United States Department of Agriculture
Natural Resources Conservation Service

Ecological Site Description

Site Stage: Provisional

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

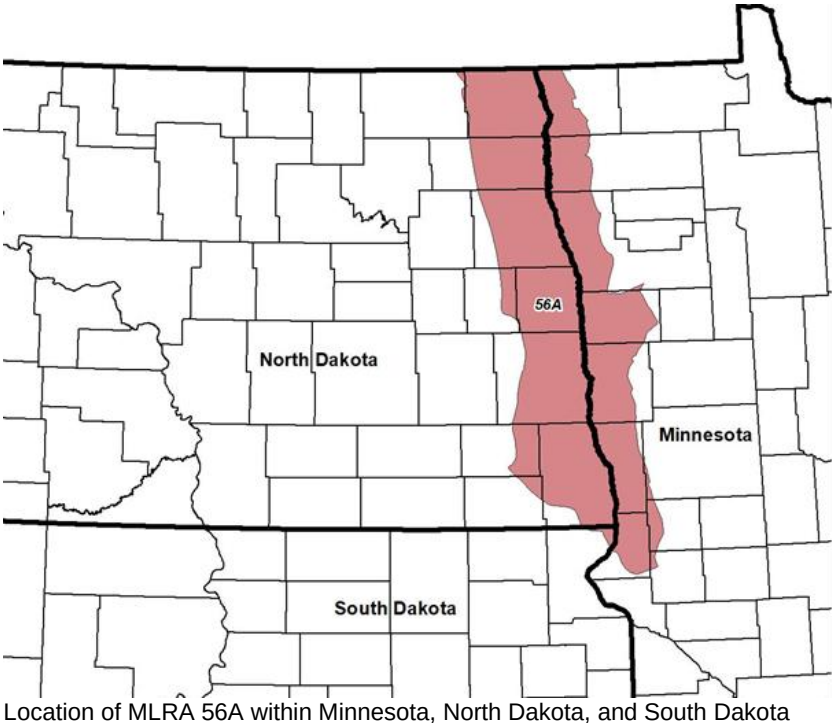
Site Name: Clayey

Site Type: Rangeland

Site ID: R056AY084ND

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

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



Location of MLRA 56A within Minnesota, North Dakota, and South Dakota

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

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

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

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

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

Ecological Site Concept

The Clayey ecological site typically is located on flats and rises on lake plains, delta plains, and ground moraines; it also occurs on side slopes of drainageways and on natural levees along major streams and rivers. The soils are very deep. The dark-colored surface soil is more than 7 inches thick (>20 inches in some soils). Surface textures are silty clay, clay, silty clay loam, clay loam, loam, or silt loam. Subsoil textures typically are clay or silty clay, although clay loam and silty clay loam

textures with >35% clay also occur. The subsoil forms a ribbon >2 inches long. Soil on this site is moderately well drained or well drained. Generally, calcium carbonate does not occur in the surface and upper subsoil layers; however, very slight to slight effervescence is allowable. At depths exceeding 16 inches, a layer of carbonate accumulation is common. Soil salinity is none to very slight (E.C. 4 dS/m) in the upper 20 inches, but below that depth may increase to slight or moderate (E.C. 4 to <16 dS/m) in some soils. Slopes range from 0 to 25 percent. On the landscape, this site is above the Claypan, Limy Subirrigated, Subirrigated, Thin Claypan, and Wet Meadow ecological sites. Due to the hydrologic impact of extensive tile drainage (e.g., lowering of the water table) in the MLRA, several soils that formed naturally as a Wet Meadow ecological site now function as Clayey ecological site.

Physiographic Features

This site typically occurs on glacial lake plains, small areas of ground moraine surrounded by lake plains, and delta plains. This site is typically on flats and rises; it also occurs on side slopes of drainageways and on natural levees along major streams and rivers. On lake plains the parent material is either fine-silty or clayey. On ground moraines the parent material is either fine-loamy or clayey. The parent material is clayey on delta plains, levees, and drainageways. Slopes are less than 25 percent.

Landform: lake plain, till-floored lake plain, ground moraine, delta plain, natural levee, upland drainageway

	Minimum	**Maximum**
Elevation (feet):	750	1475
Slope (percent):	0	25
Water Table Depth (inches):	36	>80
Flooding:		
Frequency:	None	Occasional
Duration:	None	Brief
Ponding:		
Frequency:	None	None
Runoff Class:	Low	Very High
Aspect:	No influence on this site	

Climatic Features

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

Annual precipitation typically ranges from 18 to 23 inches per year. The average annual temperature is about 40°F. January is the coldest month with average temperatures ranging from about 1°F (Pembina, North Dakota (ND) to about 11°F (Wheaton, Minnesota (MN). July is the warmest month with temperatures averaging from about 68°F (Pembina, ND) to about 73°F (Wheaton, MN). The range of normal average monthly temperatures between the coldest and warmest months is about 65°F. This large annual range attests to the continental nature of this area's climate. Winds are estimated to average about 13 miles per hour

annually, ranging from about 15 miles per hour during the spring to about 11 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

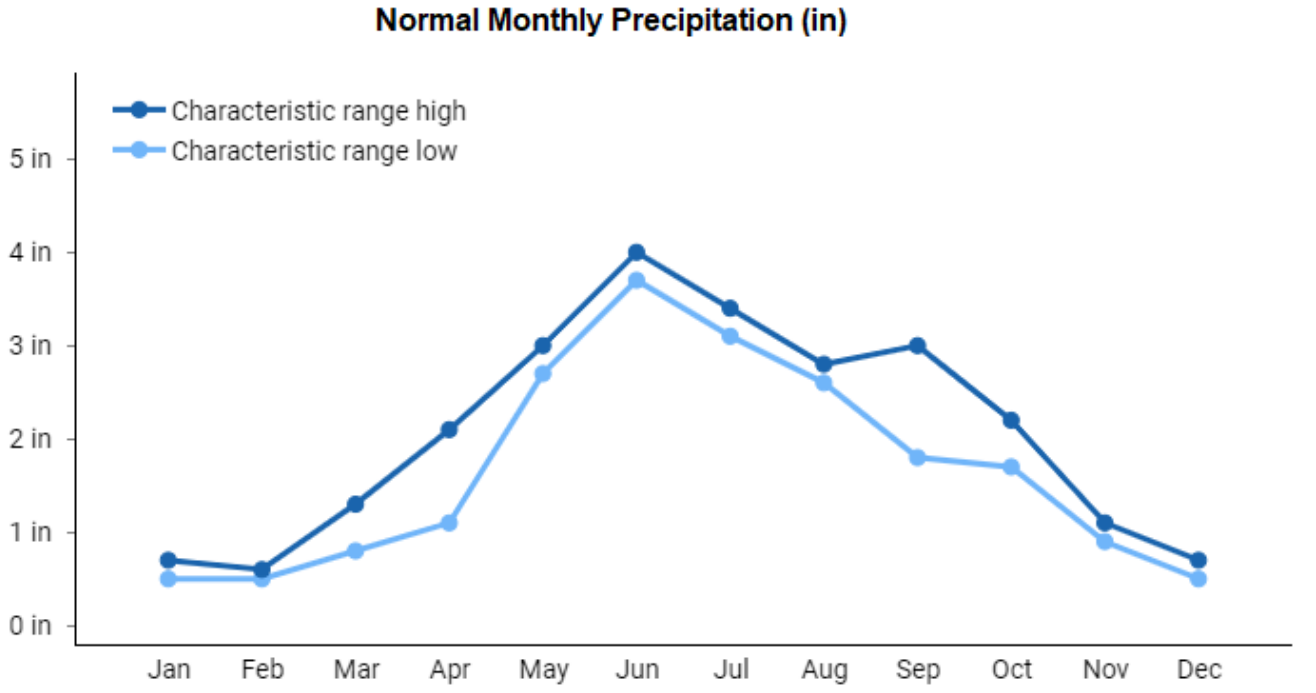
Growth of cool season plants begins in early to mid-March, slowing or ceasing in late June. Warm season plants begin growth about mid-May and continue to early or mid-September. Greening up of cool season plants may occur in September and October when adequate soil moisture is present.

Climate normals

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

Normal monthly precipitation (in)

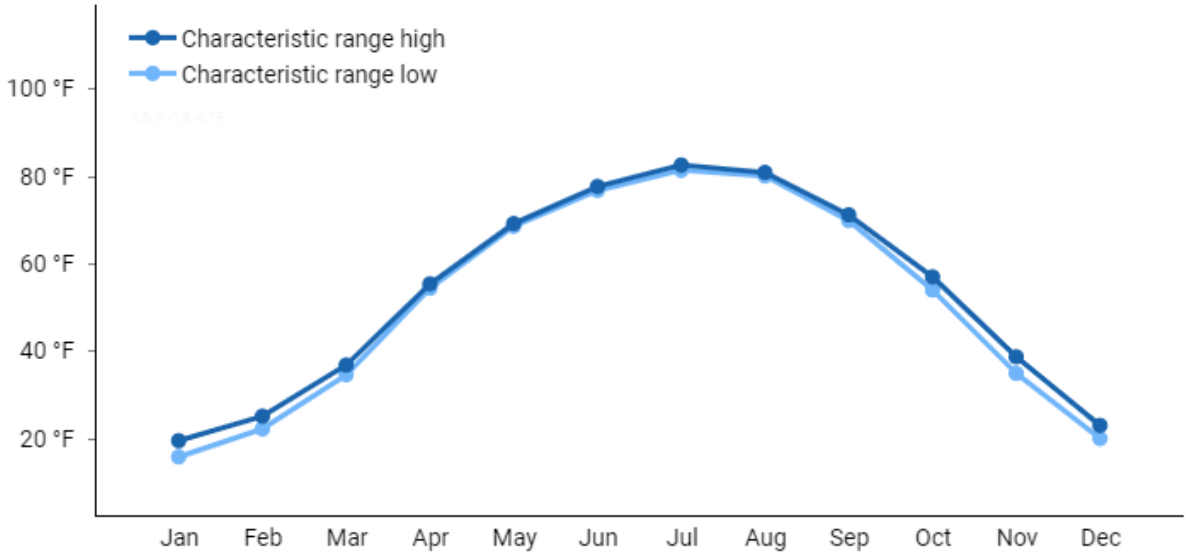
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	0.7	0.6	1.3	2.1	3	4	3.4	2.8	3	2.2	1.1	0.7
Representative low:	0.5	0.5	0.8	1.1	2.7	3.7	3.1	2.6	1.8	1.7	0.9	0.5
Actual high:	0.8	0.7	1.5	2.2	3.2	4.1	3.4	3	3.1	2.3	1.2	0.8
Actual low:	0.5	0.4	0.8	1	2.7	3.6	3	2.5	1.8	1.6	0.8	0.5



Normal monthly maximum temperature (°F)

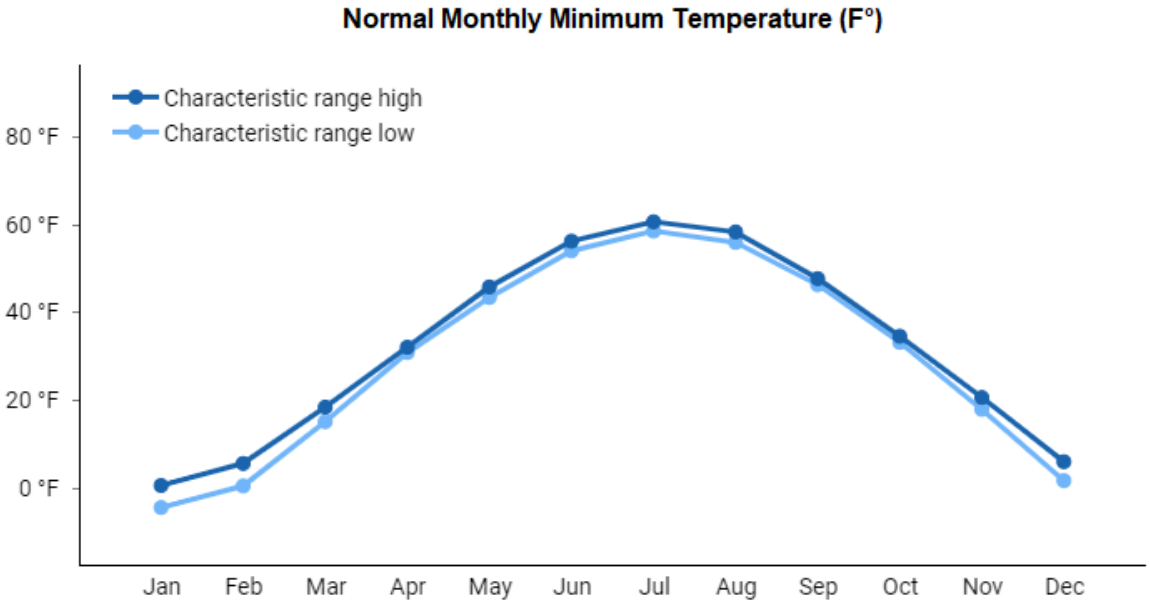
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Representative high:	19.4	25	36.7	55.3	69.1	77.6	82.5	80.8	71.1	56.9	38.6	22.9
Representative low:	15.7	22.1	34.5	54.3	68.5	76.7	81.3	80	69.8	53.9	34.8	19.9
Actual high:	19.9	25.1	36.8	55.9	69.7	77.7	82.7	80.8	71.4	57	38.6	23.9
Actual low:	13.4	19.3	32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

Normal Monthly Maximum Tempurature (F°)



Normal monthly minimum temperature (°F)

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



Climate stations used

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

Influencing Water Features

This site does not receive significant additional water during the growing season, either as runoff from adjacent slopes or from a seasonal high-water table. A few soils do have occasional, brief flooding early in the growing season. Depth to the water table is deeper than 3 feet during April through June. From July through October, it is generally deeper than 4 feet. Surface infiltration ranges from very slow to moderate; permeability through the profile is very slow to moderately slow. Water loss on this site occurs through transpiration and/or percolation below the root zone.

Representative Soil Features

Soils associated with the Clayey ES are in the Mollisol and Vertisol orders. The Mollisols are classified further as Glossic Natrudolls. The Vertisols are classified further as Aquic Hapluderts, Chromic Hapluderts, and Typic Hapluderts. These soils were developed under prairie vegetation. They formed in silty and clayey glaciolacustrine sediments, clayey alluvium, or in fine-loamy or clayey till. The soils on this site are very deep. They are moderately well drained or well drained – redoximorphic features do not occur within a depth of 3 feet. The common feature of soils in this site is a fine-textured subsoil (>35% clay) that is not dense enough to be root restrictive. Typically, the subsoil is silty clay or clay, but clay loam or silty clay loam also occur. The surface layer is 7 to more than 20 inches thick. Most commonly the surface texture is silty clay, clay, or silty clay loam; but it is loam or silt loam, in some soils. Some soils have sand textures below a depth of 40 inches.

Soil salinity is none to very slight (E.C. <4 dS/m) in the upper 20 inches; below this it may increase to slight or moderate (E.C. 4 - <16 dS/m) in some soils. Sodicity is low above the clayey subsoil. However, in some soils, it increases to moderate in the upper part of the subsoil; SAR values may exceed 13 below a depth of 20 inches in these soils.

Soil reaction typically is slightly acid to slightly alkaline (pH 6.1 to 7.8) above the subsoil and neutral to moderately alkaline (pH 6.6 to 8.4) in the subsoil and substratum. Below a depth of 20 inches, in soils with SAR values exceeding 13, the reaction may be strongly alkaline (pH 8.5 to 9.0). Calcium carbonate content is none to moderate to a depth of 16 inches or more; below it may increase to as much as 25 percent.

When dry, these soils crack. When the soils are wet, surface compaction can occur with heavy traffic. Soil surface is stable and intact. Sub-surface soil layers are non-restrictive to water movement and root penetration. These soils are susceptible to water and wind erosion. The hazard of water erosion increases on slopes greater than about 5 percent.

Major soil series correlated to the Clayey site are Aberdeen, Hattie, Nutley, Sinai, and Wahpeton.

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

Parent Material Kind: glaciolacustrine deposits, glacial till, alluvium
Parent Material Origin: lacustrine, till
Surface Texture: silty clay, clay, silty clay loam, clay loam, loam, silt loam
Surface Texture Modifier: none
Subsurface Texture Group: clayey
Surface Fragments <3" (% Cover): 0-5
Surface Fragments ≥3" (%Cover): 0-1
Subsurface Fragments <3" (% Volume): 0-8
Subsurface Fragments ≥3" (% Volume): 0-2

	Minimum	Maximum
Drainage Class:	moderately well	well
Permeability Class:**	very slow	moderately slow
Depth to first restrictive layer (inches):	80	>80
Electrical Conductivity (dS/m)*:	0	4
Sodium Absorption Ratio*:	0	8
Soil Reaction (1:1 Water):**	6.1	8.4
Soil Reaction (0.1M CaCl2):	NA	NA
Available Water Capacity (inches):**	5.0	12.0
Calcium Carbonate Equivalent (percent)*:	0	15

*These attributes represent from 0-20 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 ≤2.
**These attributes represent from 0-40 inches.

Plant Communities

Ecological Dynamics of the Site:

This ecological site description is based on nonequilibrium ecology and resilience theory and utilizes a State-and-Transition Model (STM) diagram to organize and communicate information about ecosystem change as a basis for management. The ecological dynamics characterized by the STM

diagram reflect how changes in ecological drivers, feedback mechanisms, and controlling variables can maintain or induce changes in plant community composition (phases and/or states). The application of various management actions, combined with weather variables, impact the ecological processes which influence the competitive interactions, thereby maintaining or altering plant community structure.

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

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

Weather fluctuations, coupled with managerial factors, may lead to changes in the plant communities and, under adverse impacts, may 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.

Presently the primary disturbances include widespread introduction of exotic plants, concentrated livestock grazing, lack of fire, and perhaps long-term non-use or very light grazing and no fire. Because of these changes, particularly the widespread occurrence of exotic plants, as well as other environmental changes, the Reference State is considered to no longer exist. Thus, the presence of exotic plants on the site precludes it from being placed in the Reference State. It must then be placed in one of the other states, commonly State 2: Native/Invaded State (T1A).

State 2: Native/Invaded State. Colonization of the site by exotic plants results in a transition from State 1: Reference State to State 2: Native/Invaded State (T1A). This transition was inevitable; it

often resulted from colonization by exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass) which have been particularly and consistently invasive under long-term non-use or very light grazing and no fire. Other exotic plants (e.g., Canada thistle, 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 surface and may alter infiltration, nutrient cycling, and biological activity near the soil surface. As a result, these factors coupled with shading cause desirable native plants to have increasing difficulty remaining viable and recruitment declines.

To slow or limit the invasion of these exotic grasses or other exotic plants, it is imperative that managerial techniques (e.g., prescribed grazing, prescribed burning) be carefully constructed, monitored, and evaluated with respect to that objective. If management does not include measures to control or reduce these exotic plants, the transition to State 3: Invaded State should be expected (T2A).

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

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

Once the state is well established, prescribed burning and prescribed grazing techniques have been largely ineffective in suppressing or eliminating the exotic cool-season grasses, even though some short-term reductions may appear successful. However, assuming there is an adequate component of native grasses to respond to treatments, a restoration pathway to State 2: Native/Invaded State (R3A) may be accomplished with the implementation of long-term prescribed grazing in conjunction with prescribed burning.

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

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

desired result and control weeds, some of which may be noxious weeds. A failed range planting and/or secondary succession will lead to State 3: Invaded State (R4B).

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 burning, brush management, herbaceous weed treatment) which, if properly designed and implemented, will positively influence plant community competitive interactions. The design of these management practices will be site specific and should be developed by knowledgeable individuals; based upon management goals and a resource inventory; and supported by an ongoing monitoring protocol.

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

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

Plant Communities and Transitional Pathways

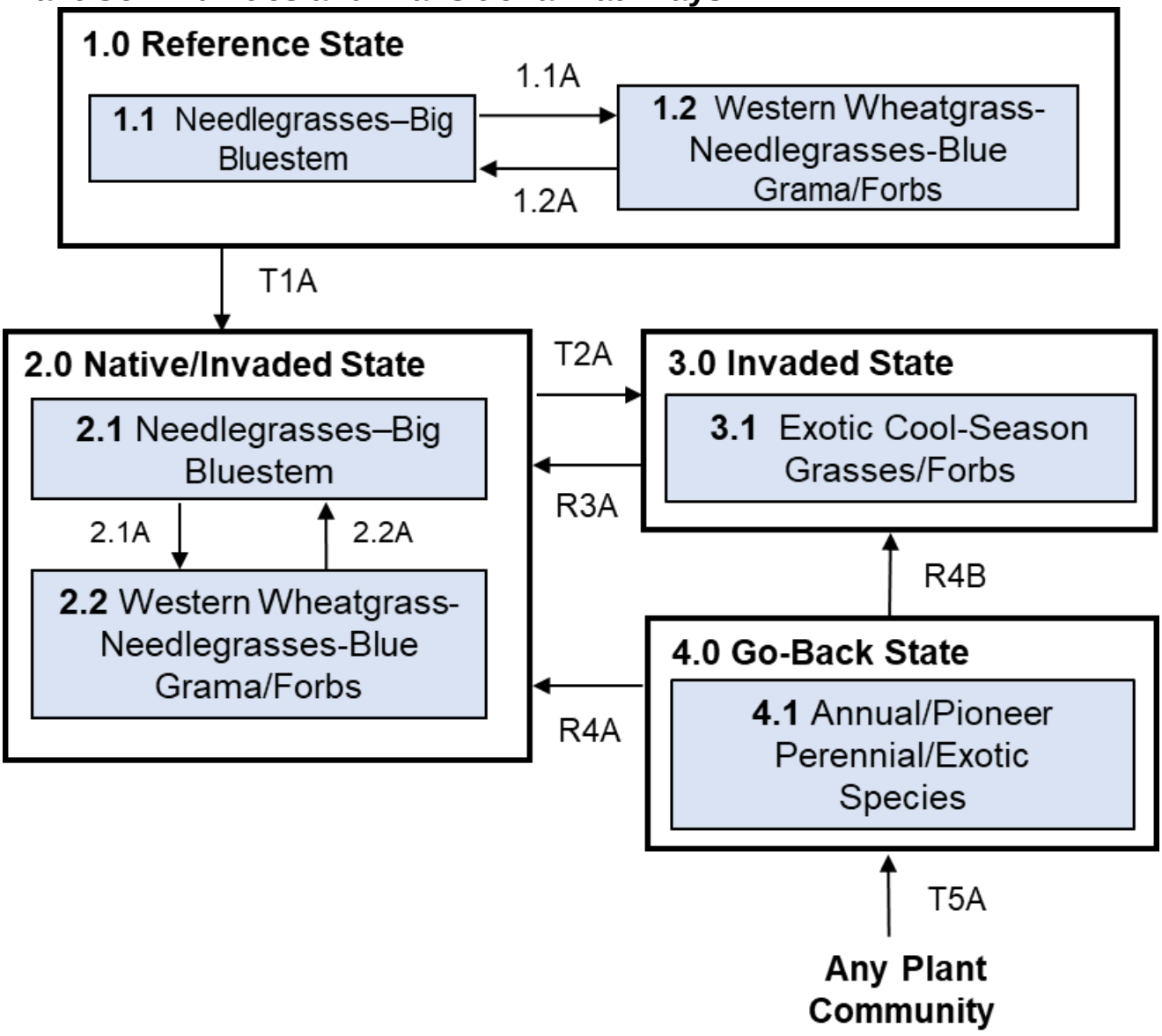


Diagram Legend - MLRA 56A Clayey	
T1A	Introduction of exotic cool-season grasses
T2A	Long-term non-use or very light grazing and no fire
T5A	Cessation of annual cropping
R3A	Long-term prescribed grazing and prescribed burning
R4A	Successful range planting
R4B	Failed range planting and/or secondary succession
CP 1.1 - 1.2 (1.1A)	Heavy grazing with or without drought
CP 1.2 - 1.1 (1.2A)	Return to average precipitation with reduced grazing
CP 2.1 - 2.2 (2.1A)	Heavy grazing with or without drought
CP 2.2 - 2.1 (2.2A)	Long-term prescribed grazing and prescribed burning

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 state was composed predominantly of cool-season grasses. The primary disturbance mechanisms for this site in the reference condition included occasional fire and grazing by large herding ungulates. Timing of fires and grazing, coupled with weather events, dictated the dynamics that occurred within the natural range of variability. 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 state is contingent upon a monitoring protocol to guide management.

Community Phase 1.1: Needlegrasses-Big Bluestem (*Hesperostipa spp., Nassella viridula-Andropogon gerardii*)

This community phase was historically the most dominant both temporally and spatially. It may be described as having been predominantly composed of cool-season grasses. The main grasses included green needlegrass, western wheatgrass, porcupinegrass, needle and thread, slender wheatgrass, and bearded wheatgrass. Other associated graminoids included the warm-season grasses (such as big bluestem, little bluestem, and blue grama). A diverse forb component was also present and often included dotted blazing star, upright prairie coneflower, purple prairie clover, and silverleaf Indian breadroot. Prairie sagewort, leadplant, prairie rose, and western snowberry were among the more common shrubs.

Annual production ranged roughly between 2100 to 3700 pounds per acre with graminoids, forbs, and shrubs contributing about 85%, 10% and 5% of the production, respectively. Community Phase 1.1 is considered the Reference Plant Community upon which most interpretations are 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 Needlegrasses-Big Bluestem		
COMMON/GROUP NAME	**SYMBOL**	**Group**	**lbs./acre**	**% Comp**
GRASSES & GRASS-LIKES			*2030 - 2465*	*70 - 85*
NEEDLEGRASS		**1**	**435 - 1015**	**15 - 35**
green needlegrass	NAVI4	1	290 - 580	10 - 20
porcupinegrass	HESP11	1	145 - 290	5 - 10
needle and thread	HECOC8	1	145 - 290	5 - 10
WHEATGRASS		**2**	**580 - 1015**	**20 - 35**
western wheatgrass	PASM	2	580 - 1015	20 - 35
slender wheatgrass	ELTR7	2	58 - 290	2 - 10
bearded wheatgrass	ELCA11	2	58 - 290	2 - 10
TALL/MID WARM-SEASON GRASSES		**3**	**145 - 290**	**5 - 10**
big bluestem	ANGE	3	29 - 290	1 - 10
sideoats grama	BOCU	3	0 - 145	0 - 5
prairie dropseed	SPHE	3	0 - 145	0 - 5
little bluestem	SCSC	3	0 - 145	0 - 5
SHORT WARM-SEASON GRASSES		**4**	**0 - 145**	**0 - 5**
blue grama	BOGR2	4	0 - 145	0 - 5
buffalograss	BUDA	4	0 - 145	0 - 5
OTHER NATIVE GRASSES		**5**	**0 - 290**	**0 - 10**
prairie Junegrass	KOMA	5	0 - 290	0 - 10
plains reedgrass	DIOLS	5	0 - 290	0 - 10
other grasses	2GRAM	5	0 - 290	0 - 10
GRASS-LIKES		**6**	**29 - 145**	**1 - 5**
needleleaf sedge	CADU6	6	29 - 145	1 - 5
Pennsylvania sedge	CAPE6	6	29 - 145	1 - 5
other grass-likes	2GL	6	0 - 145	0 - 5
FORBS		*7*	*145 - 290*	*5 - 10*
common yarrow	ACHMI2	7	29 - 87	1 - 3
white sagebrush	ARLU	7	29 - 87	1 - 3
false boneset	BREU	7	29 - 87	1 - 3
upright prairie coneflower	RATCOL3	7	29 - 87	1 - 3
scarlet globemallow	SPCO	7	29 - 87	1 - 3
Cuman ragweed	AMPS	7	29 - 58	1 - 2
wavyleaf thistle	CIUN	7	29 - 58	1 - 2
purple prairie clover	DAPU5	7	29 - 58	1 - 2
western wallflower	ERAS2	7	29 - 58	1 - 2
stiff sunflower	HEPA19	7	29 - 58	1 - 2
dotted blazing star	LIPU	7	29 - 58	1 - 2
scarlet beeblossom	OESU3	7	29 - 58	1 - 2
stiff goldenrod	OLRI	7	29 - 58	1 - 2
silverleaf Indian breadroot	REAR6	7	29 - 58	1 - 2
white heath aster	SYER	7	29 - 58	1 - 2
American vetch	VIAM	7	29 - 58	1 - 2
other native forbs	2FORB	7	29 - 145	1 - 5
SHRUBS		*8*	*29 - 145*	*1 - 5*
western snowberry	SYOC	8	29 - 145	1 - 5
prairie sagewort	ARFR4	8	0 - 87	0 - 3
prairie rose	ROAR3	8	29 - 58	1 - 2
leadplant	AMCA6	8	0 - 29	0 - 1
other shrubs	2SHRUB	8	0 - 145	0 - 5

Annual Production lbs./acre	LOW	RV	HIGH
GRASSES & GRASS-LIKES	1785 -	2465	- 3145
FORBS	210 -	290	- 370
SHRUBS	105 -	145	- 185
TOTAL	2100 -	2900	- 3700

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

Community Phase Pathway 1.1A
Community Phase Pathway 1.1 to 1.2 occurred with heavy grazing with or without drought. This resulted in increases in western wheatgrass, blue grama, and forbs with a corresponding decrease in big bluestem.

Community Phase 1.2: Western Wheatgrass-Needlegrasses-Blue Grama/Forbs (*Pascopyrum smithii-Hesperostipa spp., Nassella viridula-Bouteloua gracilis/Forbs*)
This community phase resulted from heavy grazing with or without drought. Blue grama, western wheatgrass, and forbs had markedly increased in comparison to Community Phase 1.1 while big bluestem had declined. Forbs commonly showing an increase would have included silverleaf Indian breadroot, white heath aster, common yarrow, and white sagebrush. Annual production was likely somewhat reduced compared to that of Community Phase 1.1.

Community Phase Pathway 1.2A
This Community Phase Pathway 1.2 to 1.1 occurred upon return to average precipitation and reduced grazing leading to an increase in big bluestem and corresponding decreases in blue grama, western wheatgrass, and forbs.

Transition T1A
This is the transition from the State 1: Reference State to the State 2: Native/Invaded State due to the introduction and establishment of exotic cool-season grasses - often Kentucky bluegrass, smooth brome, and/or quackgrass. This transition was inevitable and corresponded to a decline in native warm-season and cool-season grasses; it was exacerbated by chronic season-long or heavy late season grazing. Complete rest from grazing and suppression of fire would have also hastened this transition. The threshold between states was crossed when Kentucky bluegrass, smooth brome, quackgrass, or other exotic plants 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 the State 1: Reference State but has now been colonized by the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, and/or quackgrass). Although the state is still dominated by native grasses, an increase in the 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 non-use and no fire. To slow or limit the invasion of these exotic grasses, it is imperative that managerial techniques (e.g., prescribed grazing, prescribed burning) be carefully constructed, monitored, and evaluated with respect to that objective. If management does not include measures to control or reduce these exotic cool-season grasses, the transition to State 3: Invaded State should be expected.

Annual production of this state can be quite variable, in large part due to the amount of exotic cool-season grasses. However, annual production may be in the range of 1300-2500 pounds per acre.

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

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

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

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

Community Phase 2.1: Needlegrasses-Big Bluestem (*Hesperostipa spp., Nassella viridula-Andropogon gerardii*)

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

Community Phase Pathway 2.1A

Community Phase Pathway 2.1 to 2.2 results from heavy grazing, with or without drought, leading to increases in blue grama, western wheatgrass, and forbs with a corresponding decrease in big bluestem.

Community Phase 2.2: Western Wheatgrass-Needlegrasses-Blue Grama/Forbs (*Pascopyrum smithii-Hesperostipa spp., Nassella viridula-Bouteloua gracilis/Forbs*)

This community phase is similar to Community Phase 1.2 but has now been colonized by exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, and/or quackgrass). 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.

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

This Community Phase Pathway 2.2 to 2.1 occurs with long-term prescribed grazing and prescribed burning resulting in decreases in blue grama, western wheatgrass, and forbs with a corresponding increase in big bluestem.

Transition T2A

This transition from the State 2: Native/Invaded State to State 3: Invaded State generally occurs with long-term non-use or very light grazing and no fire. Exotic cool-season grasses (e.g., quackgrass, Kentucky bluegrass and/or smooth brome) become the dominant graminoids. Studies indicate that a threshold may exist in this transition when both the exotic cool-season grasses exceed 30% of the plant community and native grasses represent less than 40% of the plant community composition.

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

State 3: Invaded State

This state is the result of invasion and dominance by the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, and/or quackgrass). 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 silverleaf Indian breadroot, white heath aster, goldenrods, common yarrow, and white sagebrush. Shrubs, such as western snowberry and prairie 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, annual production may be in the range of 900-3000 pounds per acre with the exotic cool-season grasses accounting for the bulk of the annual production.

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

This community phase is dominated by exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, and/or quackgrass), often with a much-reduced forb and shrub component. Excessive accumulation of mulch may also be present, particularly when dominated by Kentucky bluegrass. Common forbs often include silverleaf Indian breadroot, white heath aster, goldenrods, common yarrow, and white sagebrush. Shrubs may include western snowberry and prairie rose.

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.

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 that the length and timing of grazing periods are adjusted to favor native species.

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

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

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

State 4: 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 needing control. Over time, however, the exotic cool-season grasses (Kentucky bluegrass, smooth brome, and/or quackgrass) 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/Exotic Species

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 needing control. Over time, however, the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, and/or quackgrass) 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 planting, prescribed grazing, prescribed burning, haying, or use of herbicides will generally be necessary to achieve the desired result and control any noxious weeds.

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

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

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

Restoration R4B

A failed range planting and/or secondary succession will lead to State 2: Native/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 is the 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 tillage induced compaction, erosion, fertility, herbicide/pesticide carryover). Thus, soil conditions should be assessed when considering restoration techniques.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

Landscape

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

By the mid-19th century, the majority of the Red River Valley had been converted from tall-grass prairie to annual crop production. To alleviate crop production loss from wetlands and overland flow, a system of shallow surface ditches, judicial ditches, and road ditches removes surface water in spring and during high rainfall events. The major soils are poorly drained with extensive areas of saline soils. Tile drainage systems have been or are being extensively

installed throughout MLRA 56A for sub-surface field drainage to enhance annual crop production.

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

Historic Communities/Conditions within MLRA 56A:

The northern tall- and mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary ecological drivers (either singly or often in combination). Frequent and expansive flooding along the Red River and its tributaries provided abundant opportunities for Native Americans to harvest wild rice. American bison roamed MLRA 56A wintering along the Red River and migrating west into MLRA 55A and 55B for parts of the season. Many species of grassland birds, small mammals, insects, reptiles, amphibians, and large herds of roaming American bison, elk, and pronghorn were historically among the inhabitants adapted to this region. Roaming herbivores, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to large predators (such as the wolf and American black bear) and smaller carnivores (such as the coyote, bobcat, red fox, and raptors). Extirpated species include free-ranging American bison and gray wolf (breeding). Extinct from the region is the Rocky Mountain locust.

Present Communities/Conditions within MLRA 56A:

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

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

Annual cropping is the main factor contributing to habitat fragmentation, reducing habitat quality for area-sensitive species. These influences fragmented the landscape, reduced, or eliminated ecological drivers (fire), and introduced exotic species including smooth brome, Kentucky bluegrass, and leafy spurge which further impacted plant and animal communities. The loss of the bison and fire as primary ecological drivers greatly influenced the character of the remaining native plant communities and the associated wildlife, moving towards a less diverse and more homogeneous landscape.

Included in this MLRA are approximately 70,000 acres of the United States Forest Service, Sheyenne National Grassland (southern portion of MLRA) with an additional 65,000 acres of

intermingled privately owned land of sandy soils providing a large tract of intact tall grass prairie within the MLRA. United Fish and Wildlife Service refuges and waterfowl production areas, along with and state wildlife management areas cover approximately 67,000 acres within the MLRA. Two of three largest cities in North Dakota are located within the MLRA.

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

Some characteristic wildlife species in this area are:

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

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

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

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

Insects play an important role providing ecological services for plant community development. Insects that are scavengers or aid in decomposition provide the food chain baseline sustaining the carnivorous insects feeding upon them. Many insects provide the ecological services necessary for pollination, keeping plant communities healthy and productive. Insects provide a protein food source for numerous species including grassland-nesting birds and their young. Extensive use of insecticides for specialty crops (such as potatoes, sugar beets, and other crops) has greatly reduced insects within this MLRA.

Species of Concern within MLRA 56A:

The following is a list of species considered "species of conservation priority" in the North Dakota State Wildlife Action Plan (2015); "species of greatest conservation need" in the Minnesota State Wildlife Action Plan, Conservation Focus Areas, Target Species (2015) and the South Dakota State Wildlife Action Plan (2014); and "species listed as threatened, endangered, or petitioned" under the Endangered Species Act within MLRA 56A at the time this section was developed:

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

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

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

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

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

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

Grassland Management for Wildlife in MLRA 56A:

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

Ecological sites occur as intermingled complexes on the landscape with gradual or sometimes abrupt transitions. Rarely do ecological sites exist in large enough acreage to manage independently. Ecological sites supporting a dominance of herbaceous vegetation (Wet Meadow, Subirrigated Sands) can be located adjacent to ecological sites that support trees (Choppy Sands and Loamy Overflow).

Management of these complex ecological sites can provide a heterogeneous or a homogenous landscape. Grassland bird use reduces as the plant community transitions to a homogenous state or increases in woody vegetation. Managers need to recognize ecological sites and the complexes they occur in to properly manage the landscape. A management regime for one

ecological site may negatively impact an adjacent site (e.g., alteration of a grazing regime within a Choppy Sands ecological site to encourage understory growth may encourage exotic cool-season grasses to increase or dominate an adjacent ecological site).

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

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

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

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

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

Clayey Wildlife Habitat Interpretation:

Clayey ecological sites have no restrictions in the soil profile. This complex of ecological sites provides habitat for many edge-sensitive, grassland bird species. Clayey habitat features support nesting and foraging grassland birds but may be too dense and tall for sharp-tailed grouse leks. Associated ecological sites include Claypan, Limy Subirrigated, Loamy, Subirrigated, Thin Claypan, and Wet Meadow.

Clayey 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); multiple plant community phases exist within states 1.0 and 2.0. These states occur primarily in response to grazing, drought, and non-use. Secondary influences include fire and anthropogenic disturbances.

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 T2A transitional pathway to Invaded State 3.0. Native grassland associated wildlife generally benefit from a heterogeneous grassland found in States 1.0 and 2.0 that include diverse grass and forb species with varying structure and density.

As plant communities degrade within State 2.0 and transition to State 3.0, cool-season exotic grasses and low shrubs increase while native forbs are reduced. This transition results in reduced structure, increased plant community homogeneity, and reduced insect populations resulting in a reduction of breeding, nesting, foraging, or winter habitat for grassland birds. When adjacent/intermingled, ecological sites undergo the same transition, the result can be an expansive, homogenous landscape. A homogenous grassland landscape does not provide quality escape or winter cover. As a result, many species are not able to meet life requisites within State 3.0.

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 or successful native range planting.

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

1.0 Reference State

Community Phase 1.1 Needlegrasses-Big Bluestem: This plant community phase offers quality 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 burning. 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 simulated 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 decomposers, scavengers, shredders, predators, herbivores, dung beetles, and fungal-feeders).

Dakota skippers do not prefer this site since it does not support forb host plants (such as woody lily, harebell and smooth camas). Regal fritillary habitat is limited due to Nuttall's violet and prairie violets being uncommon. Monarch butterfly may use flowering forbs on this site; however, few milkweed species are found on this site to support breeding and larvae development. Bumblebees and other native bees utilize forbs for pollen and nectar sources and bare ground for nesting amongst bunchgrasses. Prescribed grazing with adequate recovery periods (as well as prescribed burning) to maintain the 1.1 phase will have long term positive effects on ground dwelling insects.

Birds: This plant community provides quality nesting, foraging, and escape habitats favored by mid- to tall-grass nesting birds. Plant structure is too dense or tall for species using short-grass habitats. The low, scattered shrubs present in the plant community phase should not impact woody vegetation sensitive bird species.

Grassland birds preferring mid to tall-grass structure will use this site. In years with reduced precipitation or drought, nesting recruitment may be compromised. This plant community is too tall and dense to provide suitable areas for sharp-tailed grouse lek sites but does provide nesting and brood-rearing habitat. Diverse prey populations provide good hunting opportunity for grassland raptors. Many passerine species utilize MLRA 56A as a major migratory travel corridor.

Mammals: The diversity of grasses and forbs provide high nutrition levels for small and large herbivores including voles, mice, rodents, jackrabbits, and white-tailed deer. Moderate-statured vegetation provides suitable food and thermal, protective, and escape cover for small herbivores.

Amphibians/Reptiles: This ecological site and associated plant communities provides habitat for smooth green snakes. This ecological site can be located adjacent to wetlands, streams, or lakes, providing habitat for the northern leopard frog and Great Plains toad.

Fish and Mussels: This ecological site is not directly associated with streams, rivers, or water bodies. Associated ecological sites, such as Limy Subirrigated or Claypan, can receive run-on hydrology from Clayey sites. Management on these interconnected sites can have indirect effect on aquatic species.

Community Phase 1.2 Western Wheatgrass-Needlegrasses-Blue Grama/Forbs: This plant community phase occurs along Plant Community Pathway 1.1A from heavy grazing, with or without drought. This leads to an increase in blue grama and forbs (such as Indian breadroot, white heath aster, common yarrow, and white sagebrush) with a corresponding decline in big bluestem creating a plant community dominated by short- to mid-saturated grasses and forbs.

Invertebrates: Provides similar life requisites as Community Phase 1.1. However, an increase in sod-forming grasses may negatively impact ground nesting pollinator species. An increase in forbs provides nectar and pollen sources for many pollinating insects. Wind-pollinated white sagebrush provides nesting sites for native bees and larval food for Lepidoptera species and other insects.

Birds: Provides similar life requisites as Community Phase 1.1. However, the increase of short, warm-season grasses favors grassland-nesting birds species preferring short to mid-statured vegetation. Short, warm-season grasses may be more attractive for sharp-tailed grouse lek sites.

Mammals: Provides similar life requisites as Community Phase 1.1; however, foliage and stems of prairie sagewort provide browse for jackrabbits, cottontails, ground squirrels, and various mice species.

Amphibians and 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 Needlegrasses-Big Bluestem: This plant community develops through Transition Pathway T1A due to changes in management and the presence of exotic, cool-season grasses. Chronic season-long or late fall grazing can facilitate this transition. Complete rest from grazing and no fire events can also lead to this transition. The threshold between States 1.0 and 2.0 is crossed when Kentucky bluegrass, 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 it has a minor amount of cool-season exotic grasses and forbs. This phase still functions at a high level for native wildlife; therefore, managers should consider the 2.0 community phase pathways to avoid transitioning to the Invaded State 3.0. There is no known Community Phase Pathway back to State 1.0 from State 2.0.

Invertebrates: Provides similar life requisites as Community Phase 1.1.

Birds: Provides similar life requisites as Community Phase 1.1.

Mammals: Provides similar life requisites as Community Phase 1.1.

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

Community Phase 2.2 Western Wheatgrass-Needlegrasses-Blue Grama/Forbs:
This community developed from heavy season-long grazing with or without drought. Community Phase Pathway 2.1A leads to shorter-statured warm-season grasses. Forb diversity remains with an increase in white sage. Dominated by shorter-statured grasses and sedges, the diversity of this plant community is reduced. Prescribed grazing with adequate recovery periods along Community Phase Pathway 2.2A is an efficient, effective method to regain the cool-season grass and forb diversity components found in Community Phase 2.1.

This community phase is often found in a mosaic in the pasture in an overgrazed/under grazed pattern typical of properly stocked pastures grazed season long. Some areas will be impacted by heavy use while other areas will have a build-up of litter and a high amount of plant decadence. This mosaic of grazed and ungrazed areas provides a short- to mid-vegetative stature. Depending on the patch size of overgrazed vs. undergrazed areas, grassland nesting birds preferring short/mid-vegetative stature may prefer this plant community phase.

Invertebrates: The reduction of native forbs and increase in sod-forming grasses and sedges begin to limit foraging and nesting sites for all pollinators. Heavy, season-long grazing may reduce ground-nesting site availability. Wind-pollinated white sage provides nesting sites for native bees and larval food for butterfly species. However, depending on the amount of overgrazed vs. undergrazed area, the undergrazed areas may provide similar life requisites as Community Phase 2.1.

Birds: Provides similar life requisites as Community Phase 1.2. However, depending on the amount of overgrazed vs. undergrazed area, the undergrazed areas may provide similar life requisites as Community Phase 2.1.

Mammals: Provides similar life requisites as Community Phase 1.2. However, depending on the amount of overgrazed vs. undergrazed area, vegetative stature in the undergrazed areas could provide thermal and escape cover for mammals, especially small mammals.

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

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

3.0 Invaded State

Community Phase 3.1 Exotic Cool-Season Grasses/Forbs: Extended periods of non-use or very light grazing and no fire (via Transitional Pathway T2A) leads to a community characterized by a dominance (>30%) of exotic cool-season grasses, such as Kentucky bluegrass and smooth brome; native grasses represent less than 40%. Warm-season, native grasses may still be present but with reduced vigor and numbers. Return to State 2.0 (via Restoration Pathway R3A) through prescribed burning and high levels of grazing

management, requires remnant amounts of native warm- and cool-season and forbs to be successful. The remnant native community needs frequent prescribed burns and high levels of grazing management targeting the exotic cool-season grasses to improve competitiveness and increase vigor and density. This plant community is resistant to change; time and extensive resources will be needed to accomplish significant change. Managers need to evaluate impacts to wildlife while implementing these management practices. 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: The invasion and dominance of cool-season exotic grasses and the loss of cool-season native grasses (combined with the reduction of forb production, abundance, diversity, and richness) reduces or may eliminate habitat for invertebrate species of concern within MLRA 56A. Western snowberry and prairie rose provides early- to mid-season bloom period nectar and pollen. Common forbs (white sagebrush, white heath aster, and goldenrod) provide late season pollen and nectar opportunities. Litter and thatch levels are high, limiting bare ground for ground-nesting bee species.

Birds: The homogeneous community phase, dominated by exotic short statured grass species, provides limited habitat and life requisites for most obligate grassland-nesting birds. Bird species that favor short-statured vegetation may use this site; however, a lack of plant diversity and stature limits use by many grassland-nesting birds. Dependent upon density of western snowberry, grassland nesting birds that are sensitive to woody vegetation encroachment may be reduced.

Mammals: The dominance of short-statured, sod forming, cool-season grasses (with no use or no fire) creates a thick duff and litter layer. Limited habitat is available for mammals except for ground dwelling rodent species. Dependent upon the density of western snowberry, increased year-round cover and browse for white-tailed deer may increase.

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

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

State 4: Go-Back State

Community Phase 4.1 Annual/Pioneer Perennial/Exotic Species: These plant communities are the result of severe soil disturbance (such as cropping, recreational activity, or concentrated livestock activity for a prolonged period). Following cessation of disturbances, the resulting plant community is dominated by early pioneer annual and perennial plant species. Plant species composition and production are highly variable. Weedy plants can provide pollinator habitat along with spring and summer cover for many mammals and birds, and their young. Dense weed cover can keep soils moist, increasing the presence of insects. Milkweed can be an early pioneering pollinator species and host plant for monarch butterflies. Tall stature provided by some annual weeds offers thermal cover and seeds throughout winter for deer, small mammals, and over-wintering birds. The response by wildlife species will be dependent upon plant community composition, vegetative stature, patch size, and management activities (such as prescribed grazing, burning, inter-seeding, haying, or noxious weed control).

Successful restoration of native species along Transition Pathway R4A can result in a native grass and forb community in Native/Invaded State 2.0. Over time (with no management), the exotic cool-season perennial grasses (Kentucky bluegrass, smooth brome, and/or quackgrass) generally become established and dominate the community. Failed range planting, via Transition Pathway R4B, can result in an invaded plant community Invaded State 3.0.

Animal Community – Grazing Interpretations

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

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

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

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

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

Hydrology Functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic groups C and D. Infiltration varies from very slow to moderately slow; runoff potential varies from low to very high depending upon soil hydrologic group, surface texture, slope percent, 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 strong 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

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

In North Dakota, the United States Forest Service manages 70,000 acres on the Sheyenne National Grassland for multiple uses including camping, hunting, photography, backpacking birdwatching,

biking, horseback riding, and other non-motorized recreation. The Sheyenne National Grassland is also managed for livestock grazing. The Choppy Sands and Sands ecological sites dominate the Grassland. It is the only National Grassland in the tallgrass prairie region of the United States. The grassland provides habitat for greater prairie chicken, as well as several other sensitive species (such as the Dakota skipper and regal fritillary). It also contains one of largest populations of the western prairie fringed orchid which is listed as a threatened species by the U.S. Fish and Wildlife Service.

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

Camping: Four state parks or recreation areas provide of modern and primitive camping facilities. Minnesota hosts the Buffalo River State Park and Red River State Park. North Dakota hosts the Icelandic State Park and Turtle River State Park. These Parks provide hiking, biking, birding, canoeing, and wildlife viewing opportunities. Many local parks and private parks provide modern and primitive camping opportunities. Limited primitive camping is also available on North Dakota Game and Fish Department Wildlife Management Areas.

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

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

Wood Products

No appreciable wood products are present on the site.

Other Products

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

Site Development and Testing Plan

- Further investigation is needed on site hydrology and soil chemistry where this site is in complex or close association with salt-affected soils. There is potential for salinization of nearly level Clayey sites in these areas. The major MLRA map unit of concern is:
    - Exline-Aberdeen silty clays, 0 to 1 percent slopes (map unit 2mbkb)
- Further evaluation and refinement of the State-and-Transition model is needed to identify disturbance driven dynamics. Additional states and/or phases may be required to address grazing response.

- Further documentation may be needed for plant communities in all states. Plant data has been collected in previous range-site investigations, including clipping data; however, this data needs review. If geo-referenced sites meeting Tier 3 standards for either vegetative or soil data are not available, representative sites will be selected for further investigation.
- Site concepts will be refined as above noted investigations are completed.
- The long-term goal is to complete an approved, correlated Ecological Site Description as defined by the National Ecological Site Handbook.
- NASIS revisions needed:
    - Somewhat poorly drained phases of Aberdeen soils (OSD only recognizes moderately well drained phases) currently are linked to the Clayey ES; current ESD criteria would lead these to be linked to Subirrigated. There are 22 such components (7 major). Review is needed regarding water table depth and ESD criteria in these components prior to changing the Component ES link.
    - Currently, numerous poorly drained components are linked to the Clayey ES. Ecological sites are supposed to reflect unaltered hydrologic conditions; therefore, these components should be linked to Wet Meadow. Soil series to review and relink are:
        - Clearwater
        - Eagepoint
        - Fargo
        - Foxlake
        - Hegne
        - McDonaldsville
        - Mustinka
        - Northcote
        - Noyes
        - Reis
        - Ryan, thick solum
        - Viking

      Care is required in relinking as some of these soils have moderately saline components, also.
    - Currently, four somewhat poorly drained components (1 major) of Fargo soils are linked to Clayey; these should be relinked to Subirrigated.
    - Two components of Rolette soils (1 major) are currently linked to Clayey. These soils have alfic properties; therefore, they should be relinked to 55A Upland Hardwood Forest ES.

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

Claypan	R056AY085ND	This site typically occurs slightly lower on the landscape. It has a root-restrictive claypan layer starting between a depth of 6 to 20 inches. Commonly, visible salts occur below a depth of 16 inches.
Limy Subirrigated	R056AY087ND	This site occurs lower on the landscape. It is highly calcareous in the upper part of the subsoil; redoximorphic features are at a depth of 18 to 30 inches.
Loamy	R056AY094ND	This site occurs on similar landscape positions. The surface and subsoil layers form a ribbon 1 to 2 inches thick.
Subirrigated	R056AY095ND	This site occurs somewhat lower on the landscape. It is non-calcareous to a depth >16 inches; redoximorphic features are at a depth of 18 to 30 inches.
Thin Claypan	R056AY097ND	This site occurs lower on the landscape. It has a root-restrictive claypan layer and visible salts within a depth of 16 inches.
Wet Meadow	R056AY102ND	This site occurs in depressions and on poorly drained flats. Redoximorphic features are within a depth of 18 inches.

Similar Sites

Ecological Site Name	Site ID	Narrative
Claypan	R056AY085ND	This site typically occurs slightly lower on the landscape. It has a root-restrictive claypan layer starting between a depth of 6 to 20 inches. Commonly, visible salts occur below a depth of 16 inches.
Loamy	R056AY094ND	This site occurs on similar landscape positions. The surface and subsoil layers form a ribbon 1 to 2 inches thick.

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Inventory Data References

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

State Correlation

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

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 48a – Glacial Lake Agassiz Basin and 48d – Lake Agassiz Plains

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Site Description Approval

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

INTERPRETING INDICATORS OF RANGELAND HEALTH, Version 5, REFERENCE SHEET

Ecological site name: _Clayey____ Ecological site code: _RO56AY084ND_____
Author(s)/participant(s): _USDA-NRCS North Dakota_____
Contact for lead author: _NRCS State Rangeland Management Specialist_____
Date: _Dec. 2021____ **MLRA:** __56_____ **LRU:** _____
Composition based on (check one): ☐ Cover ☒ Annual Production

Indicators. For each indicator, describe the potential for the site using the reference sheet checklist. Where possible, (1) use quantitative measurements; (2) include expected range of values for above- and below-average years and natural disturbance regimes for each community phase within the reference state, when appropriate; and (3) cite data sources used. Continue descriptions on separate sheet.

1. Rills: Rills are not expected on this site.

2. Water flow patterns: Water flow patterns are not visible on this site.

3. Pedestals and/or terracettes: Neither pedestals nor terracettes are expected.

4. Bare ground: Bare ground is less than 5%. Bare ground patches should be small (less than 2 inches in diameter) and not connected. Animal activity (burrows and ant mounds) may occasionally result in isolated bare patches of up to 24 inches in diameter.

5. Gullies: Active gullies are not expected on this site. If present, gully channel(s) are fully vegetated with no active erosion visible.

6. Wind-scoured and/or depositional areas: No wind-scoured or depositional areas expected on this site.

7. Litter movement: Plant litter movement is not expected on this site.

8. Soil surface resistance to erosion: Stability class averages 6.

9. Soil surface loss and degradation: Use soil series description for depth, color, and structure of A-horizon.

10. Effects of plant community composition and distribution on infiltration: Mid- and short-statured bunch grasses and mid- and short-statured rhizomatous grasses are dominant and well distributed across the site. Forbs and tall-statured rhizomatous grasses are subdominant.

11. Compaction layer: No compaction layers occur naturally on this site.

12. Functional/structural groups: Due to differences in phenology, root morphology, soil biology relationships, and nutrient cycling Kentucky bluegrass, smooth brome, and crested wheatgrass are included in a new Functional/structural group, mid- and short-statured early cool-season grasses (MSeC3), **not expected for this site**.

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

	Dominance based on[1]: Annual Production _X_ or Foliar Cover __		
	Phase 1.1_	**Phase 1. __**	**Phase 1. __**
Dominant	Mid & short C3 bunch grasses (5); Mid & short C3 rhizomatous grasses (1)		
Subdominant	Forbs (16); Tall C4 rhizomatous grasses (1)		
Minor	Mid & short C4 rhizomatous grasses; Mid & short C4 bunch grasses; Grass-likes; Shrub		
Trace			

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

13. Dead or dying plants or plant parts: Dead or dying plants/plant parts are not expected on this site.

14. Litter cover and depth: Plant litter cover is 70 to 80% with a depth of 0.25 to 0.5 inches. Litter is in contact with soil surface.

15. Annual production: Annual air-dry production is 2900 lbs./ac (reference value) with normal precipitation and temperatures. Low and high production years should yield 2100 lbs./ac to 3700 lbs./ac, respectively.

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

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

Functional/Structural Groups Sheet

State ND **Office** _____ **Ecological site** Clayey **Ecol. site code** RO56AY084ND

Observers _____ **Date** _____

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

Species list of functional/structural groups in the **Reference State**	
Functional/Structural Group	Species List
Mid & short C3 bunch grasses	green needlegrass, porcupinegrass, needle and thread, slender wheatgrass, bearded
.	wheatgrass, prairie Junegrass*
Mid & short C3 rhizomatous grasses	western wheatgrass, plains reedgrass*
Mid & short C4 bunch grasses	prairie dropseed*, little bluestem*, blue grama*
Mid & short C4 rhizomatous grasses	sideoats grama*, buffalograss*
Forbs	please see plant community table 1.1
Tall C4 rhizomatous grasses	big bluestem
Grass-likes	needleleaf sedge, Pennsylvania sedge
Shrub	western snowberry, prairie sagewort*, prairie rose, leadplant*
.	
Biological soil crust[1]	

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

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

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

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

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

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

Evaluation Area - Relative dominance of functional/structural groups

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

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

** See IIRH Version 5 page 70.

Notes: