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: Sandy Claypan

Site Type: Rangeland

Site ID: R058CY085ND

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 Sandy Claypan ecological site formed in sandy alluvium located on flats and fans below badlands. Although the soil parent materials are very deep or deep; a dense, sodic claypan layer (Btn horizon) occurs in the upper part of the subsoil (starting at a depth between 6 to 20 inches) which affects root growth. The claypan subsoil is typically loam or sandy clay loam (forms a ribbon <1 inch long). The texture of the surface layer is typically fine sandy loam. In a few soils, soft sandstone may occur below depths of 60 inches. The soils are well drained. Salt accumulations are allowable below a depth 16 inches. Slopes range from 0 to 9 percent. On the landscape, this site is below the Sandy and Sands ecological sites. The Thin Claypan ecological site is in adjacent micro-lows; it has a claypan layer within a depth of 6 inches and salt accumulations within a depth of 16 inches.

Physiographic Features

The Sandy Claypan sites are located on nearly level to moderately sloping alluvial flats and fans. The parent materials are alluvium from weathered residuum (sandstone). Slopes are linear to concave and range from 0 to 9 percent.

Landform: flats, fans

	Minimum	**Maximum**
Elevation (feet):	1835	3400
Slope (percent):	0	9
Water Table Depth (inches):	72	>80
Flooding:		
Frequency:	None	None
Ponding:		
Frequency:	None	None
Runoff Class:	Medium	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

This site does not receive significant additional water, either as runoff from adjacent slopes or from a seasonal high-water table. Depth to the water table typically is greater than 6 feet throughout the growing season. Surface infiltration is moderately rapid. Permeability through the claypan layer is slow. Water loss is through percolation below the root zone and through evapotranspiration.

Representative Soil Features

Soils associated with Sandy Claypan ES are in the Alfisol order which are classified further as Aridic Natrustalfs. These soils were developed under prairie vegetation. Salt accumulations, where present, are below a depth of 16 inches. They formed in alluvium from weathered sandstone.

The common feature of soils in this site is a sodic, claypan subsoil layer that is loam or sandy clay loam; it forms a ribbon <1 inch long. Although the soil parent materials are very deep or deep, the claypan (which affects root growth) occurs in the upper part of the subsoil (starting at a depth between 6 to 20 inches). The texture of the surface layer is typically fine sandy loam. These soils commonly have a grayish subsurface layer of loam, find sandy loam or very fine sandy loam just above the claypan layer. Salt accumulations, where present, are below a depth of 16 inches. The soils in this site are well drained. **Note:** where the depth to the claypan is >20 inches, the soil should be assigned to the Sandy ecological site.

Soil salinity is typically none to very slight above the claypan layer (E.C. <4 dS/m); however, slight salinity (E.C. 4-8 dS/m) is allowable within a depth of 16 inches. Below 16 inches, it may increase to moderate (E.C. 8 - <16 dS/m) in some soils. Sodicity is low (SAR <5) above the claypan layer; but increases to moderate or high (SAR 5 to 20) in the subsoil and substratum. Soil reaction is moderately acid to neutral (pH 5.6 to 7.3)

above the claypan and slightly acid to strongly alkaline (pH 6.1 to 9.0) in the subsoil and substratum. Calcium carbonate content is typically none in the surface soil and upper few inches of the claypan layer; below this, it may increase to moderate (5-20% CaCO3).

The soil surface is stable and intact. Sub-surface soil layers are restrictive to water movement and affect root penetration. These soils are susceptible to wind and water erosion. The hazard of water erosion increases on slopes greater than 6 percent. Loss of the soil surface layer can result in a shift in species composition and/or production.

The major soil series which characterizes the Sandy Claypan ecological site is Archin.

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

Parent Material Kind: alluvium, residuum
Parent Material Origin: sandstone
Surface Texture: fine sandy loam
Surface Texture Modifier: none
Subsurface Texture Group: loamy
Surface Fragments <3" (% Cover): 0
Surface Fragments ≥3" (%Cover): 0
Subsurface Fragments <3" (% Volume): 0-6
Subsurface Fragments ≥3" (% Volume): 0

	Minimum	Maximum
Drainage Class:	well	well
Permeability Class*:	slow	slow
Depth to first restrictive layer (inches):	5	16
Electrical Conductivity (dS/m):**	0	8
Sodium Absorption Ratio*:**	0	20
Soil Reaction (1:1 Water)*:**	5.6	9.0
Soil Reaction (0.1M CaCl2):	NA	NA
Available Water Capacity (inches)*:**	2	4
Calcium Carbonate Equivalent (percent)*:**	0	20

*This attribute represents the claypan layer (starts at a depth between 5 to 16 inches).
**This attribute represents from 0-16 inches. Electrical Conductivity (E.C.) values are based on Saturated Paste method; the commonly used 1:1 field method will likely have E.C. values ≤4.
***These attributes represent from 0 to 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.

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.

A Note on Prairie Dogs: Prairie dogs prefer habitats composed predominantly of shortgrasses and avoid those dominated by tallgrasses. Historically, prairie dogs likely occupied a wide range of soils (at least occasionally) due to variations in environmental factors (such as drought severity and length, grazing pressure, etc.). Presently, the known occupation of this ecological site in this MLRA by prairie dogs is considered to be uncommon to rare. As a result, the presence of prairie dog towns for this ecological site in this MLRA is not included in this ecological description. However, prairie dog towns may be encountered on the site. If encountered impact would include increased bare ground, decreased production and plant vigor.

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.

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 two 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, most 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, smooth brome, crested wheatgrass, and/or annual bromes) which have been particularly and consistently invasive under extended periods of no use and no fire. Other exotics, such as Canada thistle and leafy spurge, are also known to invade the site.

Two 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. Managers need to understand when the plant community is at or near these parameters; all data available needs to be evaluated to determine needed management actions.

State 3: Invaded State. The threshold for this state is reached when both the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, crested wheatgrass, annual bromes) exceed 30% of the plant community and native grasses represent less than 40% of the community. Managers need to understand when the plant community is at or near these parameters; all data available needs to be evaluated to determine needed management actions. 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. This 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 (Kentucky bluegrass, smooth brome, crested wheatgrass, and/or annual bromes) will likely predominate.

Initially, due to extensive bare ground and a preponderance of shallow-rooted annual plants, the potential for soil erosion is high. Plant species richness may be high, but overall diversity (i.e., equitability) is typically low, with the site dominated by a relatively small assemblage of species. Due to the lack of native perennials and other factors, restoring the site with the associated ecological processes is difficult. However, a successful range planting may result in something approaching State 2: Native/Invaded State (R4A). Following seeding, prescribed grazing, prescribed burning, haying, and the use of herbicides generally will 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).

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

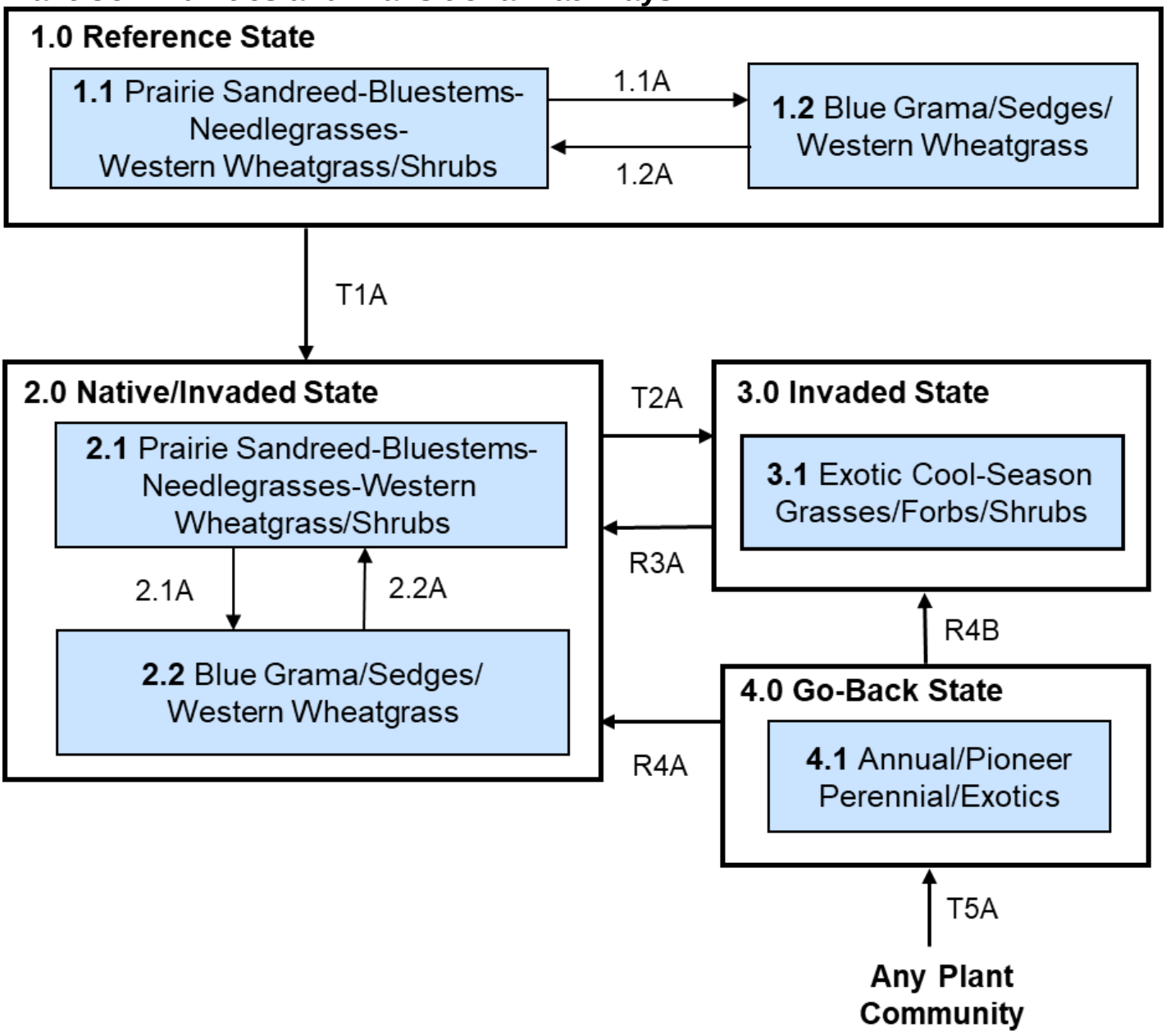

Diagram Legend - MLRA 58C Sandy Claypan	
T1A	Introducation of exotic cool-season grasses
T2A	Extended periods of non-use or very light grazing, no fire
T5A	Ceasastion of annual cropping
R3A	Long-term prescribed grazing and prescribed burning
R4A	Successful range planting with prescribed grazing and prescribed burning
R4B	Failed range planting and/or secondary succession
CP 1.1 - 1.2 (1.1A)	Long-term drought with/without heavy grazing
CP 1.2 - 1.1 (1.2A)	Return to average precipitation and reduced grazing
CP 2.1 - 2.2 (2.1A)	Heavy season-long grazing with or without drought
CP 2.2 - 2.1 (2.2A)	Prescribed grazing and prescribed burning, return to average precipitation

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 two community phases.

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: Prairie Sandreed-Bluestems-Needlegrasses-Western Wheatgrass/Shrubs (*Calamovilfa longifolia-Andropogon* spp.-*Hesperostipa* spp., *Nassella viridula-Pascopyrum smithii*/Shrubs)

This community phase was historically the most dominant both temporally and spatially. Cool-season grass and grass-like species dominated this plant community with warm-season grasses being subdominant. The major cool-season grasses included western wheatgrass, needle and thread, and green needlegrass. Big bluestem, prairie sandreed, and blue grama were major warm-season grasses. Other grasses occurring on the site included sand bluestem, Fendler threeawn, prairie Junegrass, and Sandberg bluegrass. Common forbs and shrubs included goldenrod, longbract spiderwort, scurfpea, common yarrow, prairie clover, stiff sunflower, blazing star, leadplant, western snowberry, and silver sagebrush.

Annual production likely varied from about 1400-2600 pounds per acre with grasses and grass-likes, forbs, and shrubs contributing about 85%, 10% 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 Prairie Sandreed-Bluestem-Needlegrasses-Wheatgrasses/Shrubs		
COMMON/GROUP NAME	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*1500 - 1700*	*75 - 85*
WHEATGRASS		**1**	**300 - 500**	**15 - 25**
western wheatgrass	PASM	1	300 - 500	15 - 25
Tall WARM-SEASON GRASSES		**2**	**200 - 300**	**10 - 15**
big bluestem	ANGE	2	0 - 60	0 - 3
sand bluestem	ANHA	2	20 - 100	1 - 5
prairie sandreed	CALO	2	100 - 200	5 - 10
NEEDLEGRASS		**3**	**200 - 300**	**10 - 15**
needle and thread	HECOC8	3	200 - 300	10 - 15
green needlegrass	NAVI4	3	40 - 100	2 - 5
SHORT WARM-SEASON GRASSES		**4**	**100 - 200**	**5 - 10**
blue grama	BOGR2	4	100 - 200	5 - 10
OTHER NATIVE GRASSES		**5**	**100 - 180**	**5 - 15**
Fendler threeawn	ARPUL	5	40 - 60	2 - 3
Scribner's rosette grass	DIOLS	5	0 - 20	0 - 1
Canada wildrye	ELCA4	5	0 - 20	0 - 1
prairie Junegrass	KOMA	5	20 - 40	1 - 2
Sandberg bluegrass	POSE	5	20 - 40	1 - 2
little bluestem	SCSC	5	0 - 60	0 - 3
sand dropseed	SPCR	5	0 - 20	1 - 2
GRASS-LIKES		**6**	**100 - 200**	**5 - 10**
threadleaf sedge	CAFI	6	100 - 160	5 - 8
sun sedge	CAINH2	6	40 - 100	2 - 5
FORBS		*7*	*100 - 200*	*5 - 10*
scurfpea	PSORA2	7	40 - 80	2 - 4
stiff sunflower	HEPA19	7	20 - 40	1 - 2
blazing star	LIATR	7	0 - 20	0 - 2
cinquefoil	POTEN	7	0 - 20	0 - 2
common yarrow	ACMI2	7	0 - 20	0 - 1
tarragon	ARDR4	7	0 - 20	0 - 1
white sagebrush	ARLU	7	0 - 20	0 - 1
groundplum milkvetch	ASCR2	7	0 - 20	0 - 1
wavyleaf thistle	CIUN	7	0 - 20	0 - 1
prairie clover	DALEA	7	0 - 20	0 - 1
blacksamson echinacea	ECAN2	7	0 - 20	0 - 1
sanddune wallflower	ERCAC	7	0 - 20	0 - 1
blanketflower	GAAR	7	0 - 20	0 - 1
scarlet beeblossom	OESU3	7	0 - 20	0 - 1
hairy false goldenaster	HEVI4	7	0 - 20	0 - 1
rush skeletonplant	JYJU	7	0 - 20	0 - 1
purple locoweed	OXLA3	7	0 - 20	0 - 1
beardtongue	PENST	7	0 - 20	0 - 1
spiny phlox	PHHO	7	0 - 20	0 - 1
upright prairie coneflower	ONBEB	7	0 - 20	0 - 1
goldenrod	SOLID	7	0 - 20	0 - 1
scarlet globemallow	SPCO	7	0 - 20	0 - 1
white heath aster	SYER	7	0 - 20	0 - 1
longbract spiderwort	TRBR	7	0 - 20	0 - 1
American vetch	VIAM	7	0 - 20	0 - 1
SHRUBS		*8*	*20 - 100*	*1 - 5*
leadplant	AMCA6	8	20 - 40	1 - 2
silver sagebrush	ARCA13	8	20 - 40	1 - 2
prairie sagewort	ARFR4	8	20 - 40	1 - 2
rose	ROSA5	8	20 - 40	1 - 2
western snowberry	SYOC	8	20 - 40	1 - 2
broom snakeweed	GUSA2	8	0 - 20	0 - 1
pricklypear	OPUNT	8	0 - 20	0 - 1

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	1290 -	1790	- 2290
FORBS	95 -	150	- 205
SHRUBS	15 -	60	- 105
TOTAL	1400 -	2000	- 2600

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 periods of long-term drought with or without heavy grazing pressure. This resulted in increases in the more drought and/or grazing tolerant species, such as blue grama and upland sedges, with corresponding decreases in the less drought and/or grazing tolerant species, such as prairie sandreed and the bluestems.

Community Phase 1.2: Blue Grama/Sedges/Western Wheatgrass (*Bouteloua gracilis/Carex* spp.*/Pascopyrum smithii*)
This community phase resulted from long-term drought with or without heavy grazing pressure. Compared to Community Phase 1.1, the more drought and grazing tolerant species, such as blue grama and upland sedges, have increased while less drought and grazing tolerant grasses (such as big bluestem, prairie sandreed, and the needlegrasses) have decreased. Common yarrow, white heath aster, prairie sagewort, and pricklypear generally are more prominent forbs and shrubs.

Community Phase Pathway 1.2A
Community Phase Pathway 1.2 to 1.1 occurred with the return to average precipitation and reduced grazing pressure. This resulted in increases in the less tolerant drought and/or grazing tolerant species, such as prairie sandreed and the bluestems, with corresponding decreases in the more drought and/or grazing tolerant species, such as blue grama and upland sedges.

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, smooth brome, crested wheatgrass, and/or annual bromes). 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 brome, crested wheatgrass, annual bromes, 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, smooth brome, crested wheatgrass, and/or annual bromes) 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 (T2A).

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 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: Prairie Sandreed-Bluestems-Needlegrasses-Wheatgrasses/Shrubs (*Calamovilfa longifolia-Andropogon* spp.-*Hesperostipa* spp., *Nassella viridula-Pascopyrum smithii*/Shrubs)

This Community Phase is similar to Community Phase 1.1 but has been colonized by exotic cool-season grasses (often Kentucky bluegrass, smooth brome, crested wheatgrass, and/or annual bromes). However, these exotics are present in smaller amounts with the community still dominated by native grasses.

Figure 1. Community Phase 2.1: Prairie Sandreed-Bluestems-Needlegrasses-Wheatgrasses/Shrubs

Community Phase Pathway 2.1A

Community Phase Pathway 2.1 to 2.2 occurs with heavy continuous grazing with or without drought. This results in increases in the more grazing and/or drought tolerant species, such as blue grama and upland sedges, with corresponding decreases in the less grazing and/or drought tolerant species (such as prairie sandreed and the bluestems).

Community Phase 2.2: Blue Grama/Sedges/Western Wheatgrass (*Bouteloua gracilis/Carex* spp./*Pascopyrum smithii*)

This Community Phase is similar to Community Phase 1.2 but has now been colonized by exotic cool-season grasses (often Kentucky bluegrass, smooth brome, crested wheatgrass, and/or annual bromes). These exotics, however, are present in smaller amounts with the community still dominated by native grasses.

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, particularly Kentucky bluegrass, can make this an “at risk” community even though its presence may not be obvious. If management does not include measures to control or reduce Kentucky bluegrass, the transition to State 3: Invaded State should be expected.

This Community Phase is approaching the threshold leading to a transition to State 3: Invaded State. As a result, it is an "at risk" community. 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.

Community Phase Pathway 2.2A

Community Phase Pathway 2.2 to 2.1 occurs with the return to average precipitation along with prescribed burning and grazing. This results in an increase in the less grazing and/or drought tolerant species such as prairie sandreed and the bluestems, with a corresponding decrease in the more grazing and/or drought tolerant species, such as blue grama and upland sedges.

Figure 2. Community Phase 2.2: Blue Grama/Sedges/Western Wheatgrass

Transition T2A

This transition from the State 2: Native/Invaded State to State 3: Invaded State generally occurs with heavy season-long grazing or extended periods of non-use. Exotic cool-season grasses (such as Kentucky bluegrass, smooth brome, crested wheatgrass, and/or annual bromes) become the dominant graminoids. Studies indicate that a threshold may exist in this transition when both Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition. Similar thresholds may exist for other exotic cool-season grasses. This transition may also occur under other managerial conditions, such as heavy season-long grazing (primarily Kentucky bluegrass).

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

State 3: Invaded State

This state is the result of invasion and dominance by the exotic cool-season grasses (commonly Kentucky bluegrass, smooth brome, crested wheatgrass, and/or annual bromes). Other exotic species, such as Canada thistle and leafy spurge, 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. Common forbs often include white heath aster, goldenrod, common yarrow, and white sagebrush. Shrubs, such as western snowberry and rose may show marked increases. 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 and/or brush management may be needed to manage noxious weeds and increasing shrub (e.g., western snowberry) populations.

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

This community phase is dominated by exotic cool-season grasses (such as Kentucky bluegrass, smooth brome, crested wheatgrass, and/or annual bromes), often with a much-reduced forb component. Excessive accumulation of mulch may also be present, particularly when dominated by Kentucky bluegrass. Common forbs and shrubs often include white heath aster, goldenrod, common yarrow, white sagebrush, western snowberry, and rose. The exotic forbs, such as leafy spurge and Canada thistle, may also 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, in part because many of the shrubs (e.g., western snowberry) sprout profusely following one burn. Early season prescribed burns have been successful; however, fall burning may also be an effective technique.

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

Context dependence (i.e., factors that cause variations in plant community shifts, restoration likelihood, and contribute to uncertainty). Grazing management should be applied in a manner that enhances/maximizes the competitive advantage of native grass and forb species over the exotic species. This may include the use of prescribed grazing to reduce excessive plant litter accumulations above that needed for rangeland health indicator #14 (see Rangeland Health Reference Worksheet). Increasing livestock densities may facilitate the reduction in plant litter provided length and timing of grazing periods are adjusted to favor native species.

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

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

State 4: Go-Back State

This state 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 state is plant succession following cropland abandonment. This plant community will initially include a variety of annual forbs and grasses, some of which may be noxious weeds and need control. Over time, the exotic cool-season grasses (Kentucky bluegrass, smooth brome, crested wheatgrass, and/or annual bromes) will likely predominate.

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

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

Community Phase 4.1: Annual/Pioneer Perennial /Exotics

This community phase 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. This plant community will initially include a variety of annual forbs and grasses, including noxious weeds (e.g., Canada thistle, leafy spurge) which may need control. Over time, the exotic cool-season grasses (Kentucky bluegrass, smooth brome, crested wheatgrass, and/or annual bromes) will likely predominate.

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 seeding, prescribed grazing, prescribed burning,

haying, or use of herbicides will generally be necessary to achieve the desired result and control any noxious weeds.

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

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

The method or methods of herbaceous weed treatment will be site specific to each situation; 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 seeding methods, seeded species not adapted to the site, insufficient weed control, herbicide carryover, poor seed quality (purity & germination), and/or improper management.

Transition T5A
This transition from any plant community to State 4: Go-Back State. 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.				

Sandy Claypan Wildlife Habitat Interpretation:

Sandy Claypan ecological sites have s sodic, claypan subsoil layer which occurs at a depth of 6 to 20 inches. Sandy claypan sites support tall-warm season species but become dominated by short-warm season grasses caused by drought or heavy grazing pressure. Sandy Claypan sites support diverse stands of tall and short warm-season grasses, along with a diverse stand of cool-season grass and numerous forb species. Associated ecological sites include Sands, Sandy, and Thin Claypan. This complex of ecological sites provides habitat for many edge-sensitive grassland bird species.

Sandy Claypan habitat features and components commonly support grassland-nesting birds, notably nesting and brood cover and lekking sites for sharp-tailed grouse, dependent upon its state. Insects rely on associated forbs and grasses for survival; the insects serve as food sources for birds and their young, and as forage for small and large herbivores.

Sandy Claypan 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 each state. Today, these states occur primarily in response to grazing and drought. Secondary influences include anthropogenic disturbances, black-tailed prairie dogs, and fire.

Because there is no known restoration pathway from State 2.0 to State 1.0, it is important to intensively manage using tools in State 1.0 and State 2.0 Community Phase Pathways to prevent further plant community degradation along either the T1A transitional pathway to Native/Invaded State 2.0 or T2A transitional pathway to Invaded State 3.0 thresholds. Native wildlife generally benefits from a heterogeneous grassland found in States 1.0 and 2.0 that include diverse grass and forb species with varying stature and density. As plant communities degrade within State 2.0, short warm-season grasses increase while native forbs are reduced. This transition results in reduced

stature and increased plant community homogeneity. When adjacent/intermingled ecological sites undergo the same transition, the result can be an expansive, homogenous landscape.

Success along Restoration Pathway R3A from State 3.0 to State 2.0 is very difficult and is dependent upon presence of a remnant native grass population. This concept also applies to wildlife, as the target species must either be present on adjacent State 1.0 or State 2.0 plant communities or ecological sites within the species' mobility limits. Species with limited mobility, such as Dakota skippers, must exist near the plant community to utilize restored sites. Mobile species (such as grassland-nesting birds) can more easily locate and utilize isolated, restored plant communities.

Plant community phases within the State 3.0 show dramatically increased homogeneity of exotic cool-season grasses and further reduction in native forbs. However, silver sagebrush can become dominant shrub at this site, impacting bird species-sensitive invasion by woody vegetation. Reduced forb diversity limits insect populations, negatively affecting grassland-nesting bird foraging opportunities. Increased exotic-grass litter can limit access to bare ground by nesting insects and can limit mobility by small chicks. A homogenous grassland landscape does not provide quality escape or winter cover. As a result, many species are not able to meet life requisites on communities in the 3.0 State.

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

1.0 Reference State

Community Phase 1.1 Prairie Sandreed-Bluestems-Needlegrasses-Western Wheatgrass/Shrubs: This plant community offers good wildlife habitat; 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. Predominance of grass species in this community 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 mirrored by domestic livestock. These services include putting plant material and dung in contact with mineral soil to be used by low trophic level consumers (such as invertebrate shredders, predators, herbivores, dung beetles, and fungal-feeders).

Use of this site by Dakota skippers is limited due to the lack of host plants, such as little bluestem and prairie dropseed. Regal fritillary habitat is limited due to the rarity of Nuttall's violet and prairie violets. Monarch butterfly may use flowering forbs on this site; however, few milkweed species are found on this site to support breeding. Bumblebees and other native bees utilize forbs as a nectar source and bare ground for nesting sites in bunchgrasses. Prescribed grazing with adequate recovery periods, as well as prescribed fire to maintain the 1.1 phase, has little effect on nests of ground-dwelling insects.

Birds: This plant community provides quality nesting, foraging, and escape habitats favored by mid- to tallgrass-nesting birds. Several species of grassland birds that prefer mid- to tallgrass stature will use this site. In years with reduced precipitation or drought, nesting recruitment may be compromised. This plant

community provides suitable areas for sharp-tailed grouse nesting and brood-rearing habitat. Diverse prey populations provide good hunting opportunities for grassland raptors.

Mammals: The diversity of grasses and forbs provide high nutrition levels for small and large herbivores including voles, mice, rodents, jackrabbits, pronghorn, and deer (white-tailed and mule). Short to moderate stature provides suitable food and thermal, protective, and escape cover for small herbivores. The composition of mid- to tallgrasses may limit use by the hispid pocket mouse.

Amphibians/Reptiles: The Sandy Claypan ecological site and associated plant communities provide habitat for smooth green snakes. This ecological site can provide habitat for the plains hog-nosed snake and plains spadefoot. The plains spadefoot needs small ephemeral ponds for breeding and, if not available, may not use this site. Northern leopard frog and Great Plains toad may be present if freshwater habitats (such as stock water ponds) are located in or adjacent to the site. Sandy soils provide burrowing sites for short-horned lizards; however, vegetation may be too dense. Even though silver sagebrush is common on this site, this site may not provide habitat for sagebrush lizards since they prefer rocky areas. This ecological site can provide habitat for the plains hog-nosed snake (prefer sandy soils) and plains spadefoot (prefer gravelly or sandy soils).

Fish and Mussels: This ecological site is not directly associated with streams, rivers, or water bodies. Associated ecological sites, due not provide significant additional water to this site. Management on these interconnected sites will have limited, secondary effects on aquatic species.

Community Phase 1.2 Blue Grama/Sedges/Western Wheatgrass: Long-term, drought, with or without heavy grazing pressure increases the percentage of blue grama and sedges in this plant community. This plant community becomes dominated by short, warm -season grasses, changing the stature of plant community from mid- to tallgrass, to mid- to short-grass species.

Invertebrates: Long- term drought may negatively impact ground-nesting sites for bumblebees, other native bees, and other ground-nesting insects due to reduction of forbs, timing or lack of forb flowering, or increased soil compaction.

Birds: This plant community provides quality nesting, foraging, and escape habitats favored by shortgrass-nesting birds. A shift to a shorter plant structure, along Community Phase Pathway 1.1A, benefits McCown's longspur, chestnut collared longspur, horned lark, and burrowing owl. Species that prefer a midgrass stature may be successful with normal to above-normal precipitation and a change in management along the 1.2A Community Phase Pathway. In years with reduced precipitation or heavy grazing, nesting recruitment will be compromised for midgrass-nesting species. Limited cover and diverse prey populations provide good hunting opportunities for grassland raptors.

Mammals: Shorter statured grasses reduce thermal cover and protection for mammals. This site is susceptible to short term prairie dog invasion.

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

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

2.0 Native/Invaded State

Community Phase 2.1 Prairie Sandreed-Bluestems-Needlegrasses-Western Wheatgrass/Shrubs: This plant community develops through Transition Pathway T1A, due to changes in management (chronic season-long or heavy late season grazing or complete rest) and the presence of exotic, cool-season grasses. The threshold between States 1.0 and 2.0 is crossed when Kentucky bluegrass, crested

wheatgrass, smooth brome, or other exotic species become established. This plant community phase has a very similar appearance and function to the Reference State of Community 1.1, except that it has a minor amount of cool-season exotic grasses and forbs. This phase functions at a high level for native wildlife; therefore, managers should consider the 2.0 Community Phase Pathways to avoid transitioning to State 3.0.

Invertebrates: Provides similar life requisites as Community Phase 1.1.

Birds: Provides similar life requisites as Community Phase 1.1.

Mammals: Provides similar life requisites as Community Phase 1.1.

Amphibians/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 Blue Grama/Sedges/Western Wheatgrass: Community Phase Pathway 2.1A is characterized by heavy continuous grazing with or without drought. Plant community diversity is reduced with a decline of deeper-rooted native species, replaced by shorter, shallow-rooted grasses and sedges. This plant community is on the cusp of crossing the threshold to the 3.0 Invaded State. Prescribed grazing with adequate recovery periods between grazing will shift the competitive edge to native species along Community Phase Pathway 2.2A; this is the most effective method to regain diverse cool-season grass and forb components in Community Phase 2.1. Every effort should be used to manage within Community Phase Pathway 2.2A to avoid crossing the threshold into State 3.0. Restoration Pathway R3A requires intensive management and economic inputs to successfully cross back to State 2.0.

Insects: Provides similar life requisites as Community Phase 1.2. However, the loss of native forbs and increase in sod-forming grasses limit foraging and nesting sites for all pollinators. Homogeneity of forb species may limit season-long nectar availability. Litter build-up, resulting from complete rest or light utilization, may reduce ground-nesting site availability.

Birds: An increase in cool-exotic cool-season grasses, moves this plant community towards homogeneity. Native grasses are still present in the plant community; however, the increase in cool-season exotic grasses reduces plant structure. With reduced amounts of native grasses and forbs, reduced plant stature and increased litter, bird species shift from mid- to short-grass species. Sharp-tailed grouse may still use this plant community for leks and brood rearing; however, winter cover must be provided by adjacent ecological sites or plant communities. Management for bird species that preferring mid- to tall-statured grasses should follow Community Phase Pathway 2.3A

Mammals: Provides similar life requisites as Community Phase 2.2.

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

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

3.0 Invaded State

Community Phase 3.1 Exotic Cool-Season Grasses/Forbs/Shrubs: Community Phase Pathway T2A generally occurs with heavy season-long grazing or extended periods of non-use. This plant community phase is characterized by a dominance (more than 30 percent) to a complete dominance of exotic cool-season grasses (such as Kentucky bluegrass, crested wheatgrass, and smooth brome). Western snowberry becomes a dominate shrub and tends to increase in density and cover. Restoration Pathway

R3A requires remnant amounts of native warm-season grasses (i.e., blue grama), cool-season grasses (i.e., needlegrasses, western wheatgrass, prairie Junegrass), and forbs (i.e., silverleaf Indian breadroot, upright prairie coneflower). These remnant populations can only be expressed through frequent prescribed burns and high levels of prescribed grazing management targeting the exotic cool-season grasses. 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: Non-use or low intensity (less than 20 percent utilization) grazing 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; this results in a cooler micro-climate, which is unfavorable to most insects. Lack of bare soil limits ground nesting sites for native bees and other ground-nesting insects. The lack of nectar-producing plants limits forage opportunities for bumblebees, regal fritillary, monarch butterfly, and other pollinating species.

Birds: This homogeneous community phase, dominated by exotic plant species, provides limited habitat and life requisites for most obligate grassland-nesting birds. Lack of stature and plant diversity, along with increased litter and the tendency of Kentucky bluegrass and smooth bromegrass to lay down, limits use by many grassland-nesting birds. Litter accumulations reduce use by chestnut-collared and McCown's longspurs. Western snowberry reduces use of this site by species that avoid areas with woody vegetation. Sharp-tailed grouse may use these sites for brood rearing and winter cover; however, the reduction in forbs may limit foraging opportunities for chicks.

Mammals: Black-tailed prairie dog expansion is possible in this plant community phase, which also provides foraging habitat for pronghorn and deer. Litter accumulation favors thermal, protective, and escape cover for small rodents. However, reduced availability of native grass seed may reduce food availability for species such as the hispid pocket mouse.

Amphibians/Reptiles: Provides similar life requisites as Community Phase 1.1. However, increased litter and cooler soil temperature may reduce use by sagebrush lizard, plains spadefoot, and short-horned lizard.

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, birds and their young. Dense weed cover can keep soils moist, increasing insect presence. Tall stature provided by some weeds, such as marsh elder and ragweed, offer thermal cover and seeds throughout winter.

Successful restoration of native species along Transition Pathway R4A results in a native grass and forb community in State 2.0. Failed restoration to native species through Restoration Pathway R4B results in Invaded State 3.0. Wildlife species response will be dependent upon plant community composition, vegetative structure, patch size, and management activities (such as prescribed grazing, burning, range planting, haying, or noxious weed control).

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

Water is the principal factor limiting herbage production on this site. The site is dominated by soils in hydrologic group D. Infiltration is moderately rapid and runoff potential varies from medium to high depending on slope and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where short grasses form a dense sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

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

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

Sands	R058CY076ND	This site, typically, is on hillslopes; however, it can occur on similar landforms as the Sandy Claypan site. The soils are deep or very deep and somewhat excessively to excessively drained. The surface layer of the soil is typically <12 inches and the subsoil does not affect root growth. Carbonates may or may not be present in the soil profile. The soil contains high amounts of sand and will not form a ribbon, but it may form a ball when squeezed. The Sands site has more production than the Sandy Claypan ecological site.
Sandy	R058CY077ND	This site, typically, is on hillslopes; however, it can occur on similar landforms as the Sandy Claypan site. The soils are somewhat excessively to well drained. The Sandy site does not have a dense claypan layer within a depth of 20 inches and salts, if present, are much deeper in the soil profile. The soils on Sandy ecological sites form a ribbon less than 1 inch long. The Sandy site has more production than the Sandy Claypan ecological site.
Thin Claypan	R058CY081ND	This site commonly occurs in micro-lows intermingled with the Sandy Claypan site, but also occur higher on the landscape. Soils on Thin Claypan sites are severely sodium-affected; they have a dense, root-restricting claypan within a depth of 6 inches. Salt accumulations are within a depth of 16 inches (commonly at or near the surface). The soils have a varying range of textures; but typically form a ribbon >1 inch long.

Similar Sites

Ecological Site Name	Site ID	Narrative
Sands	R058CY076ND	This site, typically, is on hillslopes; however, it can occur on similar landforms as the Sandy Claypan site. The soils are deep or very deep and somewhat excessively to excessively drained. The surface layer of the soil is typically <12 inches and the subsoil does not affect root growth. Carbonates may or may not be present in the soil profile. The soil contains high amounts of sand and will not form a ribbon, but it may form a ball when squeezed. The Sands site has more production than the Sandy Claypan ecological site.
Sandy	R058CY077ND	This site, typically, is on hillslopes; however, it can occur on similar landforms as the Sandy Claypan site. The soils are somewhat excessively to well drained. The Sandy site does not have a dense claypan layer within a depth of 20 inches and salts, if present, are much deeper in the soil profile. The soils on Sandy ecological sites form a ribbon less than 1 inch long. The Sandy site has more production than the Sandy Claypan ecological site.
Thin Claypan	R058CY081ND	This site commonly occurs in micro-lows intermingled with the Sandy Claypan site, but also occur higher on the landscape. Soils on Thin Claypan sites are severely sodium-affected; they have a dense, root-restricting claypan within a depth of 6 inches. Salt accumulations are within a depth of 16 inches (commonly at or near the surface). The soils have a varying range of textures; but typically form a ribbon >1 inch long.

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 clipping and other 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

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Site Description Approval

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ND, State Rangeland Management Specialist Date