Fluvaquents. These soils were developed under prairie vegetation. They formed in alluvium from sedimentary uplands deposited in drainageways, on stream floodplains, or on low-lying flats. The parent materials vary from coarse-loamy to clayey. The soils on this site are very deep. They are poorly drained; redoximorphic features are within a depth of 18 inches.

The common feature of soils in this site is moderate or strong salinity (E.C. >8 dS/m); many soils also have a dense, sodic, root-restrictive claypan. The high concentration of salts and sodium (where present) affects both the kind and amount of vegetation present. Generally, a seasonal high-water table is at or near the surface during the spring and early summer months. The surface layer ranges from 2 to 6 inches thick. Texture of the surface layer is typically loam, but silt loam and fine sandy loam also occur. Commonly, the subsoil is clay loam; however, textures vary from fine sandy loam to clay. The subsoil commonly has a

dense, sodic, root-limiting upper layer. However, moderately, or strongly saline soils without the dense subsoil are included in this site. The soils in this site are commonly calcareous at or near the surface. The excessive salts and sodium affect other soil properties (such as available water capacity, soil structure, infiltration, and permeability). Soils in this site generally have low to moderate organic matter content.

Eroded areas with high amounts of salt and sodium at the surface are barren of vegetation. These areas are typical of this site and are intermingled with areas of vegetation.

Chemical and physical crusts on the soil surface are common. Cryptogamic crusts occasionally occur on the soil surface. Typically, the interpretive plant community will have good cover of perennial grasses with areas of bare ground and salt crusts. These soils are susceptible to wind and water erosion. The hazard of water erosion increases on areas that are denuded of vegetation. Stream channels are intact with occasional water pockets scattered throughout. Loss of the soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to this ecological site include Harriet, Dogiecreek, and Floweree (strongly saline phase).

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

Parent Material Kind: alluvium
Parent Material Origin: residuum
Surface texture: loam, silt loam, fine sandy loam
Surface Texture Modifier: none
Subsurface Texture Group: clayey, loamy
Surface Fragments <3" (% Cover): 0
Surface Fragments ≥3" (%Cover): 0
Subsurface Fragments <3" (% Volume): 0-3
Subsurface Fragments ≥3" (% Volume): 0

	Minimum	Maximum
Drainage Class:	poorly	poorly
Permeability Class*:	very slow	moderately slow
Depth to first restrictive layer (inches):	3	>80
Electrical Conductivity (dS/m)*:	8	>16
Sodium Absorption Ratio*:	0	25
Soil Reaction (1:1 Water)*:	6.6	9.0
Soil Reaction (0.1M CaCl2):	NA	NA
Available Water Capacity (inches)*:	1	6
Calcium Carbonate Equivalent (percent)*:	1	25

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

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 58C 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, pronghorn, mule deer, and whitetail deer). Herbivory by small mammals, insects, nematodes, and other invertebrates are also important factors influencing the production and composition of the communities. Grazing and fire interaction, particularly when coupled with drought events, influenced the dynamics discussed and displayed in the following state and transition diagram and descriptions.

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

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

Three vegetative states have been identified for the site (Reference, Native/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 species (concentrated livestock grazing, lack of fire, and perhaps long-term non-use 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 species on the site precludes it from being placed in the Reference State. It must then be placed in one of the other states, commonly State 2: Native/Invaded State (T1A).

State 2: Native/Invaded State. Colonization of the site by exotic species results in a transition from State 1: Reference State to State 2: Native/Invaded State (T1A). This transition was probably inevitable; it often resulted from colonization by exotic cool-season grasses, such as Kentucky bluegrass and/or smooth brome, which have been particularly and consistently invasive under extended periods of no use and no fire. Other exotics, such as Canada thistle and field sowthistle, are also known to invade the site.

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

State 3: Go-Back State. This state typically results from the abandonment of cropland or hayland. The site will often consist 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, smooth brome, Canada thistle, field sowthistle, curlycup gumweed, and swampfire.

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 (R3A). Following seeding, prescribed grazing, prescribed burning, haying, and the use of herbicides will generally be necessary to achieve the desired result and control weeds, some of which may be noxious weeds. A failed range planting will remain in State 3: Go-Back State.

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

When the management goal is to maintain an existing plant community phase or restore to another phase within the same state, modification of existing management to ensure native species have the competitive advantage may be required. To restore a previous state, the application of two or more management practices

in an ongoing manner will be required. Whether using prescribed grazing, prescribed burning, or a combination of both with or without additional practices (e.g., brush management), the timing and method of application needs to favor the native species over the exotic species. Adjustments to account for variations in annual growing conditions and implementing an ongoing monitoring protocol to track changes and adjust management inputs to ensure desired outcome will be necessary.

The plant community phase composition table(s) has been developed from the best available knowledge including research, historical records, clipping studies, and inventory records. As more data are collected, plant community species composition and production information may be revised.

Plant Communities and Transitional Pathways

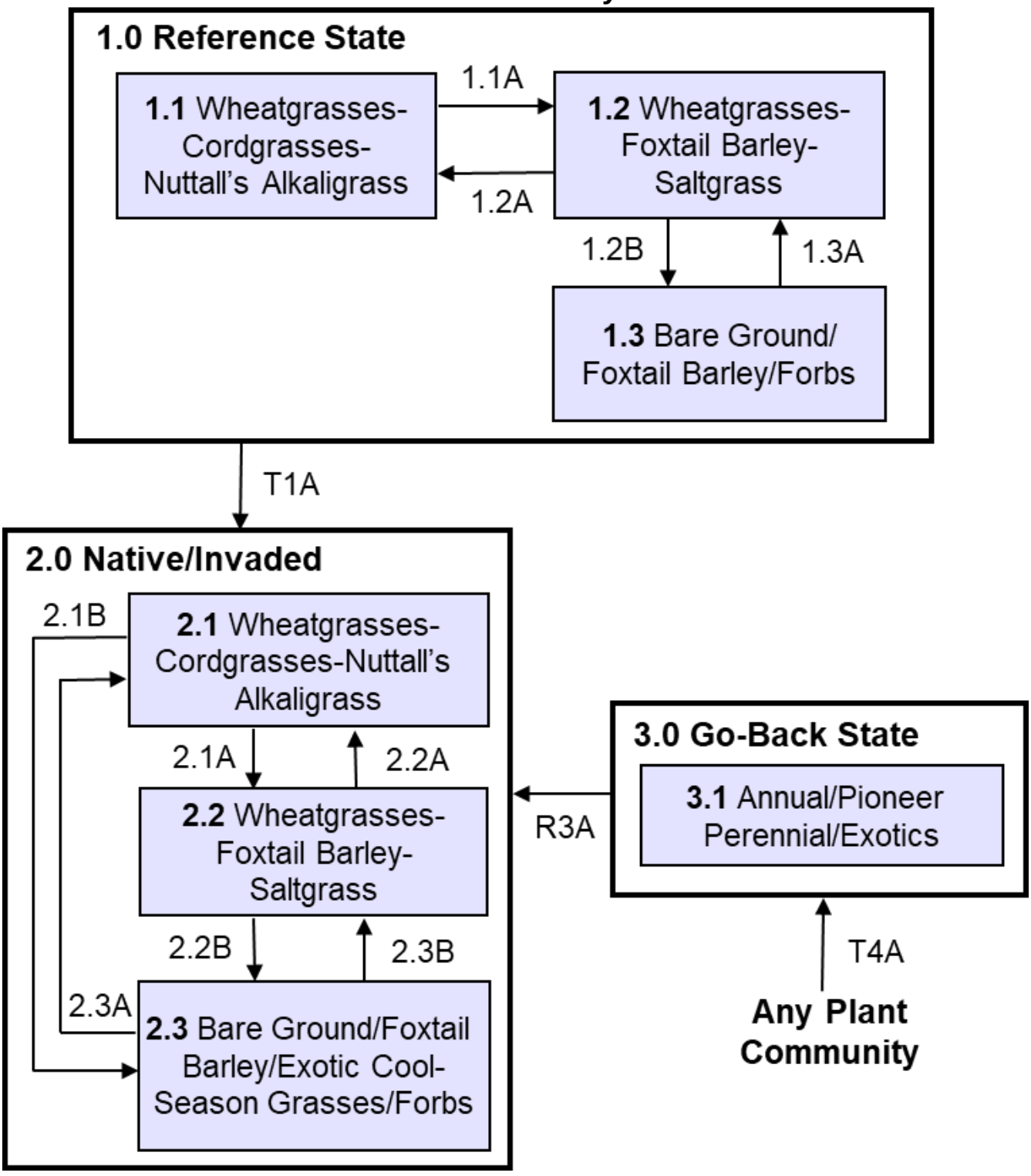

Diagram Legend-MLRA 58C Saline Lowland

T1A	Introduction of exotic cool-season grasses
T4A	Cessation of annual cropping
R3A	Successful range planting
CP 1.1 - 1.2 (1.1A)	Long-term drought with or without heavy long-term grazing
CP 1.2 - 1.1 (1.2A)	Return to average precipitaiton, light to moderate grazing
CP 1.2 - 1.3 (1.2B)	Contiued long-term drought with or without heavy long-term grazing
CP 1.3 - 1.2 (1.3A)	Return to average precipitaiton, light to moderate grazing
CP 2.1 - 2.2 (2.1A)	Long-term drought with or without heavy season-long grazing
CP 2.1 - 2.3 (2.1B)	Prolonged drought with or without heavy season-long grazing
CP 2.2 - 2.1 (2.2A)	Return to average precipitaiton with prescibed grazing
CP 2.2 - 2.3 (2.2B)	Prolonged drought with or without heavy season-long grazing
CP 2.3 - 2.1 (2.3A)	Return to average precipitaiton with prescribed grazing
CP 2.3 - 2.2 (2.3B)	Return to average precipitaiton with 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. The primary disturbance mechanisms for this site in the reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing combined with weather events dictated the dynamics that occurred within the natural range of variability. These factors likely caused the community to shift both spatially and temporally between three community phases. Two of these community phases were predominantly 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 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 Alkalaigrass (*Pascopyrum smithii, Elymus trachycaulus-Spartina* spp.-Puccinellia nuttalliana)

This community phase was historically the most dominant both temporally and spatially. It was composed of a co-dominant mixture of warm-season and cool-season grasses and other graminoids. The major grasses included western wheatgrass, Nuttall's alkaligrass, prairie cordgrass, alkali cordgrass, and saltgrass. Other grasses may have included slender wheatgrass, scratchgrass, plains bluegrass, and foxtail barley. Salt tolerant forbs (such as redwool plantain, western dock, and seepweed) may also have been common associates. Nuttall's saltbush was a common shrub.

Annual production likely varied from around 2000-3000 pounds per acre with grasses and grass-likes, forbs, and shrubs contributing about 90%, 5% and 5%, respectively. Both warm-season grasses and cool-season grasses were well represented in the community; as a result, production was 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 Western Wheatgrass-Cordgrasseses-Nuttall's Alkaligrass		
COMMON/GROUP NAME	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*1750 - 2250*	*70 - 90*
COOL-SEASON GRASSES		**1**	**1125 - 1375**	**45 - 55**
western wheatgrass	PASM	1	625 - 875	25 - 35
Nuttall's alkaligrass	PUNU2	1	50 - 250	2 - 10
slender wheatgrass	ELTR7	1	75 - 125	3 - 5
fowl bluegrass	POPA2	1	25 - 50	1 - 2
foxtail barley	HOJU	1	25 - 50	1 - 2
plains bluegrass	POAR3	1	50 - 75	2 - 3
WARM-SEASON GRASSES		**2**	**875 - 1125**	**35 - 45**
prairie cordgrass	SPPE	2	125 - 500	5 - 20
alkali cordgrass	SPGR	2	25 - 125	1 - 5
saltgrass	DISP	2	25 - 75	1 - 3
scratchgrass	MUAS	2	25 - 50	1 - 2
mat muhly	MURI	2	25 - 50	1 - 2
OTHER NATIVE GRASSES		**3**	**25 - 125**	**1 - 5**
other perennial grasses	2GP	3	25 - 125	1 - 5
GRASS-LIKES		**4**	**75 - 125**	**3 - 5**
sedge	CAREX	4	75 - 125	3 - 5
rush	JUNCU	4	50 - 75	2 - 3
cosmopolitan bulrush	BOMA7	4	0 - 125	0 - 5
other grass-likes	2GL	4	50 - 75	2 - 3
FORBS		*5*	*75 - 125*	*3 - 5*
common yarrow	ACMI2	5	25 - 50	1 - 2
textile onion	ALTE	5	25 - 50	1 - 2
purple milkvetch	ASAG2	5	25 - 25	1 - 1
aster	ASTER	5	0 - 25	0 - 1
leafy wildparsley	MUDI	5	0 - 25	0 - 1
redwool plantain	PLER	5	0 - 25	0 - 1
native forbs	2FN	5	25 - 50	1 - 2
SHRUBS		*5*	*25 - 125*	*1 - 5*
Nuttall's saltbush	ATNU2	5	0 - 100	0 - 4
other shrubs	2SHRUB	5	25 - 50	1 - 2

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	1910 -	2325 -	2740
FORBS	70 -	100 -	130
SHRUBS	20 -	75 -	130
TOTAL	2000 -	2500 -	3000

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 during long-term drought with or without heavy, long-term grazing leading to marked increases in foxtail barley and saltgrass with corresponding decreases in cordgrass and Nuttall's alkaligrass.

Community Phase 1.2: Wheatgrasses-Foxtail Barley-Saltgrass (*Pascopyrum smithii, Elymus trachycaulus-Hordeum jubatum-Distichlis spicata*)
This community phase developed with long-term 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) have 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 corresponding increases in cordgrass and Nuttall's alkaligrass.

Community Phase Pathway 1.2B
Community Phase Pathway 1.2 to 1.3 occurred with prolonged drought with or without heavy long-term grazing. This resulted in notable decreases in wheatgrasses and saltgrass with corresponding increases in bare ground and forbs.

Community Phase 1.3: Bare Ground/Foxtail Barley/Forbs (Bare Ground/*Hordeum jubatum*/Forbs)
This community phase occurred during prolonged drought with or without heavy long-term grazing. Increased salt accumulation on and near the soil surface resulted in the increase and extent of bare, salt encrusted areas and vegetation composed largely of foxtail barley and forbs (such as 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 and saltgrass with corresponding decreases in bare ground and forbs.

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, typically Kentucky bluegrass and/or smooth brome. This transition was probably 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 bromegrass, 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 (commonly Kentucky bluegrass and/or smooth brome) 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. Other exotic plants (such as Canada thistle, field sowthistle, and Russian olive) are also known to invade the

site. Due to soil chemistry (mainly salinity), this site may not become dominated by cool-season invasive species. Annual production of this state can be quite variable, in part due to the amount of exotic cool-season grasses.

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

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

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

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

Community Phase 2.1: 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, generally Kentucky bluegrass and/or smooth brome. However, these exotics are present in smaller amounts with the community still dominated by native grasses. Nuttall's alkaligrass often becomes a conspicuous component of the community; although western wheatgrass, slender wheatgrass, and cordgrasses may still be present, they have declined in importance compared to the Reference State. Extended periods of non-use will result in increased litter but will have little effect on community composition.

Figure 1. Community Phase 2.1: Wheatgrasses-Cordgrasses-Nuttall's Alkaligrass; note Saline Lowland ecological sites in MLRA 58C tend to be in drainageways on a gradual slope (0-2%).

Community Phase Pathway 2.1A

Community Phase Pathway 2.1 to 2.2 occurs during long-term drought with or without heavy, long-term grazing leading to marked increases in foxtail barley and saltgrass with corresponding decreases in cordgrass and Nuttall's alkaligrass.

Community Phase Pathway 2.1B

Community Phase Pathway 2.1 to 2.3 occurs during extended periods of non-use or very light grazing and no fire. This results in a noticeable increase in bare ground and forbs with a corresponding decrease in wheatgrasses, 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, commonly Kentucky bluegrass and/or smooth brome. These exotics, however, are present in smaller amounts with the community still dominated by native grasses.

Community Phase Pathway 2.2A

Community Phase Pathway 2.2 to 2.1 occurs with the return to average precipitation with prescribed grazing. This results in notable decreases in foxtail barley and saltgrass with corresponding increases in cordgrass and Nuttall's alkaligrass.

Community Phase Pathway 2.2B
Community Phase Pathway 2.2 to 2.3 occurs with prolonged drought with or without heavy long-term grazing. This results in notable decreases in foxtail barley and saltgrass with corresponding increases in bare ground and forbs.

Community Phase 2.3: Bare Ground/Foxtail Barley/Exotic Cool-Season Grasses/Forbs (Bare Ground/*Hordeum jubatum*/Exotic Cool-Season Grasses/Forbs)
This community phase is similar to Community Phase 1.3 but includes the establishment of exotic grasses and forbs. Exotic grasses in this community phase typically include Kentucky bluegrass and/or smooth brome. Native forbs may include silverleaf cinquefoil, western dock, redwool plantain, seaside arrowgrass, red swampfire, and Pursh seepweed. Canada thistle and field sowthistle are often common exotic forbs in this community phase.

Community Phase Pathway 2.3A
Community Phase Pathway 2.3 to 2.1 occurs with the return to average precipitation with prescribed grazing, resulting in noticeable increases in wheatgrasses, foxtail barley, and saltgrass with corresponding decreases in bare ground and forbs. This pathway is similar to that of 2.3B but differs because of differences in the botanical composition of Community Phase 2.3.

Community Phase Pathway 2.3B
Community Phase Pathway 2.3 to 2.2 occurs with the return to average precipitation with prescribed grazing, resulting in noticeable increases in wheatgrasses, foxtail barley, and saltgrass with corresponding decreases in bare ground and forbs. This pathway is similar to that of 2.3A but differs because of differences in the botanical composition of Community Phase 2.3.

State 3: Go-Back State
This state typically results from the abandonment of cropland or hayland. The site will often consist 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, smooth brome, field sowthistle, Canada thistle, curlycup gumweed, swampfire, and perhaps Russian olive.

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

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

Community Phase 3.1: Annual/Pioneer Perennial/Exotics
The Annual/Pioneer Perennial/Exotics 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 grasses, such as foxtail barley, with a variety of annual forbs (e.g., burningbush, red swampfire). Over time, a mixture of native and exotic cool-season perennial grasses may become dominant (often Kentucky bluegrass).

Restoration R3A
This Restoration Pathway from State 3: Go-Back State to State 2: Native/Invaded State can be accomplished with a successful range planting. Following seeding, prescribed grazing, prescribed burning, haying, or use of

herbicides will generally be necessary to achieve the desired result and control any noxious weeds. A failed range planting will result in this plant community remaining in State 3.0 Go-Back State.

It may be possible using selected plant materials and agronomic practices to approach something very near the functioning of State 2: Native/Invaded State. Application of chemical herbicides and the use of mechanical seeding methods using adapted varieties of the dominant native grasses are possible and can be successful. After establishment of the native plant species, management objectives must include the maintenance of those species, the associated reference state functions, and continued treatment of exotic grasses.

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). A successful range planting will account for current soil salinity levels and will include proper seedbed preparation, weed control (both prior to and after the planting), selection of adapted native species representing functional/structural groups inherent to the State 1, and proper seeding technique. Management (e.g., prescribed grazing, prescribed burning) during and after establishment must be applied in a manner that maintains the competitive advantage for the seeded native species. Adding non-native species can impact the above and below ground biota. Elevated soil nitrogen levels have been shown to benefit smooth brome and Kentucky bluegrass more than some native grasses. As a result, fertilization, exotic legumes in the seeding mix, and other techniques that increase soil nitrogen may promote smooth brome and Kentucky bluegrass invasion.

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

Transition T4A

This transition from any plant community to State 3: 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, and/or herbicide/pesticide carryover). Thus, soil conditions should be assessed when considering restoration techniques.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

Landscape

The MLRA 58C landscape is characterized by moderately dissected rolling plains with areas of local Badlands, buttes, and isolated hills. MLRA 58C is considered to have a continental climate with cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are common and characteristic of the MLRA. This area supports natural mixed-grass prairie vegetation with prairie rose, leadplant, and patches of western snowberry interspersed throughout the area. Green ash, chokecherry, and buffaloberry occur in draws and narrow valleys, creating woody riparian corridors. Complex/intermingled ecological sites create diverse grass- and shrubland habitats interspersed with varying densities linear, slope, depressional, and in-stream

wetlands associated with headwater streams and tributaries to the Missouri River. These habitats provide critical life-cycle components for many wildlife species.

Historic Communities/Conditions within MLRA 58C:

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

Present Communities/Conditions within MLRA 58C:

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

Extensive fragmentation by annual cropping has not occurred within the MLRA. Limited fragmentation from annual cropping or tame hay production has occurred within the Little Missouri River flood plain and the higher, flat plateaus. Fragmentation east and west of MLRA 58C has funneled many species into this area in search of expansive grasslands.

Some wildlife species in this area are: mule deer, white-tailed deer, elk, bighorn sheep, pronghorn, mountain lion, coyote, red fox, bobcat, prairie rattlesnake, American badger, raccoon, North American porcupine, beaver, striped skunk, American mink, white-tailed jackrabbit, black-tailed prairie dog, Eastern and Merriam's wild turkey, golden eagle, ferruginous hawks, sharp-tailed grouse, greater sage-grouse, black-billed magpie, and numerous species of grassland-nesting birds and pollinating insects. The highest diversity of bats in North Dakota also occurs in this MLRA, where eleven species have been documented.

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

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

Species unique to the MLRA:

Mountain Lions: Mountain lions were relatively common in the Badlands but disappeared from the state by the early 20th Century. Sightings resumed in the 1950's and have subsequently increased since that time. The species has recently taken up permanent residency within the region. Mountain lions occur in of the Little Missouri Badlands and woody habitat in MLRA 58C. Rugged terrain and forest provide excellent stalking cover to hunt large mammals and other prey. Mountain lions make use of caves for escape and loafing cover.

Bighorn sheep: Bighorn sheep make use of the rugged terrain, rocky outcrops, and high plateaus of MLRA 58C along the Little Missouri River. North Dakota bighorn sheep populations are almost exclusively within MLRA 58C. Bighorn sheep were once extirpated from North Dakota but were successfully reintroduced in the mid-twentieth century. They now occur in several distinct populations within MLRA 58C. Rocky Mountain juniper encroachment degrades the limited habitat for bighorn sheep. Managers should consider bighorn sheep association with domestic sheep, since transfer of pneumonia and other diseases is known to occur.

Golden eagle: The badlands within MLRA 58C are key areas for Golden eagle nesting. Adjacent grasslands, shrublands, and black-tailed prairie dog towns are used for hunting.

Bats: MLRA 58C provides life requisites for several bat species, in part due to presence of riparian forest, wooded draws, caves, and rocky outcrops. Hibernacula of six bat species have been found in MRLA 58C; however, additional work is needed to further understand utilization of hibernacula by bats during the winter months in North Dakota.

Short-horned lizard and sagebrush lizard: This MLRA provides preferred habitat for these two species. The short-horned lizard prefers semi-arid, shortgrass prairie in rough terrain, and is uncommon to locally abundant in MLRA 58C. The rare sagebrush lizard prefers sagebrush and rocky areas provided by this MLRA and adjacent MLRA 58D.

Greater sage-grouse and Brewer's sparrow: The extreme southwest extension of MLRA 58C have ecological sites capable of producing sufficient big sage canopy cover to provide greater sage-grouse life requisites. MLRA 58C and 58D are the only MLRAs in North Dakota that support Wyoming big sage brush (big sage) production. Research data indicates greater sage-grouse prefer big sagebrush canopy cover for nesting at ≥8% with an average height of around 16 inches. The species prefers winter cover canopy that averages 15% with an average height of around 8 inches. Soil site potential, management, climate, and other factors all play a role in the amount, if any, of big sagebrush on an ecological site. Changes in big sage canopy cover occur slowly (30-50 years) unless the site is impacted by fire or cultivation. Big sage recovery after a burn can take 30 to 100 years. Greater sage-grouse and Brewer's sparrow habitat and populations are reduced or eliminated when big sagebrush canopy is reduced to less than 8% for greater sage-grouse and 10% cover for Brewer's sparrow. As conifer encroachment increases, greater sage-grouse lekking activity decreases. Once conifer encroachment exceeds 4% canopy cover, no leks remain.

Species of Concern within the MLRA:

Following is a list of species considered "species of conservation priority" in the North Dakota State Wildlife Action Plan (2015); "species of greatest conservation need" in the Montana State Wildlife Action Plan (2015); and species listed as "threatened, endangered, or petitioned" under the Endangered Species Act within MLRA 58C at the time this section was developed:

Invertebrates: Dakota skipper, monarch butterfly, regal fritillary, yellow-banded bumble bee, and western bumble bee.

Birds: American kestrel, Baird's sparrow, bald eagle, black-billed cuckoo, bobolink, Brewer's sparrow, burrowing owl, chestnut-collared longspur, common poorwill, eastern screech-owl ferruginous hawk, golden eagle, grasshopper sparrow, greater sage-grouse, lark bunting, loggerhead shrike, long-billed curlew, marbled godwit, McCown's longspur, mountain plover, northern harrier, northern pintail, peregrine falcon (migration), prairie falcon, red knot (migration), red-headed woodpecker, sharp-tailed grouse, short-eared owl, Sprague's pipit, Swainson's hawk, upland sandpiper, western meadowlark, Wilson's phalarope, whooping crane (migration), and willet.

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

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

Fish and Mussels: Blue sucker, burbot, Flathead chub, northern redbelly dace, sickle-fin chub, pearl dace, shortnose gar, sturgeon chub, and sauger.

Grassland Management for Wildlife in the MLRA

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

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

Management of these complex ecological sites can provide a heterogeneous or a homogenous landscape. Grassland bird use declines as the plant community transitions to a homogenous state. Managers need to recognize ecological sites and the complexes they occur in to properly manage the

landscape. A management regime for one ecological site may negatively impact an adjacent site (e.g., alteration of a grazing regime within a Flat Bottom Wooded Draw ecological site to encourage understory growth may encourage exotic, cool-season grasses to increase or dominate an adjacent ecological site).

Life requisites and habitat deficiencies are determined for targeted species. Deficiencies need to be addressed along community phase, transitional, and restoration pathways as presented in specific state and transition models. Ecological sites should be managed and restored within the capabilities of the site to provide sustainable habitat. Managers also need to consider habitat provided by adjacent/intermingled ecological sites for species with home ranges or life requisites that cannot be provided by one ecological site.

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

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

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

Nesting waterfowl		x	x	
Northern harrier		x	x	x
Savannah sparrow		x	x	x
Short-eared owl		x	x	x
Sprague's pipit	x	x		x
Upland sandpiper	x	x		x
Western meadowlark	x	x		
Willet	x	x		x
*Many of the listed species avoid nesting in grassland areas when woody vegetation within a grassland or avoid nesting near woody vegetation in adjacent habitats. Although these species avoid areas with woody vegetation, most can tolerate a small amount of woody vegetation within areas dominated by grassland habitat, including short-statured shrubs (e.g., sagebrush, western snowberry, prairie rose, etc.) in this MLRA.				

Saline Lowland Wildlife Habitat Interpretation:

Saline Lowland ecological sites predominantly 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 Clayey, Claypan, Thin Claypan, and Wet Meadow. This complex of ecological sites provides habitat for many edge-sensitive, grassland bird species preferring short- to tall-statured vegetation, dependent upon plant community.

Saline Lowland habitat features and components commonly support grassland-nesting birds that prefer short- to medium stature vegetation. Shore birds will use this site since during periods of the year it will contain standing and/or flowing water. 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 (lack of management) 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 T1 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: This plant community offers 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 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).

Dependent upon salinity levels, Saline Lowland ecological sites provide habitat for a diverse suite of aquatic invertebrates providing an important trophic link between macrophytes and vertebrates that depend upon them as food. Rapid warming during spring snowmelt allows the invertebrate population to flourish. The vegetative structure provided by vegetated, shallow wetlands increase the abundance of aquatic invertebrates compared to less vegetated sites.

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, wetness, 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 provides quality nesting, foraging, and escape habitats favored by mid- to tallgrass-nesting birds. Dependent upon ponded water levels, this plant community may provide habitat for species preferring wetter (hydric) habitats (such as Nelson's sparrow, northern harrier, sedge wren, yellow rail, Wilson's phalarope, Wilson's snipe, etc.). This site may provide waterfowl pair bonding sites, early season invertebrate food sources, and early season shorebird habitat if semi-permanent or permanent water is nearby. The rapid warming during spring snowmelt provides water birds an abundant invertebrate protein source for egg laying. Prescribed burning maintains a grass-dominated plant community, providing habitat for bird species sensitive to woody vegetation. This plant community does not provide suitable areas for sharp-tailed grouse lek sites or nesting habitat. However, it does provide winter cover, escape habitat, and brood-rearing habitat (depending on water levels). This site provides good hunting opportunities for grassland raptors, especially northern harrier.

Mammals: Limited diversity of grasses and forbs provide reduced nutrition levels for small and large herbivores including voles, mice, jackrabbits, and white-tailed deer. During periods of ponding or runoff, this site provides a water source for many mammals. This plant community has less diversity and shorter plant stature compared to associated sites such as Clayey, Claypan, Thin Claypan, and Wet Meadow. Mid- to short-statured vegetation, wetness, and salinity provides limited thermal, protective, and escape cover for small and large 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 may 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: Long-term drought (with or without heavy, long-term 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 requisites 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.

Community Phase 1.3 Bare Ground/Foxtail Barley/Forbs: This plant community phase is characterized by bare ground and grazing-tolerant annual forbs. Long-term inundation, with or without heavy long-term grazing, will shift to increased bare ground and annual forbs with a reduction in perennial grasses. Moderate perennial forb stature and abundance are being replaced by short-statured annual forbs. Bare ground increases while litter amounts and infiltration rates decline; soil surface temperatures increase. 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).

Invertebrates: A switch to mainly wind-pollinated forbs 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. Shorebird use is limited to times of inundation.

Mammals: Bare ground and the loss of grasses provides limited food, thermal, shelter, 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; however, increased bare ground will yield additional sediment to nearby water bodies.

2.0 Native/Invaded State

Community Phase 2.1 Wheatgrasses-Cordgrasses-Nuttall's Alkaligrass: Introduction and establishment of exotic cool-season grasses exacerbated by 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: Long-term 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/Foxtail Barley/Exotic Cool-Season Grasses/Forbs: This plant community phase is characterized by bare ground and grazing-tolerant annual forbs. Prolonged drought, with or without heavy long-term grazing, will shift to increased bare ground and annual forbs with a reduction in perennial grasses. This plant community is resilient, retaining sufficient grazing-sensitive native plant species to return to the 2.1 or 2.2 community phase (via Community Phase Pathway 2.3A and 2.3B respectively).

Invertebrates: Provides similar life requisites as Community Phase 1.3.

Birds: Provides similar life requisites as Community Phase 1.3.

Mammals: Provides similar life requisites as Community Phase 1.3.

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

Fish and Mussels: Provides similar life requisite benefits as Community Phase 1.3.

3.0 Go-Back State

Community Phase 3.1 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 salt-tolerant 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, foxtail barely or exotic cool-season perennial grasses (Kentucky bluegrass and/or smooth brome) generally become re-established and dominate the community. A failed native range planting will likely maintain this plant community in State 3.0 Go-Back.

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 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

Plant available water is the principal factor limiting forage production on this site. As soil salinity increases, plant available water decreases. Under unaltered hydrologic conditions, the site is dominated by soils in hydrologic group D. Infiltration is moderately rapid to slow; runoff potential for this site varies from negligible to high depending on soil surface texture, soil permeability, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. (Refer to NRCS Section 4, National Engineering Handbook (NEH-4) for runoff quantities and hydrologic curves).

Recreational Uses

The largest acreage of public land available for recreation in the MLRA is owned and managed by the United States Forest Service (USFS) within the Little Missouri National Grasslands in North Dakota (525,211 acres). These areas are available for hunting, fishing, hiking, camping, horse and bike riding, nature viewing, etc. In addition, the Bureau of Land Management (BLM) manages 30,895 acres in North Dakota and Montana with the same recreational opportunities as the USFS lands. North Dakota and Montana Department of Trust

Lands (80,220 acres) provide hunting, bird watching, hiking, and other outdoor recreation opportunities. North Dakota Wildlife Management Areas (3,447 acres) of land managed by the states for wildlife habitat in MLRA 58C.

MLRA 58C is home to the North and South Units of Theodore Roosevelt National Park. The Park encompasses approximately 70,000 acres and welcomes approximately 900,000 visitors annually. 29,920 acres of the park is designated Wilderness Area. The south unit of the park has a 48-mile scenic drive while the north unit has a 28-mile scenic drive. The Badland and associated ecological sites provide the main scenery attraction.

Bird watching: Public and private grasslands within MLRA 58C provide essential habitat for prairie-dependent bird species (such as Sprague's pipits, western meadowlark, and Baird's sparrow) along with some of the larger, showy members of the upland prairie including marbled godwits, upland sandpipers, and willets. The abundance of publicly owned lands (such as Theodore Roosevelt National Park, USFS, North Dakota Department of Trust Lands, BLM, etc.) provide excellent birding opportunities. MLRA 58C is in the Central Flyway.

Hunting/Fishing: MLRA 58C is a fall destination for upland game bird hunters, especially sharp-tailed grouse. This MLRA also provides excellent white-tailed deer, mule deer, pronghorn, elk, coyote, and mountain lion hunting opportunities along with the only bighorn sheep hunting units in the North Dakota. The North Dakota Game and Fish Department manages three man-made fishing lakes within the MLRA. Available species include rainbow and brown trout, bluegill, and largemouth and smallmouth bass.

Camping: Many camping opportunities exist in the MLRA. Modern and primitive camping is available at the Theodore Roosevelt National Park, Sully’s Creek State Park, Little Missouri State Park, Buffalo Gap Campground, BLM land, and the Dakota Prairie National Grasslands. The Sully’s Creek and Little Missouri State Parks are designated horse parks.

Hiking/Biking: Over 150 miles of the May-Daah-Hey Trail provide some of the best single-track trails in the world for biking, hiking, or horseback riding. The International Mountain Biking Association (IMBA) has designated the hiking, biking, and horseback riding trail as EPIC - meaning it’s one of the top mountain biking trails in the United States. The trail has nine fenced campgrounds, each accessible by gravel surfaced roads; they include camping spurs, potable water, hitching rails, picnic tables, fire rings, and accessible toilets. They are spaced about every 20 miles along the trail. The North and South Units of the Theodore Roosevelt National Park provide 38.9 and 49.6 miles, respectively, of hiking trails for walkers, bikers, or horseback riders. The Little Missouri State Park has 45 miles of trails that run through the North Dakota Badlands.

Canoeing: Traversing 274 miles through MLRA 58C, the Little Missouri River provides early spring canoeing and kayaking. The Little Missouri River is the only designated State Scenic River in the MLRA. The river passes through Sully Creek State Park, the Little Missouri National Grassland, and Theodore Roosevelt National Park.

Wood Products

No appreciable wood products are present on the site.

Other Products

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

Site Development and Testing Plan

Further evaluation may be needed to determine if an Invaded State may exist. Salinity levels may allow for Kentucky bluegrass, smooth brome, or crested wheatgrass to invade this site to meet invaded state threshold. 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

Clayey	R058CY072ND	This ecological site is commonly located adjacent to and up-slope from the Saline Lowland site. These are well drained or moderately well drained soils on upland landforms that do not receive additional moisture from runoff. The subsoil forms a ribbon >2 inches long, but it is not dense enough to affect root growth.
Claypan	R058CY073ND	This ecological site is commonly located adjacent to and up-slope from the Saline Lowland site. These are moderately well drained or well drained soils with a dense, sodic claypan which restricts root growth. The depth to the claypan is between 6 and 20 inches. Visible salt and/or gypsum are common below a depth of 16 inches. Typically, the subsoil forms a ribbon >2 inches long but soil ribbons between 1 and 2 inches long are allowable. Sodium-affected landscapes in MLRA 58C exhibit the shallow micro-relief that is evident in the pock-marked appearance of the ground surface.
Thin Claypan	R058CY081ND	This ecological site is commonly located adjacent to and somewhat up-slope from the Saline Lowland site. These are somewhat poorly drained to well drained soils with a dense, sodic, root-restrictive, claypan within a depth of 6 inches. Visible salt and/or gypsum crystals are within a depth of 16 inches and commonly occur in the surface layer. Typically, the subsoil forms a ribbon >2 inches long but soil ribbons between 1 and 2 inches long are allowable.
Wet Meadow	R058CY092ND	Soils on the Wet Meadow ecological site occur on similar landscape positions as the Saline Lowland site, as well as in abandoned oxbows. The soils are non-saline to slightly saline (E.C. <8 dS/m); a dense, sodic claypan is not allowed in the Wet Meadow ecological site.

Similar Sites

Wet Meadow	R058CY092ND	Soils on the Wet Meadow ecological site occur on similar landscape positions as the Saline Lowland site, as well as in abandoned oxbows. The soils are non-saline to slightly saline (E.C. <8 dS/m); a dense, sodic claypan is not allowed in the Wet Meadow ecological site.

Acknowledgements

NRCS would like to acknowledge the United State Forest Service (USFS) and National Park Service (NPS) for access to USFS and NPS properties and technical assistance in ESD development. USFS: Jack Dahl, Nickole Dahl, Chad Prosser, Jack Butler; NPS: Chad Sexton.

Developers

ND NRCS: David Dewald, Alan Gulsvig, Mark Hayek, Jeanne Heilig, John Kempenich, Chuck Lura, Jeff Printz, and Steve Sieler.

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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 and Montana.

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 43b – Little Missouri Badlands

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 Rangeland Management Specialist Date

INTERPRETING INDICATORS OF RANGELAND HEALTH, Version 5, REFERENCE SHEET

Ecological site name: _Saline Lowland_ Ecological site code: _RO58CY090ND__
Author(s)/participant(s): M. Hayek, J. Printz, S. Boltz, R. Kilian, D. Froemke, M. Rasmusson
Contact for lead author: _NRCS State Rangeland Management Specialist__
Date: _Nov. 2021__ **MLRA:** __58C_____ **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.
5. Gullies: Active gullies are not expected on this site. If present, gully channel(s) are fully vegetated with no active erosion visible.
6. Wind-scoured and/or depositional areas: No wind-scoured or depositional areas expected on this site.
7. Litter movement: Plant litter movement not expected on this site.
8. Soil surface resistance to erosion: Stability class expected to average 3 or greater.
9. Soil surface loss and degradation: Use soil series description for depth, color, and structure of A-horizon. If sodium affected, surface structure may be platy.
10. Effects of plant community composition and distribution on infiltration: mid- and short-statured rhizomatous grasses are dominant with mid- and short-statured bunchgrasses subdominant and well distributed across the site.
11. Compaction layer: No compaction layers occur naturally on this site.
12. Functional/structural groups: Due to differences in phenology, root morphology, soil biology relationships, and nutrient cycling Kentucky bluegrass, smooth brome, and crested wheatgrass are included in a new Functional/structural group, mid- and short-statured early cool-season grasses (MSeC3), **not expected for this site**.

Dominance Category[1]	**Relative dominance of F/S groups for community phases in the *Reference State*** *Minimum expected number of species for dominant and subdominant groups is included in parentheses.*

	Dominance based on[1]: Annual Production _X_ or Foliar Cover __		
	Phase 1.1_	**Phase 1. __**	**Phase 1. __**
Dominant	**Mid & short C3 rhizomatous grasses (3)**		
Subdominant	**Tall C4 rhizomatous grasses (2); Mid & short C3 bunch grasses (3)**		
Minor	**Mid & short C4 rhizomatous grasses; Forbs; Grass-likes; Shub**		
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 15 to 35% with a depth of .05 to 1.0 inches. Litter is in contact with the soil surface.

15. Annual production: Annual air-dry production is 2500 lbs./ac (reference value) with normal precipitation and temperatures. Low and high production years should yield 2000 lbs./ac to 3000 lbs./ac, respectively.

16. Invasive plants: State and local noxious species, Kentucky bluegrass, smooth bromegrass, crested wheatgrass, quackgrass, 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.

October 2024

Functional/Structural Groups Sheet

State ND **Office** _____ **Ecological site** Saline Lowland **Ecol. site code** RO58CY090ND

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, fowl bluegrass, plains bluegrass
Tall C4 rhizomatous grasses	prairie cordgrass, alkali cordgrass
Mid & short C3 bunch grasses	Nuttall's alkaligrass, slender wheatgrass, foxtail barley
Mid & short C4 rhizomatous grasses	saltgrass, scratchgrass, mat muhly
Forbs	please see plant community table 1.1
Grass-likes	sedge, rush, cosmopolitan bulrush*
Shrub	Nuttall's saltbush*
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.	
Biological soil crust[1]	

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

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

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

*indicates species that may or may not be present on the site

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	
Shrub	
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

Notes: