USDA Natural Resources Conservation Service

Ecological site R055BY072ND
Sandy Claypan

Last updated: 4/25/2025
Accessed: 05/21/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

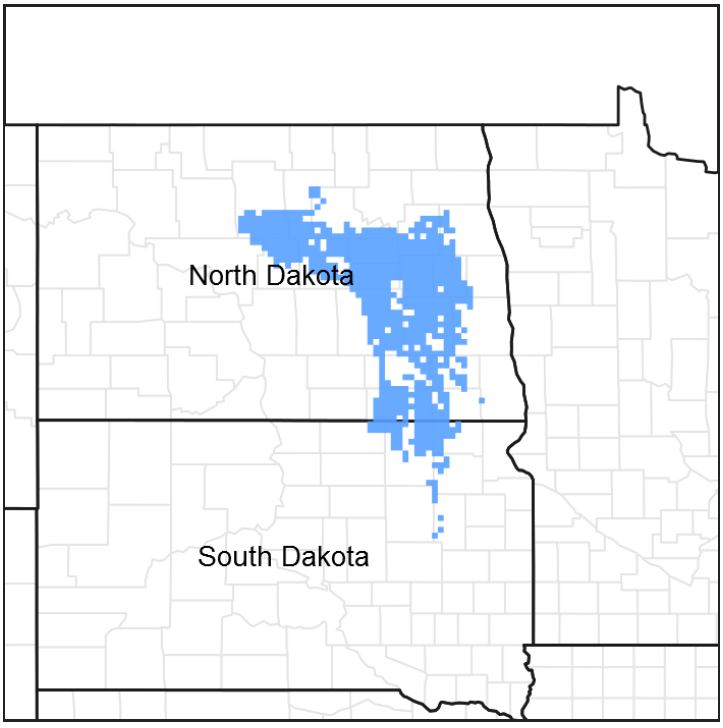

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 055B–Central Black Glaciated Plains

The Central Black Glaciated Plains MLRA is an expansive and agriculturally important region consisting of more than 10,000,000 acres and including all or a portion of 27

counties in east-central and southeastern North Dakota and northeastern South Dakota.

Most of MLRA 55B is covered by till: material that was moved and redeposited by the glaciers. Pre-glaciated bedrock (shale) is exposed on the breaks to some of the valleys and incised drainageways; but what covers the bedrock is glacier sediment, known as drift. These areas have the Late Wisconsin age till plain integrated drainage system in contrast to the closed drainage of the majority of the till plain and moraines. Some soils, particularly along the Elm, James and Sheyenne rivers, have weathered shale beds in the substratum.

The Drift Prairie Region consists of nearly level to gently rolling glacial till plains dissected by glacial outwash channels. MLRA 55B is located within the boundaries of the Prairie Pothole Region with numerous wetlands in areas without integrated drainage systems. Seven rivers flow through parts of the MLRA. The James and Sheyenne Rivers both have their headwaters in the northern part of the MLRA. A relatively narrow, low range of hills separates these rivers creating a continental watershed divide. The James River flows generally southward through the MLRA and empties into the Missouri River beyond the MLRA border. The Sheyenne River flows to the south and to the east; it empties into the Red River of the North in MLRA 56. Major tributaries to the James River are the Pipestem and Elm Rivers. The Sheyenne River receives additional water from Devils Lake (during periods of high lake levels) via two outlet pumping stations. Other important rivers in the MLRA are the Goose, Maple, and Wild Rice rivers which are also tributaries to the Red River of the North. The Wild Rice River begins in northeastern South Dakota and flows northward and eastward. In Marshall County, South Dakota and Sargent County, North Dakota, major ditch construction has served to straighten this river and more quickly drain water off adjacent farmland.

Surface and subsurface (tile) drainage systems have been constructed/installed in many areas to manage excess water and/or salinity on cropland. Soils that were poorly drained prior to wide-spread drainage may now function as somewhat poorly drained or moderately well drained soils. Restoration of hydrology to the natural conditions of the reference state may not be possible.

This region is utilized mostly by farms and ranches; about 75 percent is cropland that is dry-farmed. Cash-grain, bean and oil production crops are the principal enterprise on many farms, but other feed grains and hay are also grown. The vegetation on the steeper slopes, very stony areas, and thinner (or sandy) soils is still native rangeland. About 1 percent of this area is forested. Most forested areas occur along rivers, particularly the Sheyenne River Valley.

Classification relationships

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

Ecological site concept

The Sandy Claypan ecological site typically is located on flats and on foot slopes of rises sand plains, delta plains, and lake plains; it also can occur on terraces. Although the soil parent materials are very deep; a dense claypan layer, which affects root growth, occurs in the upper part of the subsoil (at a depth of 6 to 20 inches). The claypan subsoil layer is fine sandy loam, sandy loam, or loam (with <18% clay); it forms a ribbon <1 inch long. The texture of the surface layer is typically fine sandy loam or sandy loam, but loam and loamy fine sand are included. Generally, soil on this site is typically moderately well drained, but somewhat poorly drained soils are allowable. Accumulations of salts are allowable below a depth 16 inches. Slopes range from 0 to 6 percent. On the landscape, this site is below the Sandy and Sands ecological sites and above the Limy Subirrigated, Sodic Subirrigated, and Saline Lowland sites. The Thin Claypan ecological site is in adjacent micro-lows; it has a dense claypan layer within a depth of 6 inches. The Subirrigated Sands site occurs on similar landscape positions; it does not have the dense claypan layer of this site.

To see a full copy of the ecological site description with all tables and the full version 5 rangeland health worksheet. Please use the following hyperlink:

https://efotg.sc.egov.usda.gov/references/public/ND/55B_Sandy_Claypan_Narrative_FINAL_Ref_FSG.pdf

Associated sites

R055BY062ND	**Sandy** This site is higher on the landscape. The soil has sandy loam or fine sandy loam textures (forms a ribbon <1 inch long) to a depth >10 inches. It does not have a dense claypan layer.
R055BY074ND	**Subirrigated Sands** This site is on similar landscape positions. It has redoximorphic features at a depth of 30 to 40 inches. The subsoil does not form a ribbon. It does not have a dense claypan layer.
R055BY066ND	**Thin Claypan** This site is in micro-lows. The soil has a root-restrictive claypan layer within a depth of 6 inches and accumulated salts within 16 inches.
R055BY058ND	**Limy Subirrigated** This site is slightly lower on the landscape. The soils do not have a dense claypan layer. They are highly calcareous within a depth of 16 inches and have redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.

R055BY060ND	**Saline Lowland** This site is typically lower on the landscape. It has an accumulation of salts in the surface and subsoil layers (E.C. >8 dS/m). Typically, this site does not have a claypan layer, but one is allowed if the soil is poorly drained. All textures are included in this site.
R055BY061ND	**Sands** This site is higher on the landscape. The soil is sand or loamy sand (fine to coarse sands) within a depth of 10 inches. The subsoil does not form a ribbon. It does not have a dense claypan layer.

Similar sites

R055BY057ND	**Claypan** This site is on similar landscape positions on till plains and lake plains. The soil has a root-restrictive claypan layer that forms a ribbon >1 inch thick. Commonly, visible salts occur below a depth of 16 inches.
R055BY062ND	**Sandy** This site is higher on the landscape. The soil has sandy loam or fine sandy loam textures (forms a ribbon <1 inch long) to a depth >10 inches. It does not have a dense claypan layer within a depth of 20 inches.
R055BY066ND	**Thin Claypan** This site is in micro-lows. The soil has a root-restrictive claypan layer within a depth of 6 inches and accumulated salts within 16 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Andropogon gerardii*

Physiographic features

This site typically occurs on sandy uplands – sand plains, delta plains, and lake plains. It occurs on flats and on foot slopes of rises. A few areas are on terraces. The parent materials are glaciofluvial or sandy glaciolacustrine deposits. Slopes range from 0 to 6 percent.

Landform: sand plain, delta plain, lake plain, terrace

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Lake plain (3) Delta plain (4) Terrace
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	299–651 m
Slope	0–6%
Water table depth	46–203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 55B is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are characteristic of the MLRA. The climate is the result of this MLRA's location in the geographic center of North America. There are few natural barriers on the northern Great Plains. The air masses move unobstructed across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 18 to 23 inches per year. The normal average annual temperature is about 41.5° F. January is the coldest month with average low temperature ranging from about -4.3° F (Petersburg, ND) to about 2.5° F (Mellette, SD). July is the warmest month with temperatures averaging from about 79° F (Petersburg, ND) to about 84° F (Mellette, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 64° F. This large annual range attests to the continental nature of this MLRA's climate. Winds average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime and strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

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

Table 3. Representative climatic features

Frost-free period (characteristic range)	111-117 days
Freeze-free period (characteristic range)	128-134 days

Precipitation total (characteristic range)	483-559 mm
Frost-free period (actual range)	105-119 days
Freeze-free period (actual range)	124-135 days
Precipitation total (actual range)	457-584 mm
Frost-free period (average)	114 days
Freeze-free period (average)	131 days
Precipitation total (average)	533 mm

Climate stations used

- (1) BUTTE 5SE [USC00321225], Butte, ND
- (2) CARRINGTON [USC00321360], Carrington, ND
- (3) FORMAN 5 SSE [USC00323117], Forman, ND
- (4) HARVEY 4NE [USC00324013], Harvey, ND
- (5) LA MOURE [USC00324937], Lamoure, ND
- (6) MELLETTE 4 W [USC00395456], Northville, SD
- (7) PETERSBURG 2 N [USC00327027], Petersburg, ND
- (8) COLUMBIA 8 N [USC00391873], Columbia, SD

Influencing water features

This site does not receive significant additional water, either as runoff from adjacent slopes or from a seasonal high-water table. Although the seasonal water table can be as shallow as 1.5 feet early in the growing season on low-relief areas, the claypan layer, which affects root growth, prohibits the plants from benefiting significantly from subirrigation. Depth to the water table typically is greater than 4 feet through most of the growing season. Surface infiltration is moderately rapid or moderate. Permeability is moderately rapid or rapid in the surface soil, but slow to moderate in the claypan subsoil. Water loss is through percolation below the root zone and through evapotranspiration.

Soil features

Soils associated with Sandy Claypan ecological site are in the Mollisol order, which are classified further as Calcic Natrudolls. These soils were developed under prairie vegetation. Salt accumulations, where present, are below a depth of 16 inches. They formed in glaciofluvial or glaciolacustrine deposits; in some soils, glacial till occurs below a depth of 4 feet.

The common feature of soils in this site is a sodic, claypan subsoil layer that is fine sandy loam, sandy loam, or loam (with <18% clay); it forms a ribbon <1 inch long. Although the soil parent materials are very deep, the claypan layer, which affects root growth, occurs in the upper part of the subsoil (at a depth of 6 to 20 inches). The texture of the surface layer

is typically fine sandy loam or sandy loam, but loam and loamy fine sand are included. These soils commonly have a gray subsurface layer of loamy find sand just above the claypan layer. Salt accumulations, where present, are below a depth of 16 inches. The soils in this site typically are moderately well drained – redoximorphic features, where present, are deeper than 1.5 feet.

Soil salinity is typically none to very slight above the claypan layer (E.C. <4 dS/m); however, slight salinity (E.C. 4-8 dS/m) is allowable within a depth of 16 inches. Below 16 inches, it may increase to moderate (E.C. 8 - <16 dS/m) in some soils. Sodicity is low (SAR <5) above the claypan layer; but increases to moderate or moderately high (SAR 5-15) in the subsoil and substratum. Soil reaction is strongly acid to slightly alkaline (pH 5.1 to 7.8) above the claypan and slightly alkaline to strongly alkaline (pH 7.4 to 9.0) in the subsoil and substratum. Calcium carbonate content is typically none in the surface soil and upper few inches of the claypan layer; below this, it may increase to moderate (5-15% $CaCO_3$).

These soils are mainly susceptible to wind erosion. Loss of the soil surface layer can result in a shift in species composition and/or production.

The major soil series correlated to Sandy Claypan site is Letcher.

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

Table 4. Representative soil features

Parent material	(1) Glaciofluvial deposits (2) Glaciolacustrine deposits (3) Till
Surface texture	(1) Fine sandy loam (2) Sandy loam (3) Loam (4) Loamy fine sand
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Slow to moderate
Depth to restrictive layer	15–51 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	15.24–22.86 cm

Calcium carbonate equivalent (Depth not specified)	0–15%
Electrical conductivity (Depth not specified)	0–8 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–15
Soil reaction (1:1 water) (Depth not specified)	5.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

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 55B included frequent fires, both anthropogenic and natural in origin. Most fires, however, were anthropogenic fires set by Native Americans. Native Americans set fires in all months except perhaps January. These fires occurred in two peak periods, one from March-May with the peak in April and another from July-November with the peak occurring in October. Most of these fires were scattered and of small extent and duration. The grazing history would have involved grazing and browsing by large herbivores (such as American bison, elk, and whitetail deer). Herbivory by small mammals, insects, nematodes, and other invertebrates are also important factors influencing the production and composition of the communities. Grazing and fire interaction, particularly when coupled with drought events, influenced the dynamics discussed and displayed in the following state and transition diagram and descriptions.

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

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

Four vegetative states have been identified for the site (Reference, Native/Invaded, Invaded, and Go-Back). Within each state, one or more community phases have been identified. These community phases are named based on the more dominant and visually conspicuous species; they have been determined by study of historical documents, relict areas, scientific studies, and ecological aspects of plant species and plant communities. Transitional pathways and thresholds have been determined through similar methods.

State 1: Reference State represents the natural range of variability that dominated the dynamics of this ecological site prior to European influence. Dynamics of the state were largely determined by variations in climate and weather (e.g., drought), as well as that of fire (e.g., timing, frequency) and grazing by native herbivores (e.g., frequency, intensity, selectivity). Due to those variations, the Reference State is thought to have shifted temporally and spatially between two plant community phases.

Currently the primary disturbances include widespread introduction of exotic plants, concentrated livestock grazing, lack of fire, and perhaps long-term non-use and no fire. Because of these changes, particularly the widespread occurrence of exotic 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, crested wheatgrass) which have been particularly and consistently invasive under extended periods of 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.

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

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

State 3: Invaded State. The threshold for this state is reached when both the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass, crested wheatgrass) exceed 30% of the plant community and native grasses represent less than 40% of the community. One community phase has been identified for this state.

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

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

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

Initially, due to extensive bare ground and a preponderance of shallow rooted annual plants, the potential for soil erosion is high. Plant species richness may be high, but overall diversity (i.e., equitability) is typically low, with the site dominated by a relatively small assemblage of species. Due to the lack of native perennials and other factors, restoring the site with the associated ecological processes is difficult. However, a successful range planting may result in something approaching State 2: Native/Invaded State (R4A). Following seeding, prescribed grazing, prescribed burning, haying, and the use of herbicides will generally be necessary to achieve the desired result and control weeds, some of which may be noxious weeds. A failed range planting and/or secondary succession will lead to State 4: Invaded State (R4B).

Woody Invasion. Historically, individual (or small patches of) shrubs and/or trees were scattered across the site. However, a marked increase in fire suppression, climate

change, increase in non-use, and other factors enabled woody species to colonize, form patches (resistant to fire), and begin to or encroach on the site. These changes have enabled these patches to expand and become more widespread. Encroachment of both native and exotic woody species (e.g., Rocky Mountain juniper, Russian olive, Siberian elm, western snowberry, silverberry, ponderosa. pine, eastern red cedar, etc.) are examples of woody vegetation increasing in extent and impinging on the ecological integrity of the grassland biome. Windbreaks and other tree plantings can contain problematic and invasive species (such as eastern redcedar, Rocky Mountain juniper, ponderosa pine, Russian olive, etc.) which can contaminate surrounding grasslands. This results in increased long-term costs to maintain or restore this ecological site in native grasses and forbs.

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

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

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

State and transition model

Figure 8. Regardless of specific ecological sites, eastern red cedar and Russian olive invasion on native rangeland in a formerly treeless grassland biome. Eastern red cedar and Russian olive seed source likely translocated by birds from planted shelterbelts.

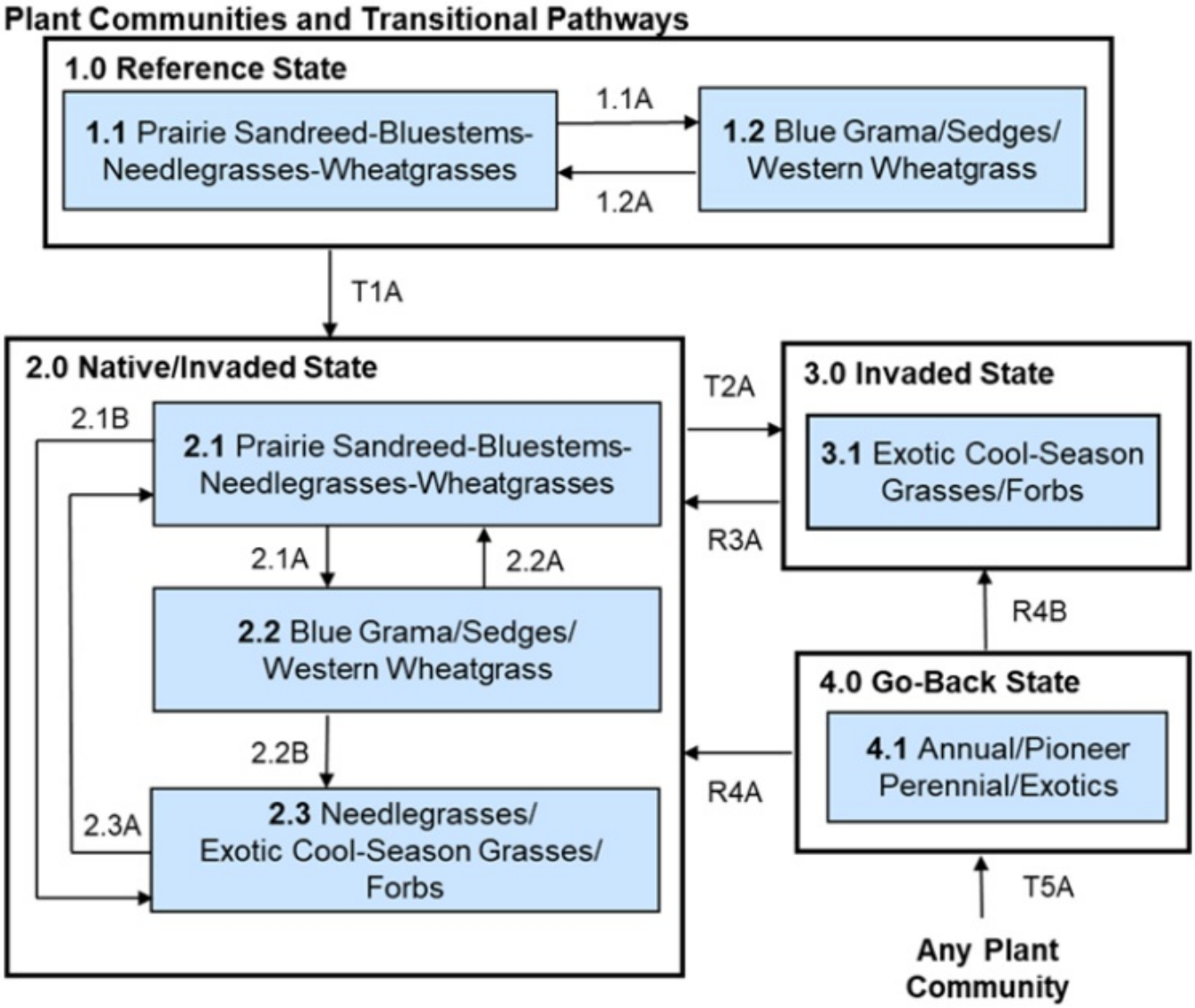

Diagram Legend-MLRA 55B Sandy Claypan	
T1A	Introduction of exotic cool-season grasses
T2A	Long-term non-use or very light grazing, no fire, heavy season-long grazing
T5A	Cessation of annual cropping
R3A	Long-term prescribed grazing and prescribed burning
R4A	Successful range planting
R4B	Failed range planting and/or secondary succession
CP 1.1 - 1.2 (1.1A)	Below average precipitation with or without heavy grazing
CP 1.2 - 1.1 (1.2A)	Return to average precipitation with light to moderate grazing
CP 2.1 - 2.2 (2.1A)	Below average precipitation with or without heavy grazing
CP 2.1 - 2.3 (2.1B)	Long-term non-use or very light grazing, no fire
CP 2.2 - 2.1 (2.2A)	Return to average precipitation and long-term prescribed grazing and prescribed burning
CP 2.2 - 2.3 (2.2B)	Long-term non-use or very light grazing, no fire
CP 2.3 - 2.1 (2.3A)	Long-term prescribed grazing and prescribed burning

State 1
Reference

This state represents the natural range of variability that dominated the dynamics of this

ecological site prior to European influence. The primary disturbance mechanisms for this site in the reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing, 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. Because of changes in disturbances and other environmental factors (particularly the widespread occurrence of exotic species), the Reference State is considered to no longer exist.

Resilience management. (i.e., management strategies that will sustain a state and prevent a transition). If intact, the reference state should probably be managed with current disturbance regimes which has permitted the site to remain in reference condition, as well as maintaining the quality and integrity of associated ecological sites. Maintenance of the reference condition is contingent upon a monitoring protocol to guide management.

Community 1.1
Prairie Sandreed-Bluestems-Needlegrasses-Wheatgrasses (Calamovilfa longifolia-Andropogon gerardii, Schizachyrium scoparium-Hesperostipa spp., Nassella viridula-Pascopyrum smithii, Elymus spp.)

This community phase was historically the most dominant both temporally and spatially. Cool-season and tall warm-season grasses dominated the plant community. The co-dominant grasses included prairie sandreed, western wheatgrass, slender wheatgrass, big bluestem, porcupinegrass, and needle and thread. Other grasses and grass-like species included blue grama, green needlegrass, little bluestem, prairie Junegrass, and sedges. Significant forbs included stiff sunflower, longbract spiderwort, hairy false goldaster, western marbleseed, dotted blazing star, and blacksamson echinacea. The dominant shrubs were leadplant, western snowberry, and prairie sagewort. Annual production likely varied from about 1800-3000 pounds per acre with grasses and grass-likes, forbs, and shrubs contributing about 85%, 10% and 5%, respectively. Both warm-season grasses and cool-season grasses are well represented in the community. As a result, production is distributed throughout the growing season. This community represents the plant community phase upon which interpretations are primarily based and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1877	2408	2909
Forb	118	202	308
Shrub/Vine	22	81	146
Total	**2017**	**2691**	**3363**

Figure 10. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	6	21	40	20	6	4	1	0	0

Community 1.2
Blue Grama/ Sedges/ Western Wheatgrass (Bouteloua gracilis/ Carex spp./ Pascopyrum smithii)

This community phase formed during periods of below average precipitation with or without drought. Dominant grass and grass-like species included blue grama, sedge, western wheatgrass, and needle and thread. Grasses of secondary importance included prairie sandreed, porcupinegrass, big bluestem, sand dropseed, and threeawn. White sagebrush, white heath aster, and common yarrow were common forbs. Annual production would have been reduced compared to that of Community Phase 1.1.

Pathway 1.1A
Community 1.1 to 1.2

Community Phase Pathway 1.1 to 1.2 occurred with below average precipitation with or without heavy grazing which led to marked increases in blue grama and sedges with corresponding decreases in prairie sandreed, bluestems, and needlegrasses.

Pathway 1.2A
Community 1.2 to 1.1

Community Phase Pathway 1.2 to 1.1 occurred with the return to average precipitation with light to moderate grazing. This would have led to increases in prairie sandreed, bluestems, and needlegrasses along with corresponding decreases in blue grama and sedges.

State 2
Native/Invaded

This state is similar to State 1: Reference State but has now been colonized by the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass, crested wheatgrass) which are now present in small amounts. Although the state is still dominated by native grasses, an increase in these exotic cool-season grasses can be expected. These exotic cool-season grasses can be quite invasive on the site and are particularly well adapted to heavy grazing. They also often form monotypic stands. As these exotic cool-season grasses increase, both forage quantity and quality become increasingly restricted to late spring and early summer due to the monotypic nature of the stand, even though annual production may increase. Native forbs generally decrease in production, abundance, diversity, and richness compared to that of State 1: Reference State. These exotic cool-season grasses have been particularly and consistently invasive under extended periods of 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, as the exotic cool-season grasses increase, peak production will shift to earlier in the growing season.

Characteristics and indicators. 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. 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 2.1
Prairie Sandreed-Bluestems-Needlegrasses-Wheatgrasses (Calamovilfa longifolia-Andropogon gerardii, Schizachyrium scoparium-Hesperostipa spp., Nassella viridula-Pascopyrum smithii, Elymus spp.)

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, crested wheatgrass, quackgrass). However, these exotics are present in smaller amounts with the community still dominated by native grasses. Annual production may be comparable to that of Community Phase 1.1 (1800-3000 pounds per acre). However, as the exotic cool-season grasses increase, peak production will shift to earlier in the growing season.

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

This community phase is similar to Community Phase 1.2 but has now been colonized by exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, crested wheatgrass, 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. If present, Kentucky bluegrass may increase under heavy grazing. Increasing amounts of exotic cool-season grasses (particularly Kentucky bluegrass) can make this an “at risk” community, even though its presence may not be obvious. If management does not include measures to control or reduce Kentucky bluegrass, the transition to State 3: Invaded State should be expected.

Community 2.3
Needlegrasses/ Exotic Cool-Season Grasses/ Forbs (Hesperostipa spp., Nassella viridula-Exotic Cool-Season Grasses/ Forbs)

This community phase forms with long-term non-use or very light grazing, and no fire. As a result, the exotic cool-season grasses increase markedly. The needlegrasses remain a conspicuous component of the community while many of the other native grasses, particularly warm-season species, decrease markedly. 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.

Pathway 2.1A
Community 2.1 to 2.2

Community Phase Pathway 2.1 to 2.2 occurs with below average precipitation with or without heavy grazing, leading to marked increases in blue grama and sedges with corresponding decreases in prairie sandreed, bluestems, and needlegrasses.

Pathway 2.1B
Community 2.1 to 2.3

Community Phase Pathway 2.1 to 2.3 occurs with long-term non-use or very light grazing, and no fire. This leads to marked increases in the exotic cool-season grasses and corresponding decreases in prairie sandreed, bluestems, and needlegrasses.

Pathway 2.2A
Community 2.2 to 2.1

Community Phase Pathway 2.2 to 2.1 occurs with the return to average precipitation and implementation of long-term prescribed grazing and prescribed burning. This leads to marked increases in prairie sandreed, bluestems, and needlegrasses along with corresponding decreases in blue grama and sedges.

Pathway 2.2B
Community 2.2 to 2.3

Community Phase Pathway 2.2 to 2.3 occurs with long-term non-use or very light grazing, and no fire. This leads to marked increases in the exotic cool-season grasses and forbs along with corresponding decreases in blue grama, sedges, and western wheatgrass.

Pathway 2.3A
Community 2.3 to 2.1

Community Phase Pathway 2.3 to 2.1 occurs with the long-term implementation of prescribed grazing and prescribed burning. This leads to marked decreases in the exotic cool-season grasses along with corresponding increases in the native grass, particularly the warm-season species (i.e., prairie sandreed and bluestems).

State 3
Invaded

This state is the result of invasion and dominance by the exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass, crested wheatgrass). Other exotic plants (e.g., leafy spurge) may also invade the site. These exotic cool-season grasses can be quite invasive on the site and are particularly well adapted to heavy grazing. They also

often form monotypic stands. As these exotic cool-season grasses increase, both forage quantity and quality become increasingly restricted to late spring and early summer due to the monotypic nature of the stand, even though annual production may increase. Native forbs generally decrease in production, abundance, diversity, and richness compared to that of State 1: Reference State. Common forbs often include white heath aster, goldenrod, common yarrow, and white sagebrush. Shrubs, such as western snowberry and rose, may show marked increases. Once the state is well established, prescribed burning and grazing techniques have been largely ineffective in suppressing or eliminating these species, even though some short-term reductions may appear successful. Annual production of this state may vary widely, in part due to variations in the extent of invasion by exotic cool-season grasses. However, as the exotic cool-season grasses increase, peak production will shift to earlier in the growing season.

Characteristics and indicators. 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. 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 3.1
Exotic Cool-Season Grasses/Forbs

This community phase is dominated by exotic cool-season grasses (e.g., Kentucky bluegrass, smooth brome, quackgrass, crested wheatgrass), often with a much-reduced forb and shrub component. Excessive accumulation of mulch may also be present, particularly when dominated by Kentucky bluegrass. Other exotic plants (e.g., leafy spurge) may also invade the site. Common forbs often include white heath aster, goldenrod, common yarrow, and white sagebrush. Shrubs, such as western snowberry and rose, may show marked increases. 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

This state is highly variable depending on the level and duration of disturbance related to the T5A transitional pathway. In this MLRA, the most probable origin of this state is plant succession following cropland abandonment. This plant community will initially include a variety of annual forbs and grasses, some of which may be noxious weeds and need control. Over time, the exotic cool-season grasses (Kentucky bluegrass, smooth brome,

quackgrass, and/or crested wheatgrass) will likely predominate.

Characteristics and indicators. 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 affects root growth. Removal of perennial grasses and forbs results in decreased infiltration and increased runoff.

Resilience management. Continued tillage will maintain the state. Control of noxious weeds will be required.

Community 4.1
Annual/Pioneer Perennial/Exotics

This community phase is highly variable depending on the level and duration of disturbance related to the T5A transitional pathway. In this MLRA, the most probable origin of this phase is secondary succession following cropland abandonment. This plant community will initially include a variety of annual forbs and grasses, including noxious weeds (e.g., leavy spurge) which may need control. Over time, the exotic cool-season grasses (Kentucky bluegrass, smooth brome, and/or quackgrass crested wheatgrass) will likely predominate.

State 5
Any Plant Community

Transition T1A
State 1 to 2

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

Constraints to recovery. Current knowledge and technology will not facilitate a successful restoration to Reference State.

Transition T2A
State 2 to 3

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. It may also occur with other management (e.g. heavy season-long grazing). Exotic cool-season grasses (e.g.,

Kentucky bluegrass, smooth brome, quackgrass, crested wheatgrass) become the dominant graminoids. Studies indicate that a threshold may exist in this transition when both the exotic plants exceed 30% of the plant community and native grasses represent less than 40% of the plant community composition. This transition may occur under other managerial conditions, for example heavy season-long grazing (primarily Kentucky bluegrass).

Constraints to recovery. Variations in growing conditions (e.g., cool, wet spring) will influence effects of various management activities on exotic cool-season grass populations.

Restoration pathway R3A
State 3 to 2

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 following one burn. Early season prescribed burns have been successful; however, fall burning may also be an effective technique. The prescribed grazing should include adequate recovery periods following each grazing event and stocking levels which match the available resources. If properly implemented, this will shift the competitive advantage from the exotic cool-season grasses to the native cool-season grasses.

Context dependence. Grazing management should be applied in a manner that enhances/maximizes the competitive advantage of native grass and forb species over the exotic species. This may include the use of prescribed grazing to reduce excessive plant litter accumulations above that needed for rangeland health indicator #14 (see Rangeland Health Reference Worksheet). Increasing livestock densities may facilitate the reduction in plant litter provided length and timing of grazing periods are adjusted to favor native species. Grazing prescriptions designed to address exotic grass invasion and favor native species may involve earlier, short, intense grazing periods with proper deferment to improve native species health and vigor. Fall (e.g., September, October) prescribed burning followed by an intensive, early spring graze period with adequate deferment for native grass recovery may shift the competitive advantage to the native species, facilitating the restoration to State 2: Native/Invaded. Prescribed burning should be applied in a manner that enhances the competitive advantage of native grass and forb species over the exotic species. Prescribed burns should be applied at a frequency which mimics the natural disturbance regime, or more frequently as is ecologically (e.g., available fuel

load) and economically feasible. Burn prescriptions may need adjustment to: (1) account for change in fine fuel orientation (e.g., “flopped” Kentucky bluegrass); (2) fire intensity and duration by adjusting ignition pattern (e.g., backing fires vs head fires); (3) account for plant phenological stages to maximize stress on exotic species while favoring native species (both cool- and warm-season grasses).

Restoration pathway R4A
State 4 to 2

This Restoration Pathway from State 4: Go-Back State to the State 2: Native/Invaded State can be accomplished with a successful range planting. Following seeding, prescribed grazing, prescribed burning, haying, or use of herbicides will generally be necessary to achieve the desired result and control any noxious weeds. It may be possible using selected plant materials and agronomic practices to approach something very near the functioning of State 2: Native/Invaded State. Application of chemical herbicides and the use of mechanical 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. A successful range planting will include proper seedbed preparation, weed control (both prior to and after the planting), selection of adapted native species representing functional/ structural groups inherent to the State 1, and proper planting technique. Management (e.g., prescribed grazing, prescribed burning) during and after establishment must be applied in a manner that maintains the competitive advantage for the seeded native species. Adding non-native species can impact the above and below ground biota. Elevated soil nitrogen levels have been shown to benefit smooth brome and Kentucky bluegrass more than some native grasses. As a result, fertilization, exotic legumes in the mix, and other techniques that increase soil nitrogen may promote smooth brome and Kentucky bluegrass invasion. The method or methods of herbaceous weed treatment will be site specific to each situation; but generally, the goal would be to apply the pesticide, mechanical control, or biological control (either singularly or in combination) in a manner that shifts the competitive advantage from the targeted species to the native grasses and forbs. The control method(s) should be as specific to the targeted species as possible to minimize impacts to non-target species.

Restoration pathway R4B
State 4 to 3

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

Context dependence. Failed range plantings can result from many causes (both singularly and in combination) including drought, poor seedbed preparation, improper

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

Restoration pathway T5A
State 5 to 4

This transition from any plant community to State 4: Go-Back State. It is most commonly associated with the cessation of cropping without the benefit of range planting, resulting in a “go-back” situation. Soil conditions can be quite variable on the site, in part due to variations in the management/cropping history (e.g., development of a tillage induced compacted layer (plow pan), erosion, fertility, and/or herbicide/pesticide carryover). Thus, soil conditions should be assessed when considering restoration techniques.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			269–673	
	western wheatgrass	PASM	*Pascopyrum smithii*	269–538	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	54–269	–
2	**Tall Warm-season Grasses**			269–673	
	big bluestem	ANGE	*Andropogon gerardii*	135–538	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	135–538	–
3	**Needlegrass**			269–673	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	135–404	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	135–404	–
	green needlegrass	NAVI4	*Nassella viridula*	0–135	–
4	**Short Warm-season Grasses**			54–269	
	blue grama	BOGR2	*Bouteloua gracilis*	54–269	–
	threeawn	ARIST	*Aristida*	0–81	–
	saltgrass	DISP	*Distichlis spicata*	0–27	–
5	**Other Native Grasses**			135–269	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	27–135	–

	little bluestem	SCSC	*Schizachyrium scoparium*	27–135	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	27–81	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	27–54	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–27	–
6	**Grass-likes**			27–135	
	threadleaf sedge	CAFI	*Carex filifolia*	27–135	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–81	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–54	–
Forb					
7	**Forbs**			135–269	
	Forb, native	2FN	*Forb, native*	27–81	–
	common yarrow	ACMI2	*Achillea millefolium*	27–54	–
	white sagebrush	ARLUA	*Artemisia ludoviciana ssp. albula*	27–54	–
	prairie clover	DALEA	*Dalea*	27–54	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	27–54	–
	dotted blazing star	LIPU	*Liatris punctata*	27–54	–
	beardtongue	PENST	*Penstemon*	27–54	–
	scurfpea	PSORA2	*Psoralidium*	27–54	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	27–54	–
	goldenrod	SOLID	*Solidago*	27–54	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	27–54	–
	white heath aster	SYER	*Symphyotrichum ericoides*	27–54	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	27–54	–
	field sagewort	ARCA12	*Artemisia campestris*	0–54	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–54	–
	milkvetch	ASTRA	*Astragalus*	0–27	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–27	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–27	–
	hairy false goldenaster	HEVIV	*Heterotheca villosa var. villosa*	0–27	–

	goldenaster		*viridula*		
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–27	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–27	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–27	–
	spiny phlox	PHHO	*Phlox hoodii*	0–27	–
	American vetch	VIAM	*Vicia americana*	0–27	–
Shrub/Vine					
8	**Shrubs**			27–135	
	leadplant	AMCA6	*Amorpha canescens*	27–81	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	27–81	–
	prairie sagewort	ARFR4	*Artemisia frigida*	27–54	–
	prairie rose	ROAR3	*Rosa arkansana*	27–54	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–54	–

Animal community

Animal Community – Wildlife Interpretations

Landscape

The MLRA 55B landscape is characterized by mostly nearly level to gently rolling till plains with some steep slopes adjacent to streams and many poorly defined drainage channels. The continental drainage divide occurs in the east central part of the MLRA. The MLRA is located within the Prairie Pothole Region with temporary, seasonal, and semi-permanent wetlands throughout the MLRA. The MLRA includes areas of eskers, kames, and ground moraines. MLRA 55B is considered to have a continental climate with cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are common and characteristic of the MLRA. This area supports mid- to tall-grass prairie vegetation with American elm, bur oak, green ash, and willow species growing along the riparian zones of river systems found throughout the MLRA. Complex intermingled ecological sites create diverse grass/shrub land habitats interspersed with varying densities of linear, slope, depressional, and in-stream wetlands associated with headwater streams and tributaries of the James, Pipestem, Maple, Goose, Sheyenne, Wild Rice, and Elm Rivers. MLRA 55B is located within North and South Dakota and within the boundaries of the Prairie Pothole Region.

Three Hydrologic Unit Areas make up this MLRA. Approximately 6% drains into the Mouse River into MLRA 55A, with the balance split between the James and Sheyenne Rivers.

By the mid-19th century, over 76% of the MLRA had been converted from mid- to 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. Tile drainage systems have been or are being installed extensively throughout MLRA 55B for sub-surface field drainage to enhance annual crop production.

Historic Communities/Conditions within MLRA 55B:

The northern tall- and mixed-grass prairie were disturbance-driven ecosystems with fire, herbivory, and climate functions as the primary ecological drivers (either singly or often in combination). American bison roamed MLRA 55B, wintering along the Mouse River in MLRA 55A and migrating through MLRA 55B and into MLRA 56A. Many species of grassland birds, small mammals, insects, reptiles, amphibians, elk, moose, pronghorn, white-tailed deer, and large herds of American bison were historically among the inhabitants adapted to this region. Roaming herbivores, as well as several small mammals and insect species, were the primary consumers linking the grassland resources to large predators (such as the wolf, American black bear, grizzly bear) and smaller carnivores (such as the coyote, bobcat, red fox, and raptors). Extirpated species include free- ranging American bison and gray wolf (breeding). Extinct is the Rocky Mountain locust.

Present Communities/Conditions within MLRA 55B:

This area supports natural prairie vegetation characterized by western wheatgrass, green needlegrass, needle and thread, and blue grama. Little bluestem is an important species on the more sloping and shallower soils. Prairie cordgrass, northern reedgrass, big bluestem, and wheat sedge (aka slough sedge) are important species on wet soils. Western snowberry, leadplant, and prairie rose are commonly interspersed throughout the area.

Over 80% of MLRA 55B has been converted to annual crop production. These influences fragmented the landscape, reduced or eliminated ecological drivers (fire), and introduced exotic plant species including smooth brome, crested wheatgrass, Kentucky bluegrass, and leafy spurge; this 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. Annual cropping is the main factor contributing to habitat fragmentation, reducing habitat quality for area- sensitive species.

Hydrological manipulation is extensive throughout the MLRA. Extensive wetland and subsurface tile drainage have taken place. Straightened segments of ephemeral and intermittent tributary streams of the James, Wild Rice, and Sheyenne River have reduced sinuosity, created oxbows, and enabled the conversion of riparian ecological sites to annual crop production. These anthropogenic impacts have reduced flood water detention and retention on the landscape. The results have been increasing storm water runoff sediment and nutrient loading to the James and Sheyenne Rivers and their tributaries

(along with lakes and reservoirs within the MLRA). Large dams on the James, Pipestem and Sheyenne rivers, along with installation of instream structures have reduced aquatic species movement within the MLRA.

National wildlife refuges, waterfowl production areas, state wildlife management areas, and North and South Dakota Department of Trust Lands provide herbaceous and woody cover for wildlife. In addition, the United States Army Corps of Engineers and the United States Bureau of Reclamation manage three man-made reservoirs - Jamestown Reservoir, Pipestem Reservoir, and Lake Ashtabula for flood control, also providing fish habitat and adjacent uplands for wildlife cover. Lonetree Wildlife Management Area (WMA) is the largest state managed wildlife area covering 32,800 acres. Arrowwood National Wildlife Refuge is the largest refuge consisting of 16,000 acres.

Characteristic wildlife species in this area are:

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

Mammals: Northern short-tailed shrew, white-tailed jackrabbit, Franklin’s ground squirrel, thirteen- lined ground squirrel, northern pocket gopher, plains pocket gopher, western harvest mouse, deer mouse, meadow vole, meadow jumping mouse, western jumping mouse, coyote, red fox, racoon, American badger, striped skunk, white-tailed deer, elk, moose, beaver, muskrat, mink, weasel, woodchuck, and red, eastern gray and fox squirrels.

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

Presence of wildlife species is often determined by ecological site characteristics including grass and forb species, tree and shrub species, hydrology, aspect, and other associated ecological sites. The home ranges of a majority of 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 in providing ecological services for plant community development. Insects that are scavengers or aid in decomposition provide the food chain baseline sustaining the carnivorous insects feeding upon them. Many insects provide the ecological services necessary for pollination, keeping plant communities healthy and

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

Species of Concern within MLRA 55B:

The following is a list of species considered “species of conservation priority” in the North Dakota State Wildlife Action Plan (2015) and South Dakota State Wildlife Action Plan (2014); and species listed as “threatened, endangered, or petitioned” under the Endangered Species Act within MLRA 55B at the time this section was developed:

Invertebrates: Dakota skipper, Iowa skipper, monarch butterfly, northern sandy tiger beetle, Ottoe skipper, Poweshiek skipperling, regal fritillary, yellow-banded bumble bee, and western bumble bee.

Birds: America avocet, American bittern, American kestrel, American white pelican, Baird’s sparrow, bald eagle, black-billed cuckoo, black tern, bobolink, burrowing owl, canvasback, chestnut-collared longspur, Dickcissel, ferruginous hawk, Franklin’s gull, grasshopper sparrow, horned grebe, lark bunting, LeConte’s sparrow, lesser scaup, marbled godwit, Nelson’s sparrow, northern goshawk, northern harrier, northern pintail, osprey (migration), peregrine falcon (migration), piping plover (migration), red knot (migration), sharp-tailed grouse, short-eared owl, Swainson’s hawk, upland sandpiper, western meadowlark, willet, Wilson’s phalarope, whooping crane (migration), and yellow rail.

Mammals: Arctic shrew, big and little brown bats, Franklin’s ground squirrel, northern river otter, plains pocket mouse, pygmy shrew, Richardson’s ground squirrel, and silver-haired bat.

Amphibians and Reptiles: Canadian toad, plains hognose snake, smooth green snake, and snapping turtle.

Fish and Mussels: Black sandshell, blacknose shiner, Carmine shiner, creek heelsplitter, creeper, deertoe, fragile papershell, mapleleaf, northern pearl dace, northern redbelly dace, pink heelsplitter, threeridge, trout-perch, yellow sandshell, and Wabash pigtoe.

Grassland Management for Wildlife in MLRA 55B

Management activities within the community phase pathways impact wildlife but are essential for maintenance of healthy grassland ecosystems. Community phase, transitional, and restoration pathways are keys to long-term management within each State and between States. Timing, intensity, and frequency of these inputs can have dramatic positive or negative effects on local wildlife species. Ranchers and other land managers must always consider the long-term beneficial management effects of

grassland and woodland resources in comparison to typically short-term negative effects to the habitats of individual species.

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

Management of these complex ecological sites can provide a heterogeneous or a homogenous landscape. Grassland bird use reduces as the plant community transitions to a homogenous state. Managers must recognize ecological sites and the complexes in which they occur 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 the Invaded Wooded State of Loamy 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 for targeted species or species guilds. Managers also need to consider vegetative associations provided by adjacent/intermingled ecological sites for species with home ranges or life requisites that may not be provided by one ecological site.

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

To see the chart please follow the hyperlink:
https://efotg.sc.egov.usda.gov/references/public/ND/55B_Sandy_Claypan_Narrative_FINAL_Ref_FSG.pdf

Sandy Wildlife Habitat Interpretation

Sandy Claypan ecological sites have a sodic, claypan subsoil layer which occurs at a depth of 6 to 20 inches. Sandy Claypan sites support tall-warm season species but

become dominated by short- warm season grasses caused by drought or heavy grazing pressure. Sandy Claypan sites support diverse stands of tall and short warm-season grasses, along with a diverse stand of cool-season grass and numerous forb species. Associated ecological sites include Limy Subirrigated, Saline Lowland, Sands, Sandy, Subirrigated Sands, Sodic Subirrigated, and Thin Claypan. This complex of ecological sites provides habitat for many edge-sensitive grassland bird species.

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

Sandy Claypan ecological sites may be found in four plant community states (1.0 Reference State, 2.0 Native/Invaded State, 3.0 Invaded State, and 4.0 Go-back State) within a local landscape. Multiple plant community phases exist within each state. Today, these states occur primarily in response to grazing and drought. Secondary influences include anthropogenic disturbances, black- tailed prairie dogs, and fire.

Because there is no known restoration pathway from State 2.0 to State 1.0, it is important to intensively manage using tools in State 1.0 and State 2.0 community phase pathways to prevent further plant community degradation along the T1A transitional pathway to Native/Invaded State 2.0 to 3.0 Native Invaded State thresholds. Native wildlife generally benefits from a heterogeneous grassland found in States 1.0 and 2.0 that include diverse grass and forb species with varying structure and density. As plant communities degrade within State 2.0, short warm-season grasses increase while native forbs are reduced. This transition results in reduced structure and increased plant community homogeneity. When adjacent/intermingled ecological sites undergo the same transition, the result can be an expansive, homogenous landscape.

State 3.0 occurs when cool-season exotic grasses, such as crested wheatgrass, begin to dominate the site. Reduced forb diversity limits insect populations, negatively affecting grassland nesting bird foraging opportunities. Increased lesser spikemoss can limit access to bare ground by nesting. A homogenous grassland landscape does not provide quality escape or winter cover. As a result, many species are not able to meet life requisites. State 3.0 has dramatic increases of short, warm- season grasses and lesser spikemoss with a further reduction in native forbs. Successful restoration along the R3A pathway with native vegetation seeding and mechanical treatment will be expensive and dependent upon climatic and seedbed conditions.

Likewise, success along restoration pathways R3A and R4A from State 3.0 and 4.0 to State 2.0 is very difficult and is dependent upon presence of a remnant native grass population. This concept also applies to wildlife as the target species must either be present on adjacent State 1.0 or State 2.0 plant communities or on ecological sites within the species' mobility limits. Species with limited mobility, such as Dakota skippers, must exist near the plant community to utilize restored sites.

Mobile species (such as grassland nesting birds) can easily locate isolated, restored plant communities.

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

1.0 Reference State

Community Phase 1.1 Prairie Sandreed-Bluestems-Needlegrasses-Wheatgrasses: This plant community 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 fire. Predominance of grass species in this community favors grazers and mixed-feeders (animals selecting grasses as well as forbs and shrubs). The structural diversity provides habitat for a wide array of migratory and resident birds.

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

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

Birds: This plant community provides quality nesting, foraging, and escape habitats favored by mid- to tallgrass-nesting birds. Several species of grassland birds that prefer mid- to tallgrass stature will use this site. In years with reduced precipitation or drought, nesting recruitment may be compromised. This plant community provides suitable areas for sharp-tailed grouse nesting and brood-rearing habitat. Diverse prey populations provide good hunting opportunities for grassland raptors.

Mammals: The diversity of grasses and forbs provide high nutrition levels for small and large herbivores including voles, mice, rodents, jackrabbits, pronghorn, and deer. Short to moderate stature provides suitable food, thermal, protective, and escape cover for small herbivores.

Amphibians/Reptiles: The Sandy Claypan ecological site and associated plant communities provide habitat for smooth green snakes, plains hog-nosed snake (prefer sandy soils), and northern prairie skink (secondary range in MLRA 55B). Habitat for the northern leopard frog and Canadian toad is dependent upon distance to water features (such as wetlands, lakes, or streams).

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

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

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

Birds: This plant community provides quality nesting, foraging, and escape habitats favored by shortgrass- nesting birds. A shift to a shorter plant structure (along Community Phase Pathway 1.1A) benefits McCown’s longspur, chestnut collared longspur, horned lark, and burrowing owl. Species that prefer a midgrass stature may be successful with normal to above-normal precipitation and a change in management along the 1.2A Community Phase Pathway. Sharp-tailed grouse may still use this plant community for leks and brood rearing; however, winter cover must be provided by adjacent ecological sites or plant communities. Limited cover and diverse prey populations provide good hunting opportunities for grassland raptors.

Mammals: Shorter statured grasses reduce thermal, escape, and protective cover for mammals.

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

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

2.0 Native/Invaded State

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

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

Invertebrates: Provides similar life requisites as Community Phase 1.1.

Birds: Provides similar life requisites as Community Phase 1.1.

Mammals: Provides similar life requisites as Community Phase 1.1.

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

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

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

Insects: Provides similar life requisites as Community Phase 1.2.

Birds: Provides similar life requisites as Community Phase 1.2

Mammals: Provides similar life requisites as Community Phase 2.2.

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

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

Community Phase 2.3 Needlegrasses/Exotic Cool-Season Grasses/Forbs: Long-term non-use or very light grazing, and no fire (along Community Pathway 2.1B or 2.2B) leads to a community phase characterized by shorter-statured grasses, including the increase of cool-season exotic grass and the reduction of prairie sandreed. This is an “at risk” plant community with high amounts of Kentucky bluegrass out-completing native grasses. Every effort should be made by managers to avoid implementing a grazing system that may favor reaching the 30 percent threshold for Kentucky bluegrass via Transitional

Pathway T2A. When this plant community transitions over to State 3.0, it has little chance of restoration back to State 2.0 by implementing a prescribed grazing system and introducing prescribed fire.

Invertebrates: An increase exotic cool-season grass and a reduction in forbs reduces pollen and nectar sources, limiting use by pollination insect species. White heath aster, goldenrod, and white sagebrush are the main pollinator species. Increased litter may begin to limit ground nesting insect opportunities.

Birds: Grassland-nesting birds that favor short-statured vegetative cover will use this site. However, long-term non-use and no fire increases exotic cool-season exotic grasses, reducing use by grassland nesting birds.

Mammals: As exotic cool-season grasses increase, thermal, protective or escape cover becomes limited.

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

Fish and Mussels: Although this ecological site is not typically adjacent to streams, rivers, or water bodies, runoff from Community Phase 2.3 increases due to management that increases short- statured grass and reduces bunch grasses. Management of this community phase, in conjunction with neighboring run-on sites, will have an indirect negative effect on aquatic species in streams and/or tributaries receiving water from Sands and adjacent sites.

3.0 Invaded State

Community Phase 3.1 Exotic Cool-Season Grasses/Forbs: Community Phase Pathway T2A generally occurs during long-term non-use or with heavy season-long grazing. This plant community phase is characterized by a dominance (more than 30 percent) to a complete dominance of exotic cool-season grasses (such as Kentucky bluegrass, crested wheatgrass, and smooth brome). Western snowberry tends to increase in density and cover. Restoration Pathway R3A requires remnant amounts of native warm-season grasses (i.e., blue grama), cool-season grasses (i.e., needlegrasses, western wheatgrass, prairie Junegrass), and forbs (i.e., silverleaf Indian breadroot, upright prairie coneflower). These remnant populations can only be expressed through frequent prescribed burns and high levels of prescribed grazing management targeting the exotic cool-season grasses. Intensified management along the R3A pathway will have significant short-term negative impacts on wildlife habitat; however, this is necessary to restore long-term native habitat functions.

Invertebrates: Non-use or low intensity (less than 20 percent utilization) grazing limits use by beneficial insects provided in States 1.0 and 2.0. Increased litter and lack of grazing leads to limited contact between plant material and mineral soil; this results in a cooler micro-climate which is unfavorable to most insects. Lack of bare soil limits ground nesting

sites for native bees and other ground-nesting insects. The lack of nectar-producing plants limits forage opportunities for bumblebees, regal fritillary, monarch butterfly, and other pollinating species.

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

Mammals: Litter accumulation favors thermal, protective, and escape cover for small rodents. Large mammal thermal, protective, and escape cover becomes limited.

4.0 Go-Back State

Community Phase 4.1 Annual/Pioneer Perennial/Exotics: These plant communities are the result of severe soil disturbance (such as cropping, recreational activity, or concentrated livestock activity for a prolonged period). Following cessation of disturbances, the resulting plant community is dominated by early pioneer annual and perennial plant species. Plant species composition and production are highly variable. Weedy plants can provide pollinator habitat along with spring and summer cover for many mammals and birds, and their young. Dense weed cover can keep soils moist, increasing insect presence. Tall stature provided by some weeds, such as marsh elder and ragweed, offer thermal cover and seeds throughout winter.

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

Animal Community – Grazing Interpretations

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

grazing management. More accurate stocking rate estimates should eventually be calculated using actual stocking rate information and monitoring data.

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

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

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

Utilization Level % Use Description
Slight (Light) 0-20 Appears practically undisturbed when viewed obliquely. Only choice areas and forage utilized.

Moderate 20-40 Almost all of accessible range shows grazing. Little or no use of poor forage. Little evidence of trailing to grazing.

Full 40-60 All fully accessible 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.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group C. Infiltration varies from moderate to moderately rapid; runoff potential for this site varies from medium to high depending on surface texture, slope percent, and ground cover. The dense, claypan layer slows water movement through the soil profile. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama, Kentucky bluegrass, and/or smooth brome will result in reduced infiltration and increased runoff. 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: National wildlife refuges, waterfowl production areas, state wildlife management areas (WMA), and North Dakota and South Dakota Department of Trust Lands provide herbaceous and woody cover for wildlife. National Wildlife Refuges and waterfowl production areas are owned and managed by the United States Fish and Wildlife Service and are available for public hunting, hiking, and bird watching. In addition, the United States Army Corps of Engineers and the United States Bureau of Reclamation manage three man-made reservoirs - Jamestown Reservoir (2,036 acres), Pipestem Reservoir (1,027 acres), and Lake Ashtabula (5,174 acres) for flood control, also providing fish habitat and adjacent uplands for wildlife cover. Lonetree WMA is the largest state managed wildlife area covering 32,800 acres. Numerous WMAs in North Dakota and Game Production Areas in South Dakota are found within this MLRA. The largest refuges managed by the United States Fish and Wildlife service are Arrowwood National Wildlife Refuge (NWR) Complex consists of 75,000 acres and Tewaukon National NWR covers 8,363 acres.

Fishing: Approximately 100 lakes are managed for public fishing within MLRA 55B. Most of these lakes offer boat docks and ramps. These lakes contain various sport fish including walleye, northern pike, yellow perch, catfish, trout, crappie, and bluegill. Many of these lakes are known for excellent round-around walleye and yellow perch fishery.

Camping: Fort Ramson State Park, Pipestem Reservoir, Jamestown Reservoir, Spiritwood Lake, Clausen Springs, Little Yellowstone, Richmond Lake State Recreation Area, Mina Lake State Recreation Area, and other public and private campgrounds are found within the MLRA. Limited, primitive camping is available on wildlife management areas. Ft. Ransom State Park (North Dakota), located along the Sheyenne River has a designated horse park with 15 miles of trails.

Hiking/Biking/Horseback Riding: Horseback riders, hikers, and biker can enjoy over 15 miles of multi-use trails at Fort Ransom State Park. The Jamestown Reservoir (5 miles),

Pipestem Reservoir (8 miles) and Arrowwood National Wildlife Refuge (9.4 miles) maintain hiking trails. The Lonetree Wildlife Management Area has a 32- mile segment of the North Country Trail. It is designed for hiking and non-motorized travel including mountain bikes or horseback riding.

Canoeing/Kayaking: The Sheyenne River offers 278 miles of canoeing/kayaking from May-July. A kayak kiosk is located at Valley City and canoe/kayak rentals are available at Fort Ransom State Park. The James River has a canoe trail starting in Grand Rapids and canoeing down to the James River Dam site in LaMoure; no rentals are available.

Auto Tour: A 63-mile scenic drive starts north of Valley City and heading south through Sheyenne River Valley. Audubon National Wildlife Refuge offers a 5.5-mile auto-tour route winding through both prairie grassland and wetland habitats of the lower portion of the James River Valley.

Wood products

There are no significant wood products found on this site.

Other products

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

Other information

Site Development and Testing Plan
• Further evaluation is needed on the drainage class/seasonal high water table. The Letcher OSD allows somewhat poorly drained phases. Current soils correlations are almost entirely moderately well drained phases. Letcher minor components commonly occur in map units with predominantly poorly drained soils (e,g, Stirum). On-site investigation is needed to determine if plant communities on the somewhat poorly drained phase of Letcher better fits Sandy Claypan, Saline Subirrigated, or Saline Lowland ESD.
• Further evaluation and refinement of the State-and-Transition model may be needed to identify disturbance driven dynamics. Additional states and/or phases may be required to address grazing response.
• Further documentation may be needed for plant communities in all states. Plant data has been collected in previous range-site investigations, including clipping data; however, this data needs review. If geo-referenced sites meeting Tier 3 standards for either vegetative or soil data are not available, representative sites will be selected for further investigation.
• Site concepts will be refined as the above noted investigations are completed.
• The long-term goal is to complete an approved, correlated Ecological Site Description as defined by the National Ecological Site Handbook.

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.

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.

Other references

Bakker, K.K. 2003. The effect of woody vegetation on grassland nesting birds: an annotated bibliography. The Proceedings of the South Dakota Academy of Science 82:119-141.

Barker, W.T. and W. C. Whitman. 1988. Vegetation of the Northern Great Plains. Rangelands 10(6): 266-272. Bluemle. J.P. 2016. North Dakota's geologic legacy. North Dakota State University Press. 382 pages.

Briske, D.D. (editor). 2017. Rangeland systems – processes, management, and challenges. Springer Series on Environmental Management. 661 pages.

Burgess, R.L. 1965. A study of plant succession in the sandhills of southeastern North Dakota. Proceedings ND Academy of Science 19:62-80

DeKeyser, E.S., G. Clambey, K. Krabbenhoft, and J. Ostendorf. 2009. Are changes in species composition on central North Dakota rangelands due to non-use management? Rangelands 31:16-19

Dix, R.L. and F.E. Smeins. 1967. The prairie, meadow, and marsh vegetation of Nelson County, North Dakota. Canadian Journal of Botany 45:21-57.

Dornbusch, M.J., R.F. Limb, and C.K. Gasch. 2018. Facilitation of an exotic grass through nitrogen enrichment by an exotic legume. Rangeland Ecology & Management 71:691-694.

Dyke, S.R., S.K. Johnson, and P.T. Isakson. 2015. North Dakota state wildlife action plan. North Dakota Game and Fish Department, Bismarck, ND. 468 pages.

Ehrenfeld, Joan G. 2002. Effects of exotic plant invasions on soil nutrient cycling processes. Ecosystems 6:503-523.

Endangered and threatened wildlife and plants; designation of critical habitat for the Dakota skipper and Poweshiek skipperling; Vol. 79 No. Final Rule October 1, 2015, 50 CFR Part 17.

Ereth, C., J. Hendrickson, D. Kirby, E. DeKeyser, K. Sedevic, and M. West. Controlling Kentucky bluegrass with herbicide and burning is influenced by invasion level. Invasive Plant Science and Management 10: 80-89.

Ewing, J. 1924. Plant succession on the brush prairie in northwestern Minnesota. Journal of Ecology 12:228- 266.

Gilgert, W.; and S. Zack. 2010. Integrating multiple ecosystem services introduction ecological site descriptions. Rangelands: 32:49-54.

Grant, T.A. and R.K. Murphy. 2005. Changes on woodland cover on prairie refuges in North Dakota, USA. Natural Areas Journal 25:359-368.

Heitschmidt, R. K., K. D. Klement, and M. R. Haferkamp. 2005. Interactive effects of drought and grazing on Northern Great Plains rangelands. Rangeland Ecology and Management 58:11-19.

Hendrickson, J.R., P. S. Johnson, M. A. Liebig, K. K. Sedivec, and G. A. Halvorson. 2016. Use of ecological sites in managing wildlife and livestock: an example with prairie dogs. Rangelands

Hendrickson, J.R., S.L. Kronberg, and E.J. Scholljegerdes. 2020. Can targeted grazing reduce abundance of invasive perennial grass (Kentucky bluegrass) on native mixed-grass prairie? Rangeland Ecology and Management, 73:547-551.

Higgins, K.F. 1984. Lightning fires in grasslands in North Dakota and in pine-savanna lands in nearby South Dakota and Montana. J. Range Manage. 37:100-103.

Higgins, K.F. 1986. Interpretation and compendium of historical fire accounts in the Northern Great Plains. United States Department of Interior, Fish and Wildlife Service. Resource Publication 161. 39 pages.

Higgins, K.F., A.D. Kruse, and J.L. Piehl. 1989. Effects of fire in the Northern Great Plains. U.S. Fish and Wildlife Service and Cooperative Extension Service South, Dakota State University. Extension Circular 761. 48 pages.

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://hprcc.unl.edu)

Johnson, Sandra. 2015. Reptiles and amphibians of North Dakota. North Dakota Game and Fish Department. 64 pages.

Jordan, N. R., D.L. Larson, and S.C. Huerd. 2008. Soil modification by invasive plants: effects on native and invasive species of mixed-grass prairies. Biological Invasions 10:177-190.

Mader, E., M. Shepherd, M. Vaughan, and S.H. Black. 2011. Attracting native pollinators: protecting North America's bees and butterflies. Accessed at https://xerces.org, May 1, 2017.

North Dakota Division of Tourism, Accessed on February 25, 2019. Available at https://www.ndtourism.com/sports-recreation

North Dakota Parks and Recreation Department, Accessed on February 25, 2019. Available at http://www.parkrec.nd.gov/recreationareas/recreationareas.html

Palit, R., G. and E.S. DeKeyser. 2022. Impacts and drivers of smooth brome (Bromus inermis Leyes.) invasion in native ecosystems. Plants: 10,3390. http://https://www.mdpi.com/2223-7747/11/10/1340

Palit, R., G. Gramig, and E.S. DeKeyser. 2021. Kentucky bluegrass invasion in the Northern Great Plains and prospective management approaches to mitigate its spread. Plants: 10,817. https://doi.org/10.3390/plants10040817

Printz, J.L. and J.R. Hendrickson. 2015. Impacts of Kentucky bluegrass Invasion (Poa pratensis) on ecological processes in the Northern Great Plains. Rangelands 37(6):226-232.

Redmann, Robert E. 1975. Production ecology of grassland plant communities in western North Dakota. Ecological Monographs 45:83-106.

Reeves, J.L., J.D. Derner, M.A. Sanderson, J.R. Hendrickson, S.L. Kronberg, M.K. Petersen, and L.T. Vermeire. 2014. Seasonal weather influences on yearling beef steer production in C3-dominated Northern Great Plains rangeland. Agriculture, Ecosystems and Environment 183:110-117.

Royer, R. A., 2003. Butterflies of North Dakota: an atlas and guide. Minot State University, Minot, ND.

Seabloom, R. 2020. Mammals of North Dakota. North Dakota Institute for Regional Studies, Fargo, ND. 470 pages.

Sedivec, K.D., J.L. Printz. 2014. Ranchers guide to grassland management IV. NDSU Extension Service publication R1707.

Severson, K. E. and C. Hull Sieg. 2006. The nature of eastern North Dakota: Pre-1880 Historical Ecology. North Dakota Institute for Regional Studies.

South Dakota Dept. of Game, Fish and Parks. 2014. South Dakota wildlife action plan. Wildlife Division Report 2014-03.

Spaeth, K.E., Hayek, M.A., Toledo, D., and Hendrickson, J. 2019. Cool season grass impacts on native mixedgrass prairie species in the Norther Great Plains. America's Grassland Conference: Working Across Boundaries. The Fifth Biennial Conference on the Conservation of America's Grasslands. Bismarck, ND. 20- 22 August.

Tidwell, D., D.T. Fogarty, and J.R. Weir. 2021. Woody encroachment in grasslands, a guide for understanding risk and vulnerability. Oklahoma State University, Oklahoma Cooperative Extension Service publication E- 1054. 32 pages.

Toledo, D., M. Sanderson, K. Spaeth, J. Hendrickson, and J. Printz. 2014. Extent of Kentucky bluegrass and its effect on native plant species diversity and ecosystem services in the Northern Great Plains of the United State. Invasive Plant Science and Management 7(4): 543-552.

USDA, NRCS. 2021. National Range and Pasture Handbook, (https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/landuse/rangepasture/?cid=stelprdb1043084)

USDA, NRCS. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

USDA, NRCS. National Soil Information System, 100 Centennial Mall North, Room 152, Lincoln, NE 68508- 3866. (https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/tools/?cid=nrcs142p2_053552)

USDA, NRCS. National Water & Climate Center, 1201 NE Lloyd Blvd, Suite 802, Portland, OR 97232-1274. (https://www.wcc.nrcs.usda.gov/)

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

USDA, NRCS, Various Published Soil Surveys.

USDI BLM.1999. Utilization studies and residual measurements. Interagency Technical Reference 1734-3.

Vinton, M.A. and E.M. Goergen. 2006. Plant-soil feedbacks contribute to the persistence of Bromus inermis in tallgrass prairie. Ecosystems 9: 967-976.

Whitman, W.H., H. Hanson, and R. Peterson. 1943. Relation of drought and grazing to North Dakota range lands. North Dakota Agricultural Experimentation Bulletin 340.

Contributors

Jeff Printz, NRCS State Range Management Specialist, Retired
Stan Boltz, NRCS Range Health Specialist
Jody Forman, NRCS Range Management Specialist
David Dewald, NRCS State Biologist, Retired
Mark Hayek, State Range Management Specialist, Retired
Kevin Sedivec, Extension Range Managements Specialist
Shawn Dekeyser, North Dakota State University
Rob Self, The Nature Conservancy
Lee Voight, NRCS Range Management Specialist

Approval

Suzanne Mayne-Kinney, 4/25/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	USDA-NRCS North Dakota
Contact for lead author	NRCS State Rangeland Management Specialist
Date	04/25/2025
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are not expected on this site.

---

2. **Presence of water flow patterns:** Water flow patterns are not visible.

---

3. **Number and height of erosional pedestals or terracettes:** Neither pedestals nor terracettes are expected.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 5 to 20%. 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. **Number of gullies and erosion associated with gullies:** Active gullies are not expected on this site.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** No wind-scoured or depositional areas expected on this site.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Plant litter movement not expected on this site.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class averages 5 or greater.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth, color, and structure of A-horizon.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Mid- and short-statured bunchgrasses and tall-statured rhizomatous grasses are dominant and well distributed across the site. Mid- and short-statured rhizomatous grasses and forbs are subdominant.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile**

features which may be mistaken for compaction on this site): No compaction layers occur on this site except for the naturally occurring pan 6 to 16 inches below the surface.

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Phase 1.1: Mid & short C3 bunch grasses (4); Tall C4 rhizomatous grasses (2)

    Sub-dominant: Phase 1.1: Mid & short C4 bunch grasses (3); Mid & short C3 rhizomatous grasses (1); Forbs (12)

    Other: Phase 1.1: Grass-likes; Shrub; Mid & short C4 rhizomatous grasses

    Additional: 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.

    To see a full version 5 rangeland health worksheet with functional/structural group tables. Please use the following hyperlink:

    https://efotg.sc.egov.usda.gov/references/public/ND/55B_Sandy_Claypan_Narrative_F

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Rare to not occurring on this site.

---

14. **Average percent litter cover (%) and depth (in):** Plant litter cover is 50 to 70% with a depth of 0.25 to 0.5 inches. Litter is in contact with the soil surface.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production: Annual air-dry production is 2400 lbs./ac (reference value) with normal precipitation and temperatures. Low and high production years should yield 1800 lbs./ac to 3000 lbs./ac, respectively.

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** State and local noxious species, Kentucky bluegrass, smooth bromegrass, crested wheatgrass, and Eastern red cedar/juniper.

---

17. **Perennial plant reproductive capability:** Noninvasive species in all functional/structural groups are vigorous and capable of reproducing annually under normal weather conditions.
