USDA Natural Resources Conservation Service

Ecological site R055BY064ND
Loamy

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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 Delta; 46e – Tewaukon Dead ice Moraine; 46f – End Moraine Complex; 46i – Drift Plains; and 46j – Glacial Outwash .

Ecological site concept

The Loamy ecological site typically is located on glaciated uplands – rises on ground moraines and lake plains; on back slopes on moraines; and on side slopes of escarpments. Some areas of moraines are covered with silty loess – particularly on the east side of Glacial Lake Dakota. The site also occurs on flats on outwash plains and on terraces which are no longer impacted by frequent flooding. Generally, the soils are very deep; however, some have layers of sand and gravel or weathered shale in the substratum (>20 inches deep). The dark-colored surface soil is more than 7 inches thick. Surface textures typically are loam or silt loam; but clay loam, silty clay loam, and fine sandy loam also occur. The subsoil is loam, clay loam, silt loam, or silty clay loam (forms a ribbon 1 to 2 inches long). Soil on this site is moderately well drained or well drained. Generally, the depth to effervescence exceeds 12 inches; however, very slight effervescence is allowable where the depth to a layer of accumulated carbonate (strong or violent effervescence) is >20 inches. Soil salinity, typically, is none to very slight in the upper 20 inches, but below that depth may increase to moderate in some soils. Slopes range from 0 to 30 percent. On the landscape, this site is below the Thin Loamy and Shallow Loamy ecological sites and above the Loamy Overflow, Limy Subirrigated, Wet Meadow, and Subirrigated sites. The Clayey ecological site occurs on similar landscape positions; the subsoil forms a ribbon >2 inches long. The transition between Loamy and Thin Loamy sites is determined by depth to accumulated carbonates. Soils with strong or violent effervescence within a depth of 8 inches are included in Thin Loamy - even where a thin, non-calcareous subsoil layer occurs above the calcic layer. This soil profile occurs most commonly where there has been cultivation at some time, but it also occurs in some soils in native grass.

Associated sites

R055BY059ND	**Loamy Overflow** This site occurs on lower, concave slopes on till plains and lake plains – a run-on position; it also occurs on frequently flooded floodplain steps and low terraces. The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055BY056ND	**Clayey** This site typically occurs somewhat lower on the landscape. The subsoil layer forms a ribbon >2 inches long.
R055BY073ND	**Shallow Loamy** This site occurs on escarpments higher on the landscape. It has soft sedimentary shale bedrock within a depth of 20 inches. The soil above the shale forms a ribbon 1 to 2 inches long.

R055BY065ND	**Subirrigated** This site occurs on flats and in shallow depressions which have occasional, brief ponding early in the growing season. It has redoximorphic features at a depth of 18 to 30 inches. If present, a highly calcareous subsoil is >16 inches deep. All textures are included in this site.
R055BY058ND	**Limy Subirrigated** This site occurs lower on the landscape. It is highly calcareous in the upper part of the subsoil and has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.
R055BY068ND	**Thin Loamy** This site occurs on higher, convex slopes on till plains and lake plains. It is highly calcareous (strong or violent effervescence) within a depth of 8 inches . The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055BY071ND	**Wet Meadow** This site occurs in depressions and flats on uplands; it also occurs on floodplains. It is poorly drained - a seasonal high water table is typically within a depth of 1.5 feet during the months of April through June; in depressions, it is frequently ponded (typically <1.5) in April and May. It typically has redoximorphic features within a depth of 18 inches. Some soils are highly calcareous. E.C. is <8 in the surface and subsoil layers. All textures are included in this site.

Similar sites

R055BY059ND	**Loamy Overflow** This site occurs on lower, concave slopes on till plains and lake plains – a run-on position; it also occurs on frequently flooded floodplain steps and low terraces. The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055BY056ND	**Clayey** This site typically occurs somewhat lower on the landscape. The subsoil layer forms a ribbon >2 inches long.
R055BY062ND	**Sandy** This site occurs on till plains and lake plains that are mantled with fine sandy loam or sandy loam eolian deposits. The surface and subsoil layers from a ribbon <1 inch long.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site typically occurs on glaciated uplands. Most commonly, it is on rises on ground moraines and lake plains; on back slopes on moraines; and on side slopes of escarpments. It also occurs on flats on outwash plains. On ground moraines and moraines, the parent material is either fine-loamy or coarse-loamy till or fine-silty loess over till. On lake plains, the parent material is fine-silty, coarse-silty, fine-loamy or coarse-loamy glaciolacustrine sediments. On escarpments, the parent material is till or colluvium (at least 20 inches thick) over weathered shale. On outwash plains, the parent material is fine-loamy glaciofluvial deposits (at least 20 inches thick) over coarser glaciofluvial deposits. Included in this site are terraces which are no longer impacted by frequent flooding. Slopes range from 0 to 35 percent.

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Terrace (3) Lake plain (4) Escarpment (5) Outwash plain
Runoff class	Low to high

Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	980–2,135 ft
Slope	0–35%
Water table depth	36–80 in
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. 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 16 to 21 inches per year. The normal average annual temperature is about 41.5° F. January is the coldest month with average temperatures ranging from about 2° F (Maddock, ND) to about 11° F (Mellette, SD). July is the warmest month with temperatures averaging from about 67° F (Maddock, ND) to about 73° F (Redfield 2 NE, 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 occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of native cool-season plants begins in late March and continues to early to mid July. Native warm-season plants begin growth in mid May and continue to the end of August. Green 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)	111-116 days
Freeze-free period (characteristic range)	128-134 days
Precipitation total (characteristic range)	19-22 in
Frost-free period (actual range)	105-119 days
Freeze-free period (actual range)	124-135 days
Precipitation total (actual range)	18-23 in
Frost-free period (average)	113 days
Freeze-free period (average)	131 days
Precipitation total (average)	21 in

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) REDFIELD [USC00397052], Redfield, SD
- (8) PETERSBURG 2 N [USC00327027], Petersburg, ND

Influencing water features

This site does not receive additional water as runoff from adjacent slopes (it is commonly in a run-off landscape position). Neither does it receive significant additional water from a seasonal high water table. Depth to the water table exceeds 3 feet in the spring and ranges from 4 feet to more than 6 feet during the summer months. Surface infiltration is moderately slow or moderate. Saturated hydraulic conductivity throughout the profile typically is moderately high; however, in soils with contrasting substratum materials, it is very high where gravelly and moderately low where weathered shale beds occur. Water loss is through evapotranspiration and percolation below the root zone. Where this site occurs on terraces, flooding frequency is none to occasional.

Soil features

Soils associated with Loamy ES are in the Mollisol order. The Mollisols are classified further as Calcic Argiudolls, Pachic Argiudolls, Calcic Hapludolls, Typic Hapludolls, Pachic Hapludolls, Oxyaquic Hapludolls, Glossic Natrudolls (<35% clay), and Cumulic Hapludolls (>6% slope on uplands or on terraces). These soils were developed under prairie vegetation. The soils in this site commonly formed in till, silty loess over till, glaciolacustrine sediments, or colluvium from till or residuum. A few formed in alluvium.

The common feature of soils in this site are the medium and moderately fine textures through most of the root zone. Surface textures most commonly are loam or silt loam; but clay loam and silty clay loam are included. Also, fine sandy loam is allowable where it is <10 inches thick. Most of these soils are very deep; however, some are moderately deep (20 to 40 inches) to layers of weathered shale or sand and gravel. They are moderately well drained or well drained. Where present, redoximorphic features are deeper than 3 feet.

Soil salinity, typically, is none to very slight (E.C. <4) in the surface layer and upper subsoil; however, E.C. as high as 8 is allowable in the upper subsoil. In some soils it increases to moderate (E.C 8 - <16) in the lower subsoil and substratum. Sodicity is none to low to a depth of more than 30 inches in most soils; but in some soils, it is moderate in the subsoil. Soils with moderate salinity or sodicity within a depth 20 inches have visible gypsum accumulations in the subsoil.

Soil reaction is slightly acid to slightly alkaline (pH 6.1 to 7.8) in the surface layer and upper part of the subsoil. It commonly increases to moderately alkaline (pH 7.9 to 8.4) in the lower subsoil; this is most commonly due to a layer of calcium carbonate accumulation, but it can also be due to increased sodicity. Where carbonate accumulation is present, this layer is typically below a depth of 12 inches and the layers above do not effervesce. In the layer of accumulation, $CaCO_3$ can be >30 percent below a depth of 20 inches. In a few soils, soil reaction may be strongly alkaline (pH 8.5 to 9.0) in the lower subsoil and substratum.

Some pedestaling of plants occurs, but it is not very evident on casual observation and occurs on less than 5% of the plants. Water flow paths are typically non-existent. The soil surface is stable and intact. These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. Loss of the soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to the Loamy site are: Aastad, Barnes, Beotia, Cathay, Camtown, Darnen, Doland, Eckman, Edgeley, Emrick, Estelline, Fordville, Forman, Gardena, Great Bend, Heimdal, Kensal, Kranzburg, La Prairie (>6% slope), LaDelle (rarely flooded), Lankin, Overly, Poinsett, Putney, Rentill, Spottswood, Svea, Vang, Vida, Vienna, and Walsh.

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) Till (2) Glaciolacustrine deposits (3) Residuum

Surface texture	(1) Loam (2) Stony silt loam (3) Very stony silty clay loam (4) Bouldery clay loam (5) Extremely stony (6) Cobbly
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	20–80 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–18%
Available water capacity (0-40in)	6–12 in
Calcium carbonate equivalent (0-40in)	0–30%
Electrical conductivity (0-20in)	0–4 mmhos/cm
Sodium adsorption ratio (0-20in)	0–8
Soil reaction (1:1 water) (0-20in)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–25%

Ecological dynamics

The site developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and frequent fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a slow decline in vegetative vigor and composition will occur. Under favorable conditions, the site has the potential to resemble the reference state. Interpretations for this site are based on the Green Needlegrass/Western Wheatgrass Plant Community Phase (1.1). The Reference State has been determined by study of rangeland relict areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered. Community phases, community pathways, states, transitions, thresholds and restoration pathways have been determined through similar studies and experience.

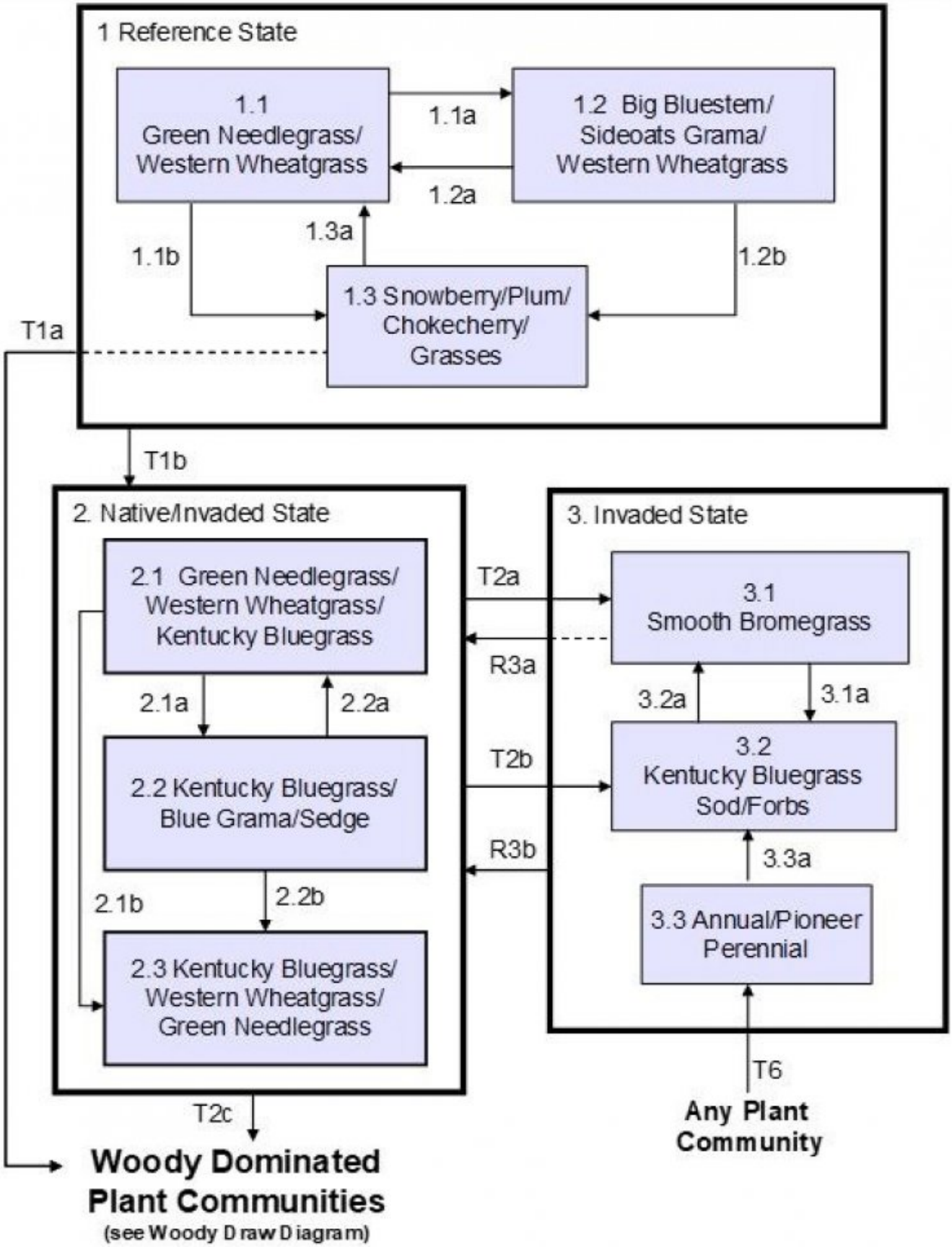
The natural disturbance regime consisted of frequent fires caused both by natural and Native American ignition sources. These fires occurred during any season of the year, but were concentrated in the spring and late summer or early fall. Lightning fires occurred most frequently in July and August while fires started by Native Americans occurred in April, September and October. Large ungulate grazing was heavy and occurred often, but usually for short durations. Grazing may have been severe when occurring after a fire event. The grazing and fire interaction, especially when coupled with drought events, set up the dynamics discussed and displayed in the following state and transition diagram and descriptions.

When this site is located within proximity to wooded floodplain sites, it may have transitioned to a woody (tree and shrub) dominated plant community. This situation primarily occurred along major river valleys where the floodplain sites served as a seed source for the woody plant material to expand onto adjoining sites, especially after settlement when historic fire regime was altered. This transition is represented on the state and transition diagram as transitional pathway T1a and T2c.

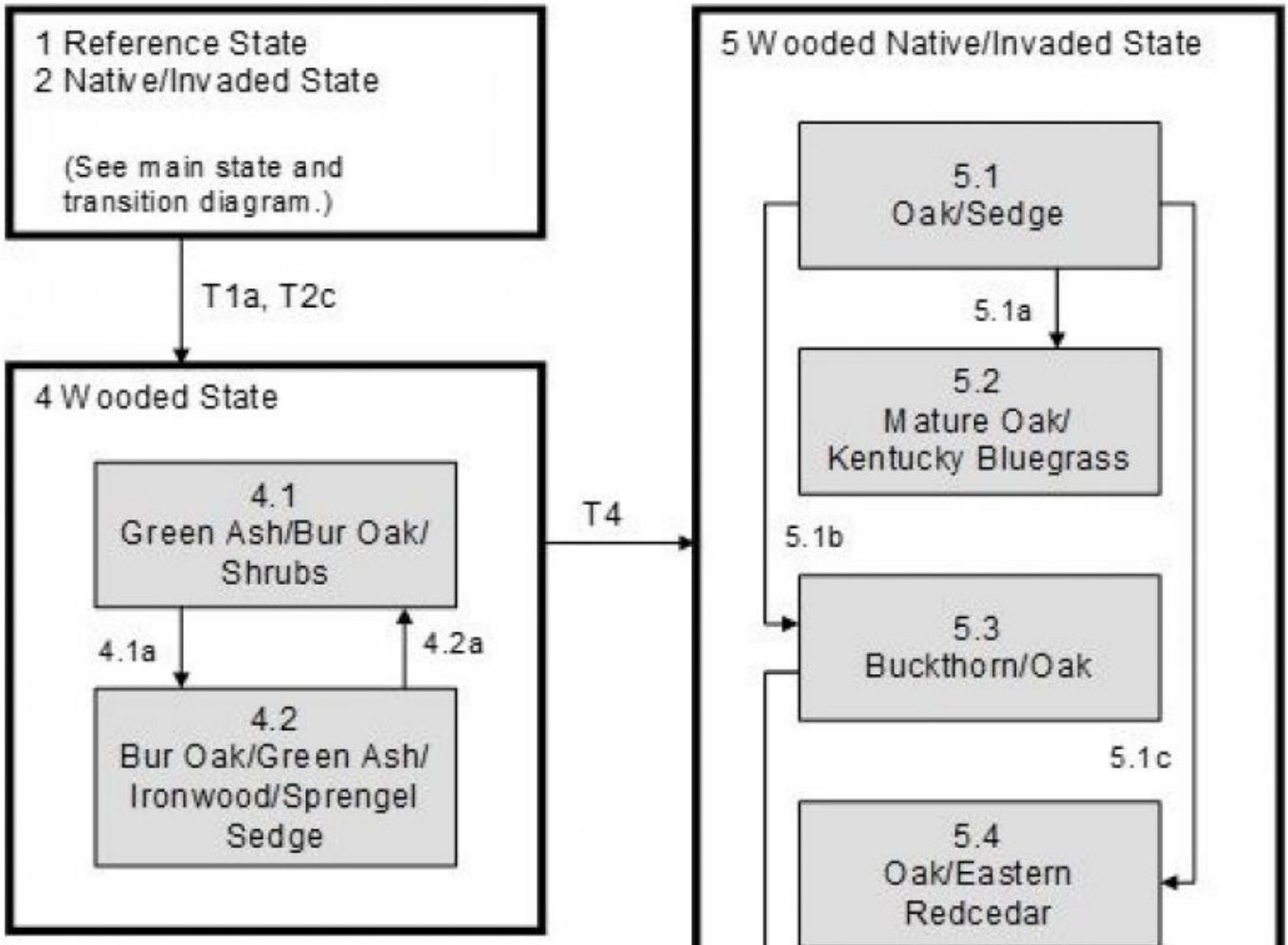
This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence, causes this site to depart from the reference plant community. Blue grama and Kentucky bluegrass, if present, will begin to increase. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass will decrease in frequency and production. In time, heavy continuous grazing will likely cause upland sedges and blue grama and/or Kentucky bluegrass, if present, to dominate and pioneer perennials and annuals to increase. The resulting plant community is relatively stable and competitive advantage prevents other species from establishing. Extended periods of non-use and/or lack of fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and/or smooth bromegrass. Shrubs such as western snowberry increase in this situation, especially in areas prone to snow accumulation and drift.

Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and/or states may be revised or removed; new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

State and transition model



1.1a – Spring fire followed by heavy grazing;**1.1b, 1.2b** – Above normal precipitation, reduced fire frequency; **1.2a, 1.3a** – Return to normal weather patterns and fire frequency; **T6** – Cropped go-back; **2.1a, T2b, 3.1a** – Heavy continuous grazing; **T2a, 2.1b, 2.2b, 3.2a** – Non-use, no fire; **R3a** – Prescribed burning followed by prescribed grazing; **2.2a** – Prescribed grazing with adequate recovery opportunity; **R3b** – Range seeding followed by prescribed grazing; **3.3a** Time with or without grazing;**T1b** - introduction of non-native species; **T1a, T2c** – Transition only occurs when site is located near loamy floodplain sites which serve a seed sources for trees and shrubs;



T1a – Removal of fire prior to introduction of non-native species; T2c – Removal of all disturbances, non-native species present; **4.1a** –Time, no disturbance; **4.2a** – Drought and fire; **T4** – Removal of fire and introduction of non-native species; **5.1a** – Continuous season-long grazing; **5.1b** – Invasion by buckthorn; **5.1c** – encroachment of Eastern red cedar; **5.3a** – Oak senescence, no oak regeneration

For simplification purposes, the pre-European transition returning from the wooded state to the reference state is not shown on the state and transition diagrams. Repeated intense disturbances (e.g., fire, fire coupled with grazing) would have reverted these smaller patches of trees to the herbaceous dominated Reference State.

State 1
Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. This state is dominated by cool season grasses. The primary disturbance mechanisms for this site in the reference condition include frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictate the dynamics that occur within the natural range of variability. Cool season species can decline and a

corresponding increase in warm season grasses will occur.

Community 1.1
Green Needlegrass/Western Wheatgrass

This community phase was the most dominant both temporally and spatially. The prevailing climate and weather patterns favored the development of this community phase dominated by cool season grasses such as, green needlegrass and western wheatgrass. There are also other needlegrasses and wheatgrasses present as well as various amounts of warm season grasses such as big bluestem, blue grama and sideoats grama. A variety of leguminous and non-leguminous perennial forbs are present but only in slight amounts. This is the reference plant community phase and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. This is a naturally nitrogen deficient plant community with a carbon to nitrogen ratio of approximately 40:1.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1440	2506	3155
Forb	135	210	300
Shrub/Vine	25	84	145
Total	**1600**	**2800**	**3600**

Figure 9. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

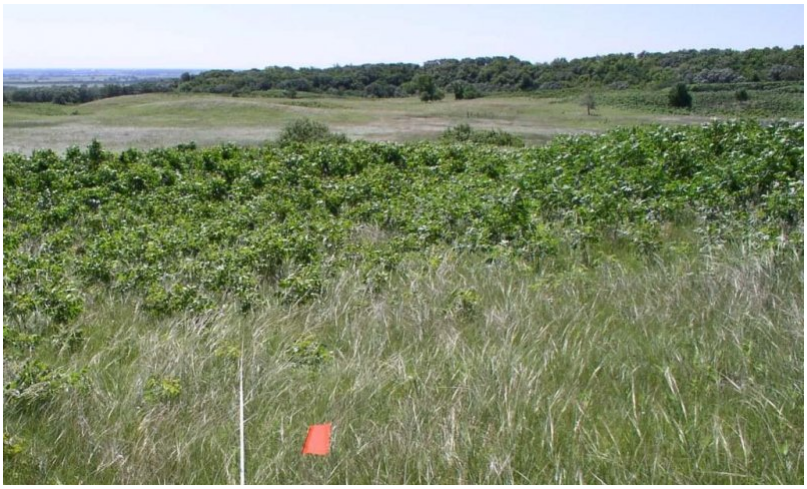
Community 1.2
Big Bluestem/Sideoats Grama/Western Wheatgrass

When natural or management actions favor a shift from cool season dominated communities to warm season grass dominated communities this is the resulting community phase. This community phase is dominated by a combination of big bluestem, sideoats grama and western wheatgrass. Blue grama and prairie dropseed are also obvious on the site. Deep rooted summer perennial forbs are showy and evident, but are only minor components in the system.

Figure 10. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	1	5	20	38	25	8	3	0	0	0

Community 1.3
Snowberry/Plum/Chokecherry/Grasses



Although this community phase appeared shrub dominated, grasses would have still constituted the majority of the production for this community phase. The western snowberry would have been spread across the site with chokecherry and plum in scattered patches. A remnant herbaceous understory was still present but may have been limited by reduced sunlight due to shrub canopy. Due to a reduced warm season component within this plant community, energy capture would have been shifted slightly to spring and early summer. Dominant functional/structural plant groups have been replaced by group(s) considered as minor components in community phase 1.1.

Pathway 1.1a
Community 1.1 to 1.2

This pathway occurs when events favor the decrease of cool season grasses and the increase of warm season grasses. Such events include early spring fires followed by severe grazing. This may have been a common occurrence in the natural range of variability. Spring and early summer drought, especially combined with early season burns or grazing could also initiate this pathway. Continuous early season burning or continuous early season grazing would also favor this pathway. Along this pathway, the dominant timing of energy capture shifts from spring and early summer to summer and early fall as the plant functional groups begin to change.

Pathway 1.1b
Community 1.1 to 1.3

Green Needlegrass/Western Wheatgrass

Snowberry/Plum/Chokecherry/ Grasses

This pathway was initiated by periods of above normal precipitation coupled with a reduction in fire frequency. The reduced fire frequency permitted the woody component of the plant community to expand and shift the dominance to the shrub species.

Pathway 1.2a
Community 1.2 to 1.1

The climate of the northern Great Plains favors this pathway. Time and natural and/or management events that

favor a decrease in warm season grasses and an increase in cool season grasses will initiate this pathway. Summer fires and/or short duration severe summer grazing will favor this pathway. These events were common within the natural range of variability. As the plant functional groups shift from warm season to cool season, the timing of energy capture shifts to earlier in the growing season.

Pathway 1.2b
Community 1.2 to 1.3

This pathway was initiated by periods of above normal precipitation coupled with a reduction in fire frequency. The reduced fire frequency permitted the woody component of the plant community to expand and shift the dominance to the shrub species.

Pathway 1.3a
Community 1.3 to 1.1

Snowberry/Plum/Chokecherry/ Grasses

Green Needlegrass/Western Wheatgrass

A return to historic fire frequencies and normal, to below normal, precipitation would shift the competitive advantage back to the herbaceous component.

State 2
Native/Invaded

This state is very similar to the reference state. The invasion of introduced cool season sodgrasses has altered the natural range of variability for this ecological site. This state is still dominated by native cool season grass, but invasive introduced cool season sodgrasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include grazing by domestic livestock and infrequent fires. Timing and duration of grazing coupled with weather events dictate the dynamics that occur within this state. The cool season native grasses can decline and an increase in introduced sod grasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season long grazing.

Community 2.1
Green Needlegrass/Western Wheatgrass/Kentucky Bluegrass

This community phase is very similar in appearance and function to Phase 1.1 with the exception of the presence of minor amounts of non-native, cool season rhizomatous grasses such as Kentucky bluegrass and smooth bromegrass. The prevailing climate and weather patterns favor the development of this community phase dominated by the cool season grasses, green needlegrass and western wheatgrass. There are also other needlegrasses and wheatgrass present as well as small amounts of warm season grasses such as big bluestem, sideoats grama and blue grama. A variety of perennial forbs are present but only in slight amounts. Productivity is very similar to community phase 1.1 as is the timing of energy capture, infiltration rates and nutrient cycling.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1440	2506	3155
Forb	135	210	300
Shrub/Vine	25	84	145
Total	**1600**	**2800**	**3600**

Figure 12. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

Community 2.2
Kentucky Bluegrass/Blue Grama/Sedge

This community phase occurs when natural or management actions favor the development of a sodgrass community. It is dominated by Kentucky bluegrass, blue grama and upland sedges. Needleleaf and threadleaf

sedge are the dominate sedges. Both tap rooted and fibrous rooted perennial forbs increase in this phase, but remain a minor component. Nutrient cycling declines due to a lack of deep root grasses, higher soil surface temperatures due to lack of plant cover, and lack of leguminous forbs. Water cycling also declines due to a decrease in the rooting depth of the plant community, increase in percent of bare ground, and increased soil surface temperatures.

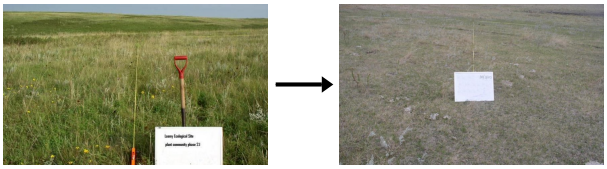
Figure 13. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	23	42	15	5	4	1	0	0

Community 2.3
Kentucky Bluegrass/Western Wheatgrass/Green Needlegrass

This community phase is characterized by an increase in the introduced cool season sodgrass, Kentucky bluegrass. This community phase is the most dominant today both temporally and spatially. Kentucky bluegrass has become nearly co-dominant with the native cool season grasses western wheatgrass and green needlegrass. Warm season grasses are present but only in minor amounts. The amount and diversity of tap rooted perennial forbs decreases. Production and infiltration both decrease and this community phase is at risk of transitioning across a state threshold. With natural or management actions that decrease the composition of the cool season native bunchgrasses and increase the composition of Kentucky bluegrass, transition T2a will be initiated.

Pathway 2.1a
Community 2.1 to 2.2



Green Needlegrass/Western Wheatgrass/Kentucky Bluegrass

Kentucky Bluegrass/Blue Grama/Sedge

Several combinations of events can occur to initiate this pathway. Severe repeated late season grazing or burning will favor the shift to sod forming grasses and sedges. Chronic heavy season-long grazing will also favor this shift. Along this pathway, the timing of energy capture shifts from spring and early summer to early spring and mid summer. The change in plant functional and structural groups and the composition and distribution of the vegetation causes a decrease in production and an increase in runoff with a corresponding decrease in infiltration. Nutrient cycling is restricted as the rooting depth of the vegetation decreases with the change in functional and structural groups. Plant community diversity is reduced with a loss of leguminous forbs and minor grass components.

Pathway 2.1b

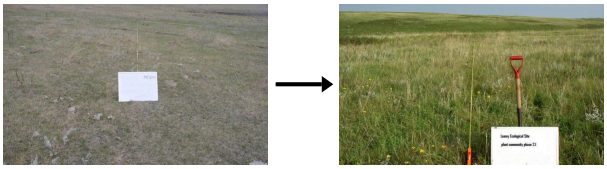
Community 2.1 to 2.3

Green Needlegrass/Western Wheatgrass/Kentucky Bluegrass

Kentucky Bluegrass/Western Wheatgrass/Green Needlegrass

This pathway is initiated with any action that allows the introduced Kentucky bluegrass to increase. Heavy late season or chronic season-long grazing will favor this change. Total rest from grazing and no fire events will also initiate this pathway. The change in plant functional and structural groups and the composition and distribution of the vegetation causes a decrease in production and an increase in runoff with a corresponding decrease in infiltration. Nutrient cycling is restricted as the rooting depth of the vegetation decreases with the change in functional and structural groups. Available nitrogen increases due to invasive legumes (black medic and sweetclover) altering the carbon to nitrogen ratio, favoring non-native, nitrogen dependent species such as Kentucky bluegrass.

Pathway 2.2a
Community 2.2 to 2.1

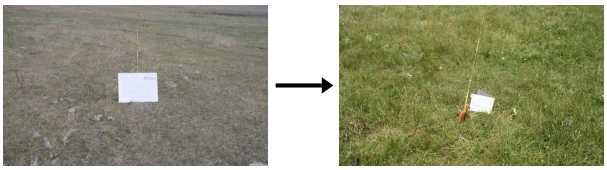


Kentucky Bluegrass/Blue Grama/Sedge

Green Needlegrass/Western Wheatgrass/Kentucky Bluegrass

This pathway is characterized by natural or management actions such as time and summer drought combined with grazing timing and intensity that provides adequate recovery periods for the native cool season grasses. The climate of the northern Great Plains favors this pathway and the removal of disturbances that favor sodgrasses will initiate the pathway. The change of plant functional and structural groups will increase the annual production and shift the timing of the energy capture from early spring and mid-summer to late spring/summer. As this pathway continues, the change in composition and distribution of the plant community will increase infiltration and reduce runoff.

Pathway 2.2b
Community 2.2 to 2.3



Kentucky Bluegrass/Blue Grama/Sedge

Kentucky Bluegrass/Western Wheatgrass/Green Needlegrass

Complete rest from grazing and no fire events will initiate this pathway. This lack of disturbance results in plant litter accumulation which alters energy capture, nutrient cycling and the micro-climate at the soil surface. These changes favor the shade tolerant species such as Kentucky bluegrass and smooth bromegrass.

State 3
Invaded

This state is the result of invasion and dominance of Kentucky bluegrass and/or smooth brome. This state is characterized by these two species and an increasing thatch layer that effectively blocks introduction of other plants into the system. Once the state is well established, even drastic events such as high intensity fires driven by high fuel loads of litter and thatch, will not result in more than a very short term reduction of these two species. These

events may reduce the dominance of the sodgrasses, but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish and dominate before the sodgrasses rebound and again dominate the system.

Community 3.1
Smooth Brome

This community phase is dominated by a monotypic stand of smooth brome. The longer this community phase exists the more resilient it becomes. Natural or management disturbances that reduce the cover of smooth brome are very short lived due to the abundance of rhizomes of smooth brome in the soil and the lack of proagules of other species present.

Community 3.2
Kentucky Bluegrass Sod/Forbs Community Phase

This community phase is dominated by the cool season sodgrass Kentucky bluegrass. Runoff is relatively high and nutrient cycling is limited by the shallow rooting depth of these species and the lack of leguminous forbs.

Figure 14. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

Community 3.3
Annual/Pioneer Perennial

The Annual/Pioneer Perennial community phase is highly variable depending on the level and duration of disturbance related to the T5 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. Overtime, the introduced cool-season perennial grasses will begin to establish on this site.

Pathway 3.1a
Community 3.1 to 3.2

Smooth Brome

Kentucky Bluegrass Sod/Forbs Community Phase

Heavy continuous grazing will shift the plant community to the grazing tolerant Kentucky bluegrass.

Pathway 3.2a
Community 3.2 to 3.1

Kentucky Bluegrass Sod/Forbs Community Phase

Smooth Brome

This pathway is initiated by continuous rest from grazing and fire. With the lack of grazing and fire to remove the litter, a thatch builds which reduces sunlight, competition from other species and favors the development of a monoculture of smooth brome. Energy inputs into the system are limited to one early growing species, and runoff

increases. Nutrient cycling is severely limited to the rooting depth of the smooth brome and production declines.

Pathway 3.3a
Community 3.3 to 3.2

Annual/Pioneer Perennial

Kentucky Bluegrass
Sod/Forbs Community Phase

With grazing and time, the grazing tolerant Kentucky bluegrass will continue to increase leading to community phase 3.2. In the absence of grazing, this pathway will lead to a community phase resembling 3.1 with the primary difference being the lack of western snowberry and remnant native grass species

State 4
Wooded

A wooded state may occupy this site when it occurs in association with river drainages and within close proximity to wooded loamy floodplain sites which serve as seed sources for the tree and shrub species. Elimination of fire as a disturbance factor and alteration of the historic grazing regimes resulted in the scattered shrub patches forming almost continuous woody dominated plant communities across the site. This state is characterized by an overstory of tall trees such as bur oak and green ash an understory of small trees and shrubs such as ironwood and chokecherry. Depending upon the amount of canopy cover, an herbaceous shade tolerant understory of sedges, smooth bromegrass, wildrye and/or Kentucky bluegrass may also be present.

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Plant productivity and health
- Plant structure and composition
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates

Community 4.1
Green Ash/Bur Oak/Shrubs

This plant community phase was/is characterized by a dominance of green ash and bur oak with lesser amounts of ironwood and boxelder. Shrubs include chokecherry, plum, snowberry, and gooseberry. An herbaceous understory of sedges, wildrye, and assorted forbs may also be present depending upon the amount of canopy cover. Kentucky bluegrass, smooth bromegrass and other non-native species may also be present if this plant community transitioned from State 2, Native/Invaded State. As the trees mature and canopy cover increases, herbaceous production declines and shrubs/vines associated with mature woodlands may begin to occupy the understory.

Community 4.2
Bur Oak/Green Ash/Ironwood/Sprengel Sedge

This plant community phase represented a mature to over-mature phase in which mature bur oak and green ash dominate with an understory of ironwood, gooseberry and other shade tolerant shrubs. The herbaceous component is limited to Sprengel sedge and other shade tolerant grasses/grass-likes such as Virginia wildrye. Regeneration of green ash and bur oak may have been limited by the closed canopy.

Pathway 4.1a
Community 4.1 to 4.2

As community phase 4.1 matured, the impacts of fire were reduced due to canopy cover and lack of fine fuels. This lack of disturbance resulted in further canopy development and eventually, canopy closure. Canopy closure further limited sunlight penetration, reducing herbaceous component to highly shade tolerant species and eventually, limiting tree regeneration.

Pathway 4.2a
Community 4.2 to 4.1

This pathway was initiated by drought and the associated increase in fire behavior and frequency resulting from these dryer conditions.

State 5
Wooded Native/Invaded

The introduction of non-native species and elimination of the fire as a disturbance mechanism results in a tree and shrub dominated plant community with an understory of native and non-native shade tolerant herbaceous species.

Community 5.1
Oak/Sedge

This community phase is very similar in composition and function as those community phases described in State 4, Wooded State. Bur oak and green ash are the dominant trees with an understory of small trees, shrubs, and woody vines including ironwood, chokecherry, gooseberry, Virginia creeper, and riverbank grape. An herbaceous understory of sedges, wildrye, and introduced species such as Kentucky bluegrass and smooth bromegrass may also be present depending upon the amount of canopy cover. This is a relatively stable state with both tree and shrub regeneration occurring.

Community 5.2
Mature Oak/Kentucky Bluegrass

This community phase is dominated by mature bur oak trees with an understory of Kentucky bluegrass and possibly Sprengel’s sedge where the tree canopy is closed. “Park-like” best describes the appearance of this community phase. Bur oak, green ash and ironwood regeneration is very limited. Heavy grazing also limits shrub growth so the understory is relatively open. Ground cover can vary from leaf litter to herbaceous depending upon canopy cover which also makes herbaceous production highly variable.

Community 5.3
Buckthorn/Oak

This plant community phase closely resembles the Oak/Sedge community phase but with varying amounts of the invasive shrub buckthorn present. Initially, scattered buckthorn plants are relatively inconspicuous but as time progresses, buckthorn begins to dominate the understory, displacing native shrubs and limiting tree regeneration.

Community 5.4
Oak/Eastern Redcedar

This community phase is similar to the Oak/Sedge community phase except it has been invaded by eastern redcedar. Eastern redcedar is native to the state; however, it is considered an invasive on loamy sites. Historically, periodic fire would have eliminated young eastern redcedar trees from the community before they attained a height or density to avoid a killing fire event. Without the benefit of these fires, young cedar trees can become established and spread across the site. Increasing amounts of eastern redcedar on a site can dramatically alter the historic ecological processes. The switch from a deciduous dominated community to one dominated by a coniferous species alters the functional/structural groups, changing the way energy, nutrients and water are cycled through the site.

Community 5.5
Buckhorn/Kentucky Bluegrass

This community phase represents a complete shift from the bur oak, green ash dominated community to one dominated by the invasive buckthorn and Kentucky bluegrass. The highly competitive nature of these two invasive species essentially eliminates the native species from this community. The overall stature and complexity of the community is lowered as a mid-statured shrub becomes the dominant species.

Pathway 5.1a
Community 5.1 to 5.2

Heavy, season-long grazing reduces tree and shrub regeneration and results in a more open canopy. This additional sunlight and heavy grazing pressure favors the Kentucky bluegrass resulting in a shift toward community phase 5.2, Mature Oak/Kentucky Bluegrass.

Pathway 5.1b
Community 5.1 to 5.3

This pathway is initiated when the Oak/Sedge community phase is invaded by Buckthorn. This invasion may occur with, or without the presence of livestock grazing.

Pathway 5.1c
Community 5.1 to 5.4

This pathway is initiated when the Oak/Sedge community phase is invaded by Eastern red cedar. This invasion may occur with, or without the presence of livestock grazing.

Pathway 5.3a
Community 5.3 to 5.5

As buckthorn increases and becomes a dominant understory shrub, regeneration of bur oak and green ash becomes less common and eventually, nonexistent. As older bur oak and ash trees begin to die, the lack of regeneration due to competition from the buckthorn results in a dramatic change in the appearance and stature of the plant community.

State 6

Any Plant Community

This state is the result of annual cropping.

Community 6.1
Annual/Perennial Crops

This plant community is the result of cropping.

Transition T1b
State 1 to 2

This is the transition from the native cool season grass dominated reference state to a state that has been invaded by introduced cool season grass species. When propagules of Kentucky bluegrass are present, this transition occurs as natural and/or management actions favor a decline in the composition of cool season bunchgrasses and an increase in cool season sodgrasses. Chronic season long or heavy late season grazing facilitate this transition. Complete rest from grazing and no fire events can also lead to this transition. The threshold between states is crossed when Kentucky bluegrass becomes established on the site.

Transition T1a
State 1 to 4

This is the transition from the native herbaceous or herbaceous/shrub dominated Reference State to a state that is dominated by mature trees and shrubs. This transition occurs on those Loamy sites located along major river systems and in close proximity to frequently flooded Loamy Overflow ecological sites. These flooded sites served as a source of seed for trees and shrubs which, coupled with an alteration of the fire frequency following settlement, permitted this transition from an herbaceous dominated plant community to a woody dominated community. Increasing tree size and canopy cover altered the micro-climate and reduced fine fuel amounts, reducing fire frequency and intensity.

Transition T2a/b
State 2 to 3

T2a - Several combinations of events can occur to initiate this pathway. Severe repeated late season grazing or burning will favor the shift to sod forming grasses and sedges. Chronic heavy season-long grazing will also favor this shift. Along this pathway, the timing of energy capture shifts from spring and early summer to early spring and mid-summer. The change in plant functional and structural groups and the composition and distribution of the vegetation cause a decrease in production and an increase in runoff with a corresponding decrease in infiltration. Nutrient cycling is restricted as the rooting depth of the vegetation decreases with the change in functional and structural groups. Plant community diversity is reduced with a loss of leguminous forbs and minor grass components. T2b - This pathway is initiated with any action that allows the introduced Kentucky bluegrass to increase. Heavy late season or chronic season-long grazing will favor this change. Total rest from grazing and no fire events will also initiate this pathway. The change in plant functional and structural groups and the composition and distribution of the vegetation causes a decrease in production and an increase in runoff with a corresponding decrease in infiltration. Nutrient cycling is restricted as the rooting depth of the vegetation decreases with the change in functional and structural groups. Available nitrogen increases due to invasive legumes (black medic and sweetclover) which alters the carbon to nitrogen ratio, favoring non-native, nitrogen dependent species such as Kentucky bluegrass.

Transition T2c
State 2 to 4

Removal of all disturbance from Loamy sites which are located adjacent to Loamy Overflow sites with existing trees to serve as seed sources.

Restoration pathway R3a/b
State 3 to 2

R3a - This restoration pathway may be initiated with the combination of prescribed burning followed by high levels of prescribed grazing management. The success of this restoration pathway depends on the presence of a remnant population of native grasses in community phase 3.1. This remnant population may not be readily apparent without close inspection. The application of prescribed burning may be needed at relatively short intervals in the early phases of this restoration process. Some previous efforts have shown promise with early season prescribed burning; however, fall burning may also be effective under certain circumstances. Both prescribed grazing and prescribed burning are necessary to successfully initiate this restoration pathway. R3b - It may be possible using selected plant materials and agronomic practices to approach something very near the functioning of the Native/Invaded State (State 2). Application of chemical herbicides and the use of mechanical seeding methods using adapted varieties of the dominant native grasses are possible and can be successful. After establishment of the native plant species, management objectives must include the maintenance of those species, the associated reference state functions, and the continued treatment of the introduced sodgrasses.

Transition T4
State 4 to 5

This transition occurs when non-native species and/or invasive native species invade the site. This may include such species as Kentucky bluegrass, smooth bromegrass, buckthorn and Eastern redcedar.

Transition T6
State 6 to 3

This transition occurs with cessation of cropping practices being applied to any plant community phase on this ecological site.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			280–560	
	western wheatgrass	PASM	*Pascopyrum smithii*	140–560	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	140–280	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	56–280	–
2	**Needlegrass**			420–840	
	green needlegrass	NAVI4	*Nassella viridula*	140–700	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	140–280	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	140–280	–
3	**Short Warm-season Grasses**			56–140	
	blue grama	BOGR2	*Bouteloua gracilis*	56–140	–
4	**Tall/Mid Warm-Season Grasses**			140–560	
	big bluestem	ANGE	*Andropogon gerardii*	140–560	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–140	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–140	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–84	–
5	**Other Native Perennials**			56–140	
	Grass, perennial	2GP	*Grass, perennial*	0–84	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	28–84	–
6	**Grass-likes**			28–140	

	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	28–140	–
	sedge	CAREX	*Carex*	28–140	–
Forb					
7	**Forbs**			140–280	
	Forb, native	2FN	*Forb, native*	0–140	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	28–56	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	28–56	–
	false boneset	BREU	*Brickellia eupatorioides*	28–56	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	28–56	–
	purple prairie clover	DAPU5	*Dalea purpurea*	28–56	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	28–56	–
	tall blazing star	LIAS	*Liatris aspera*	28–56	–
	dotted blazing star	LIPU	*Liatris punctata*	28–56	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	28–56	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	28–56	–
	goldenrod	SOLID	*Solidago*	0–56	–
	white heath aster	SYER	*Symphyotrichum ericoides*	28–56	–
	American vetch	VIAM	*Vicia americana*	28–56	–
	northern bedstraw	GABO2	*Galium boreale*	28–56	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–28	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–28	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–28	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–28	–
Shrub/Vine					
8	**Shrubs**			28–140	
	leadplant	AMCA6	*Amorpha canescens*	28–84	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	28–84	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–56	–
	prairie rose	ROAR3	*Rosa arkansana*	0–56	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–56	–

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			280–560	
	western wheatgrass	PASM	*Pascopyrum smithii*	140–560	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	140–280	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	56–280	–
2	**Needlegrass**			420–840	
	green needlegrass	NAVI4	*Nassella viridula*	140–700	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	140–280	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	140–280	–

3	**Short Warm-season Grasses**			56–140	
	blue grama	BOGR2	*Bouteloua gracilis*	56–140	–
4	**Tall/Mid Warm-Season Grasses**			140–560	
	big bluestem	ANGE	*Andropogon gerardii*	140–560	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–140	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–140	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–84	–
5	**Other Native Perennials**			56–140	
	Grass, perennial	2GP	*Grass, perennial*	0–84	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	28–84	–
6	**Grass-likes**			28–140	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	28–140	–
	sedge	CAREX	*Carex*	28–140	–
7	**Non-Native Grasses**			28–84	
	smooth brome	BRIN2	*Bromus inermis*	28–56	–
	Kentucky bluegrass	POPR	*Poa pratensis*	28–56	–
	Grass, perennial	2GP	*Grass, perennial*	0–28	–
Forb					
8	**Forbs**			140–280	
	Forb (herbaceous, not grass nor grass-like)	2FORB	*Forb (herbaceous, not grass nor grass-like)*	0–140	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	28–56	–
	northern bedstraw	GABO2	*Galium boreale*	28–56	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	28–56	–
	false boneset	BREU	*Brickellia eupatorioides*	28–56	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	28–56	–
	purple prairie clover	DAPU5	*Dalea purpurea*	28–56	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	28–56	–
	tall blazing star	LIAS	*Liatris aspera*	28–56	–
	dotted blazing star	LIPU	*Liatris punctata*	28–56	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	28–56	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	28–56	–
	goldenrod	SOLID	*Solidago*	0–56	–
	white heath aster	SYER	*Symphyotrichum ericoides*	28–56	–
	American vetch	VIAM	*Vicia americana*	28–56	–
	sweetclover	MELIL	*Melilotus*	0–28	–
	black medick	MELU	*Medicago lupulina*	0–28	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–28	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–28	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–28	–
Shrub/Vine					
9	**Shrubs**			28–140	
	leadplant	AMCA6	*Amorpha canescens*	28–84	

	leadplant	AMCA6	*Amorpha canescens*	28–84	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	28–84	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–56	–
	prairie rose	ROAR3	*Rosa arkansana*	0–56	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–56	–

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 kettle holes, kames, and 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 MLRA 55B. This area supports mid- to tall-grass prairie vegetation with quaking aspen, 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.

Two major Hydrologic Unit Areas make up this MLRA. 46% of the MLRA drains into the James River while 48% drains into the Sheyenne River and other tributaries to the Red River (in MLRA 56). Only 6% drains into the Mouse River (in MLRA 55A) watershed.

By the mid-19th century the 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 56. Many species of grassland birds, small mammals, insects, reptiles, amphibians, elk, moose, pronghorn, and large herds of American bison were historically among the inhabitants adapted to this region. Roaming herbivores, as well as several small 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 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 surface wetland drainage and subsurface tile drainage has taken place. Ephemeral and intermittent streams and the James, Wild Rice, and Sheyenne River have been straightened - removing sinuosity, creating oxbows, converting riparian zones to annual crop production. These anthropogenic impacts have reduced flood water detention and retention on the landscape. The results have been increasing storm water runoff sediment and nutrient loading to the James and Sheyenne Rivers and their tributaries (along with lakes and reservoirs within the MLRA). The installation of instream structures has reduced aquatic species movement within the MLRA.

National wildlife refuges, waterfowl production areas, state wildlife management areas, and North 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 3 man-made reservoirs - Jamestown Reservoir (2,036 acres), Pipestem Reservoir (1,027 acres), and Lake Ashtabula (5,174 acres) for flood control 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. The largest refuges managed by the United States Fish and Wildlife service are: Arrowood National Wildlife Refuge (NWR) Complex which consists of 75,000 acres; Tewaukon National NWR which covers 8,363 acres; and, in South Dakota, the Sand Lake NWR consists of 21,498 acres.

Some characteristic wildlife species in this area are:

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

Mammals: Northern short-tailed shrew, 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, red, and 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 species are usually larger than one ecological site or are dependent on more than one ecological site for annual life requisites. Ecological sites offer different habitat elements as the annual life requisites change. Habitat improvement and creation must be conducted within the mobility limits of a known population for the species.

Insects play an important role 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, Dakota stonefly, Iowa skipper, monarch butterfly, northern sandy tiger beetle, Ottoe skipper, Poweshiek skipperling, regal fritillary, yellow-banded bumble bee, and western bumble bee.

Birds: 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, greater prairie-chicken, horned lark, lark bunting, LeConte's sparrow, lesser scaup, marbled godwit, Nelson's sparrow, northern goshawk, northern harrier, northern pintail, peregrine falcon (migration), piping plover (migration), red knot (migration), sharp-tailed grouse, short-eared owl, Swainson's hawk, trumpeter swan, upland sandpiper, western meadowlark, willet, Wilson's phalarope, and whooping crane (migration).

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

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

Fish and Mussels: Banded killifish, black sandshell, blacknose shiner, Carmine shiner, creek heelsplitter, creeper, deertoe, fragile papershell, mapleleaf, northern pearl dace, northern redbelly dace, pearl dace, pink heelsplitter, threeridge, Topeka shiner, 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 5.0). Conversely, ecological sites that are dominated by short- to mid-statured grasses (Claypan) can be adjacent to sites with bare soil only supporting a minor amount 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 Woody Dominated 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 phases, as found in Loamy Overflow Wooded Community Phase 4. The following chart provides sensitivity to woody vegetation and preferred vegetative stature heights.

Grassland-nesting
Bird Species Preferred Vegetative Stature Avoids woody vegetation*

Short < 6 inches Medium 6 - 12 inches Tall >12 inches
Baird's sparrow x x x
Bobolink x x x
Brewer's sparrow x x
Burrowing owl x x
Chestnut-collared longspur x x x
Common yellowthroat x
Dickcissel x x
Ferruginous hawk x x
Grasshopper sparrow x x x
Horned lark x x
Killdeer x x
Lark bunting x x
Lark sparrow x
Le Conte's sparrow x x
Long-bill curlew x x
Marbled godwit x x x
McCown's longspur x x x
Mountain plover x x
Nelson's sparrow x x
Nesting waterfowl x x
Northern harrier x x x
Savannah sparrow x x x
Short-eared owl x x x
Sprague's pipit x x x
Upland sandpiper x x x
Western meadowlark x x
Willet x x x
*Many of the listed species avoid nesting in grassland areas with large amounts of woody vegetation within a grassland or avoid nesting near woody vegetation in adjacent habitats. Although these species avoid areas with woody vegetation, most can tolerate a small amount of woody vegetation within areas dominated by grassland habitat, including short-statured shrubs (e.g., sagebrush, western snowberry) in this MLRA.

Loamy Wildlife Habitat Interpretation:

Loamy sites, typically, have no restrictions in the soil profile; but a few sites have shale or gravel at a depth greater than 20 inches. This complex of ecological sites provides habitat for many edge-sensitive grassland bird species. Loamy habitat features support nesting and foraging grassland birds but may be too dense and tall for sharp-tailed grouse leks. Associated ecological sites include Clayey, Limy Subirrigated, Subirrigated, Loamy Overflow, Thin Loamy, Shallow Loamy, and Wet Meadow.

Loamy ecological sites may be found in five plant community states (1.0 Reference State, 2.0 Native/Invaded State, 3.0 Invaded State, 4.0 Wooded State, and 5.0 Wooded Native/Invaded State). Multiple plant community phases exist within all states. These states occur primarily in response to grazing, drought, and non-use. Secondary influences include fire and anthropogenic disturbances.

Because there is no known restoration pathway from State 2.0 to State 1.0, it is important to intensively manage using tools in State 1.0 and State 2.0 community phase pathways to prevent further plant community degradation along either the T2A or T2B transitional pathway to Invaded State 3.0. Native, grassland associated wildlife generally benefit from a heterogeneous grassland (found in States 1.0 and 2.0) that includes diverse grass and forb species with varying structure and density. Conversion to a woody state (along transitional pathway T1A or T2C) generally benefits wildlife species that can tolerate (or require) woody habitat within plant communities found in States 4.0 and 5.0.

As plant communities degrade within State 2.0, warm-season grasses (particularly short-statured and cool-season exotic grasses) increase while native forbs are reduced. This transition results in reduced structure, increased plant community homogeneity, and reduced insect populations - resulting in a reduction of breeding, nesting, foraging, or winter habitat for grassland birds. When adjacent/intermingled, ecological sites undergo the same transition, the

result can be an expansive, homogenous landscape.

Success along restoration pathway R3A and R3B from State 3.0 to State 2.0 is very difficult and is dependent upon presence of a remnant native grass population or successful native range seeding. Plant community phases (within State 3.0) show dramatic increased homogeneity of exotic cool-season grasses and further reduction in native forbs. Reduced forb diversity limits insect populations, negatively affecting grassland nesting bird foraging opportunities. However, western snowberry can become a dominant shrub at this site impacting bird species sensitive to woody vegetation invasion but at the same time providing habitat for beneficial pollinating insects. Increased exotic-grass litter can limit access to bare ground by nesting insects. A homogenous grassland landscape does not provide quality escape or winter cover. As a result, many species are not able to meet life requisites within State 3.0.

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

1.0 Reference State

Community Phase 1.1 Green Needlegrass-Western Wheatgrass: This plant community offers excellent wildlife habitat and 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 simulated by domestic livestock. These services include putting plant material and dung in contact with mineral soil to be used by low trophic level consumers such as invertebrate decomposers, scavengers, shredders, predators, herbivores, dung beetles, and fungal-feeders.

Dakota skippers do not prefer this site due to limited host plants, such as little bluestem and prairie dropseed. Regal fritillary habitat is limited due to Nuttall's violet and prairie violets being uncommon. Monarch butterfly may use flowering forbs on this site; however, few milkweed species are found on this site to support breeding and larvae development. The ecological site does not provide habitat for the northern sandy tiger beetle which prefers dry, sandy dunes or sandy areas away from water. This plant community provides potential habitat for the Ottoe Skipper preferring mid to tall-statured grasses. Bumblebees and other native bees utilize forbs for pollen and nectar and bare ground for nesting amongst bunchgrasses. Prescribed grazing with adequate recovery periods, as well as prescribed fire, to maintain the 1.1 phase will have long term positive effects on ground dwelling insects.

Birds: This plant community provides quality nesting, foraging, and escape habitats favored by short- to mid-grass nesting birds. Plant structure may be too dense or tall for species using short-grass habitats; however, it may be used during periods of drought or management such as rotational grazing or fire (resulting in defoliation) along community phase pathway 1.1A. The low scattered shrubs present in the plant community phase should not impact woody vegetation sensitive bird species.

Grassland birds preferring mid-grass structure 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 leks and nesting and brood-rearing habitat. Limited structure and diverse prey populations provide good hunting opportunity for grassland raptors. Many passerine species utilize MLRA 55B as a major migratory travel corridor. Grassland species sensitive to woody associations during nesting and brooding may utilize the woodier fragmented sites.

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

Amphibians/Reptiles: This ecological site and associated plant communities provide habitat for smooth green

snakes. This ecological site can provide habitat for the northern leopard frog and Great Plains toad if freshwater habitat such as wetlands, streams, or lakes are near the site.

Fish and Mussels: This ecological site can be located near wetlands, streams, rivers, or water bodies. Associated ecological sites, such as Loamy Overflow and Wet Meadow, can receive run-on hydrology from Loamy sites out-letting into receiving waters. Management on these interconnected sites can have direct effects on aquatic species.

Community Phase 1.2: Big Bluestem-Sideoats Grama-Western Wheatgrass: This plant community phase occurs from events that favor a decrease of cool-season grasses and in increase in warm-season grasses, including early spring fires followed by severe grazing. Continuous season-long grazing could also initiate this pathway.

Invertebrates: Provides similar life requisites as Community Phase 1.1. However, showy deep-rooted perennial forbs provide increased pollinator habitat. An increase in warm-season, sod-forming grasses may negatively impact ground nesting pollinator species.

Birds: Provides similar life requisites as Community Phase 1.1. However, the increase of tall warm season grasses, favors grassland-nesting birds species preferring mid- to tall-statured vegetation. Tall, warm-season grasses provide additional winter habitat for species such as sharptailed grouse.

Mammals: Provides similar life requisites as Community Phase 1.1. Depending on the density of tall warm season grasses, large ungulates, such as deer, may have increased escape and thermal cover.

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

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

Community Phase 1.3 Snowberry/Chokecherry/Grasses: Combined with above normal precipitation and a reduction in fire frequency, native shrubs become prominent and begin to dominate. Plum and chokecherry will appear in patches while western snowberry may have spread across the entire site.

Invertebrates: Provides similar life requisites as Community Phase 1.1. However, the increased shrub component will provide early- (chokecherry) and mid- season (western snowberry) nectar and pollen sources for bumblebees, regal fritillary, monarch butterfly, and other pollinating species.

Birds: Western snowberry-dominated sites provide nesting, brood, and winter cover for sharp-tailed grouse and ring-necked pheasant. Western snowberry, chokecherry, and plum provides winter cover and food (berries) for grassland-nesting bird species that use (or can tolerate a small amount of) woody vegetation within areas dominated by grassland habitat. Woody vegetation may not reach enough density to provide habitat for woodland edge species. Brown-headed cowbird use will increase with an increase in the woody cover component of this ecological site.

Mammals: Increase in woody habitat provides winter and escape cover, birthing sites, browse, etc. for white-tailed deer. The increase in woody cover will not benefit bat species found in MLRA 55B since necessary maternity trees are limited to non-existent.

Amphibians and Reptiles: Provides similar life requisites as Community Phase 1.1. However, the increase in woody vegetation will decrease habitat quality for the smooth green snake.

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

2.0 Native/Invaded State

Community Phase 2.1 Green needlegrass-Western Wheatgrass-Kentucky Bluegrass: This plant community develops through Transition Pathway T1B due to changes in management and the presence of exotic, cool-season grasses. Lack of fire and chronic season-long or late fall grazing can facilitate this transition. The threshold between States 1.0 and 2.0 is crossed when Kentucky bluegrass, smooth brome grass, or other exotic species become established. This plant community phase has a very similar appearance and function to the Reference State of Community 1.1, except it has a minor amount of cool-season exotic grasses and forbs. This phase functions at a

high level for native wildlife; therefore, managers should consider the 2.0 community phase pathways to avoid transitioning to the Invaded State 3.0. There is no known Community Phase Pathway back to State 1.0 from State 2.0.

Invertebrates: Provides similar life requisites as Community Phase 1.1. Increase in sod-forming exotic cool season grasses reduces bare ground, reducing the potential for ground nesting bees. Although forb diversity is maintained, increased competition from exotic cool-season grass may reduce density of native forbs reducing nectar and pollen availability.

Birds: Provides similar life requisites as Community Phase 1.1.

Mammals: Provides similar life requisites as Community Phase 1.1.

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

Community Phase 2.2 Kentucky Bluegrass-Blue Grama/Sedge: Chronic, heavy season-long grazing or severe late-season grazing along Community Phase Pathway 2.1A leads to shorter-statured grasses. Dominated by shorter-stature grasses and a loss of nitrogen-fixing or leguminous native forbs, the diversity of this plant community is reduced. Both tap-rooted and fibrous-rooted perennial forbs increase in this phase but remain a minor component. Prescribed grazing with adequate recovery periods along Community Phase Pathway 2.2A is an efficient, effective method to regain the cool-season grass and forb diversity components in Community Phase 2.1.

Invertebrates: The reduction of native forbs and increase in sod-forming, cool- and warm-season grasses limit foraging and nesting sites for all pollinators. Continuous, heavy season-long grazing or heavy seasonal grazing may reduce ground-nesting site availability. Homogeneity of forb species may limit season-long nectar availability.

Birds: Chronic, heavy season-long grazing or severe late-season grazing will reduce nesting sites, forage (invertebrates), and cover. A reduced forb component may limit foraging opportunities for birds. The stature is generally short, serving both mid- short-grass nesting birds. Shortgrass-nesting birds favor this phase. Species that prefer mid-grass stature generally will be successful with normal to above normal precipitation and a change in management along the 2.2A Community Pathway. In years with reduced precipitation or heavy grazing during the nesting season, use by mid-grass nesting species may be compromised. This plant community provides areas suitable for sharp-tailed grouse lek site development. Limited stature and vegetative cover limits prey populations and hunting opportunities for grassland raptors.

Mammals: Suitable food and thermal, protective, and escape cover (reduction in litter) for most mammals become limited. The loss of diversity of grasses and forbs reduces nutrition levels for small and large herbivores including voles, mice, rodents, jackrabbits, and white-tailed deer.

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

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

Community Phase 2.3 Kentucky Bluegrass-Western Wheatgrass-Green Needlegrass: Management activities (via Community Pathway 2.1B) through heavy, late season or chronic season-long grazing or (via Community Pathway 2.2B) total rest from grazing, combined with no fire events, allows for Kentucky bluegrass to increase. Runoff and available nitrogen increase. Invasive black medic and yellow sweet clover provide Kentucky bluegrass the needed nitrogen to flourish.

Invertebrates: The increase in sod-forming Kentucky bluegrass further limits nesting sites for pollinators. However, the increase in sweet clover and black medic provide pollen and nectar for a variety of pollinators.

Birds: Chronic, heavy season-long grazing or severe late-season grazing will reduce nesting sites, forage (invertebrates), and cover. The stature is generally short, serving grassland-nesting birds that prefer short-stature vegetation. However, total rest will provide vegetation that is short- to mid-stature. Dependent upon the degree of Kentucky bluegrass invasion, the lack of plant diversity and stature, along with increased litter and the tendency of Kentucky bluegrass and smooth bromegrass to lay down, limits use by many grassland-nesting birds. This plant community provides areas suitable for sharp-tailed grouse lek site development. Limited stature and diverse prey

populations provide good hunting opportunities for grassland raptors.

Mammals: Heavy, late season or chronic season-long grazing limits suitable food and thermal, protective, and escape cover (reduction in litter) for most mammals. Ground squirrels (thirteen-lined and Richardson's) prefer these sites. The increased litter from total rest from grazing combined with no fire events provides protective and escape cover for small mammals. Through Community Pathway 2.1B, black medic and sweet clover provides high nutritional levels for small and large herbivores including voles, mice, rodents, jackrabbits, and white-tailed deer.

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

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

3.0 Invaded State

Community Phase 3.1 Smooth Bromegrass: Community Phase Pathway T2A is characterized by non-use and elimination of fire when exotic cool-season grasses are present (as in Community Phase 2.0). This plant community phase is characterized by a dominance (>30%) of exotic cool-season grasses, such as smooth bromegrass; native grasses represent less than 40% of the plant community. Restoration Pathway R3A, through prescribed burning and high levels of grazing management, requires remnant amounts of native warm- and cool-season and forbs to be successful. The remnant native community needs frequent prescribed burns and high levels of grazing management targeting the exotic cool-season grasses to improve competitiveness and increase vigor and density. Without intensive management, the remnant native plants will not increase adequately to transition back to State 2.0. Intensified management along the R3A Pathway will have significant short-term negative impacts on wildlife habitat; however, this is necessary to restore long-term native habitat functions.

Invertebrates: Exotic grasses limit use by beneficial insects provided in States 1.0 and 2.0. Increased litter and lack of grazing leads to limited contact between plant material and mineral soil resulting in a cooler microclimate, 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. This Community Phase does not provide life requisites for any species of concern within MLRA 55B.

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

Mammals: Litter accumulation and exotic grass cover favors thermal, protective, and escape cover for small rodents.

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

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

Community Phase 3.2: Kentucky Bluegrass Sod/Forbs: Transitional Phase Pathway T2B or Community Phase Pathway 3.1A are characterized by heavy continuous grazing when exotic cool-season grasses are present (as in Community Phase 2.0). This plant community phase is characterized by a dominance (>30%) of exotic cool-season grasses, such as Kentucky bluegrass; native grasses represent less than 40% of the plant community.

Restoration Pathway R3A, through prescribed burning and high levels of grazing management, requires remnant amounts of native warm- and cool-season and forbs to be successful. The remnant native community needs frequent prescribed burns and high levels of grazing management targeting the exotic cool-season grasses to improve competitiveness and increase vigor and density. Without intensive management, the remnant native plants will not increase adequately to transition back to State 2.0. Intensified management along the R3A Pathway will have significant short-term negative impacts on wildlife habitat; however, this is necessary to restore long-term native habitat functions.

Invertebrates: Due to lack of forb species diversity, nectar and pollen sources become limited. Common forbs would include goldenrod, western yarrow, aster, western ragweed and a variety of introduced forbs which do not provide adequate season-long pollen sources. Dense Kentucky bluegrass sod and continuous heavy season-long reduces ground-nesting bee habitat.

Birds: Dominated by Kentucky bluegrass sod with heavy continuous season-long grazing, this plant community provides limited cover of any type for grassland-nesting birds. Species preferring short-grass will use this community, but use may be limited due heavy continuous season-long grazing.

Mammals: This plant community provides limited thermal, protective, and escape cover for small or large mammals. Heavy continuous season-long grazing favors ground dwelling mammals such as Richardson's ground squirrels.

Amphibians and Reptiles: Excessive heavy season-long grazing limits use of this site by smooth green snakes. Foraging opportunities for northern leopard frog and Great Plains toad are limited even if freshwater habitat such as wetlands, streams, or lakes are adjacent to the site due to lack of insect populations and excessive heavy season-long grazing.

Fish and Mussels: Dense sod resulting from excessive heavy season-long grazing reduces infiltration and increases runoff from this ecological site. During normal to above normal precipitation events, increased runoff may negatively impact flow in adjacent streams and creeks and adjacent waterbodies.

Community Phase 3.3: Annual/Pioneer Perennial: These plant communities are the result of severe soil disturbance such as cropping, recreational activity, or concentrated livestock activity for a prolonged time 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. The response by wildlife species will be dependent upon plant community composition, vegetative stature, patch size, and management activities (such as prescribed grazing, burning, inter-seeding, haying, or noxious weed control). Successful restoration of native species along Transition Pathway R3B can result in a native grass and forb community in State 2.0.

4.0 Wooded State/5.0 Wooded Native/Invaded State

Loamy ecological sites did not historically support a woody plant community and, today, these usually exist as a linear woody feature on a linear/concave landscape commonly referred to as woody draws. The wooded state occurs when the Loamy ecological site is located near a seed source for woody vegetation such as a wooded Loamy Overflow ecological site. In woody draws, the Loamy – Wooded State occurs on the side slopes above Loamy Overflow – Wooded State (foot slopes and bottom of the draws). The removal of all disturbance through Transition Pathways T1A and T2C are the major contributors to this community phase, crossing the threshold from an herbaceous plant community to a community dominated by hardwoods and shrubs. The composition of this woody plant community will be dependent upon shading (tree canopy density), management (grazing), and the amount of invasive grass and shrub species.

Wooded State 4.0 and Wooded Invaded State 5.0: Green Ash-Bur Oak/Shrubs (Community Phase 4.1), Bur Oak-Green Ash/Ironwood/Sprengel Sedge (Community Phase 4.2), Oak/Sedge (Community Phase 5.1), and Buckthorn/Oak (Community Phase 5.3): Wooded draws are an important vegetative type used by many large herbivorous mammals. Multi-level canopy, high edge-to-area ratio, and prevalence of preferred forage provides high quality wildlife habitat. Within MLRA 55B, woody draws (such as those in Wooded State 4.0 and Wooded/Invaded State 5.0) provide important travel corridors, security cover, and foraging, loafing, and parturition (birthing) areas.

Invertebrates: Early season flowering shrubs provide pollen and nectar. However, pollinating insects will need adjacent herbaceous- and forb-dominated ecological sites for mid- to late-season pollen sources. Lower trophic-level consumers such as invertebrate decomposers, scavengers, shredders, predators, herbivores, dung beetles, and fungal-feeders will use woody plant material, leaves, and limited amount of grasses in contact with mineral soil. The woody component of this site is not conducive to use by any insect species of conservation priority within MLRA 55B. Woody plant material is available for wood-nesting bees. These wind-protected, moist plant communities provide favorable habitat for flying insects (flies, mosquitoes, moths, etc.). Favorable climatic

conditions can lead to large hatches of insects. This Community Phase does not provide life requisites for any species of concern within MLRA 55B.

Birds: This site no longer provides habitat for grassland-nesting bird species due to the dominance of woody vegetation. Bird species that use and benefit from woodland edge (such as wild turkey, black-billed cuckoo, black-capped chickadee, gray catbird, and Swainson's hawk) can be found in this community phase. These community phases provide nesting habitat for many migratory passerines and excellent winter cover for sharp-tailed grouse, eastern screech owl, great horned owl, wild turkey, and non-migrating passerine birds such as black-capped chickadee and white-breasted nuthatch. Berry producing shrubs provide late summer, fall, and winter forage for many bird species. Wildlife use increases as the depth of snow increases during the winter, thereby becoming critical to the sustainment of winter resident bird populations. The presence of woody plant species may increase mammalian and avian predation and increase brood parasitism by brown-headed cowbirds on adjacent grassland ecological sites.

Mammals: Little and big brown bat use these states for roost sites and forage. Small herbivores that can use (or tolerate) woodland edge such as American porcupine and cotton-tail rabbit will benefit from this plant community phase. Shrubs and trees provide security and thermal cover used by white-tailed deer for foraging, loafing, and rearing young-of-the-year. Multi-layer shrub/tree communities provide concealment protection from predators during parturition. Plant species provide highly nutritious forage during peak lactation, one of the most energy-demanding time periods of the year for female ungulates. Winter white-tailed deer diets are dominated by chokecherry, western snowberry, serviceberry, rose, and various species of gooseberry.

Amphibians and Reptiles: This Wooded State does not provide habitat for species of conservation priority within MLRA 55B.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1. However, the wooded state can occur along drainageways directly adjacent to Riparian Complex Ecological Sites, rivers, and streams. The bare soil found under the tree and shrub canopy may reduce infiltration and nutrient cycling. Run-off, sediment yield, and nutrient load increase from the site, negatively impacting receiving water bodies.

Wooded State 5.0: Mature Bur Oak/Kentucky Bluegrass (Community Phase 5.2), Bur Oak/Eastern Redcedar (Community Phase 5.4), and Buckthorn/Kentucky Bluegrass (Community Phase 5.5): Invasion of Kentucky bluegrass, along with heavy season-long livestock grazing, will convert this plant community to a "park-like" appearance in the Mature Bur Oak/Kentucky Bluegrass Community Phase. The invasion of buckthorn and Kentucky bluegrass (out-competing bur oak) creates a Buckthorn/Kentucky Bluegrass Community Phase. The invasion of eastern redcedar, with or without livestock grazing, leads to the Bur Oak/Eastern Redcedar Community Phase.

Community Phase 5.2 Mature Bur Oak/Kentucky Bluegrass: This "park-like" plant community is caused by heavy, season-long grazing - reducing or eliminating shrub or tree regeneration.

Invertebrates: Wind pollinated oak and the lack of shrub or forb understory limits pollinator use. Lower trophic-level consumers such as invertebrate decomposers, scavengers, shredders, predators, herbivores, dung beetles, and fungal-feeders will use woody plant material, leaves, and limited amount of grasses in contact with mineral soil. This Community Phase does not provide life requisites for any species of concern within MLRA 55B.

Birds: Grassland-nesting bird species intolerant of woody vegetation are eliminated from this site, while species associated with woodlands and woodland edges will increase. However, the lack of a woody/shrub understory will may limit bird use to those that favor the tree canopy. The presence of woody plant species may increase avian predator and brood parasitism by brown-headed cowbirds on adjacent grasslands. This site provides limited winter cover for resident bird species.

Mammals: Bat species found within MLRA 55B may use this site for roosting and maternity trees. Nearby community phases that support insects provide foraging opportunities. This phase provides limited thermal, escape, and loafing habitat for white-tailed deer.

Amphibians and Reptiles: This Wooded State does not provide habitat for species of conservation priority within MLRA 55B.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1. However, the wooded state can occur along drainageways directly adjacent to Riparian Complex Ecological Sites, streams, and rivers. Sod forming Kentucky bluegrass reduces infiltration and nutrient cycling. Run-off, sediment yield, and nutrient load increase from the site, negatively impacting receiving water bodies.

Community Phase 5.4 Bur Oak/Eastern Redcedar: The invasion of eastern redcedar is the major contributor to this community phase. Loamy ecological sites did not historically support eastern redcedar. Dense conifers lead to changes in soil chemistry and a change in the associated herbaceous plant community. A detritus layer of juniper needles-leaves, shade, shallow root system, and interception of precipitation with a possible soil chemistry change (decrease in pH) reduces or eliminates the herbaceous or forb understory.

Invertebrates: Conifers and bur oak are wind-pollinated and thus have limited benefits for pollinating insects. The loss of a forb component limits insect populations.

Birds: Grassland-nesting bird species intolerant of woody vegetation are eliminated from this site, while species associated with woodlands and woodland edges will increase. The presence of woody plant species may increase predation by mammals and avian predators and brood parasitism by brown-headed cowbirds. This site provides year-round habitat for wild turkey and winter and escape habitat for ringed-necked pheasant and sharptailed grouse.

Mammals: Bat species found within MLRA 55B may use this site for roosting and maternity trees. Nearby community phases that support insects provide foraging opportunities. This phase provides significant thermal, escape, and loafing habitat for white-tailed deer.

Amphibians/Reptiles: This Wooded State does not provide habitat for species of conservation priority within MLRA 55B.

Fish and Mussels: Provides similar life requisites as Community Phase 1.1; however, the wooded state can occur along drainageways directly adjacent to Riparian Complex Ecological Sites, rivers, and streams. The bare soil found under the tree and shrub canopy reduces infiltration and nutrient cycling. Run-off, sediment yield, and nutrient load increase from the site, negatively impacting receiving water bodies.

Community Phase 5.5 Buckthorn/Kentucky bluegrass: Invasive buckthorn begins to dominate this site eliminating the bur oak and ash overstory. Along with invasive Kentucky bluegrass, native grass and forb species are virtually non-existent.

Invertebrates: Buckthorn may provide limited pollen in late spring. However, the loss of a forb component limits insect populations. This Community Phase does not provide life requisites for any species of concern within MLRA 55B.

Birds: Grassland-nesting bird species intolerant of woody vegetation are eliminated from this site, while species associated with shrubs woodlands and woodland edges will increase; however, buckthorn is not a preferred nesting site for many passerines. Buckthorn berries are consumed and spread by many bird species.

Mammals: This plant community will not provide bat habitat. It provides limited thermal, escape, and loafing habitat for white-tailed deer and other mammals.

Amphibians/Reptiles: This Community Phase does not provide life requisites for any species of concern within MLRA 55B.

Fish and Mussels: Provides similar life requisites as Community Phase 5.2.

Animal Community – Grazing Interpretations

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

interpretation of this inventory data will permit the establishment of a safe, initial stocking rate for the type and class of animals and level of grazing management. More accurate stocking rate estimates should eventually be calculated using actual stocking rate information and monitoring data.

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

Hydrological functions

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

Recreational uses

National wildlife refuges, waterfowl production areas, state wildlife management areas, and North 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 3 man-made reservoirs - Jamestown Reservoir (2,036 acres), Pipestem Reservoir (1,027 acres), and Lake Ashtabula (5,174 acres) for flood control providing fish habitat and adjacent uplands for wildlife cover. Lonetree WMA is the largest state managed wildlife area covering 32,800 acres. The largest refuges managed by the United States Fish and Wildlife service are: Arrowood National Wildlife Refuge (NWR) Complex consists of 75,000 acres, Tewaukon National NWR covers 8,363 acres and, in South Dakota, the Sand Lake NWR consists of 21,498 acres.

Hunting and bird watching: Over 137,000 acres of National Wildlife Refuges and waterfowl production areas owned and managed by the United States Fish and Wildlife Service are available for public hunting, hiking, and bird watching. Thousands of acres of state wildlife management areas and North Dakota Department of Trust Lands are found in the MLRA. The North Dakota Game and Fish Department manages the Lonetree Wildlife Management Areas (WMAs) located in Wells and Sheridan Counties. Numerous other WMAs in North Dakota and Game Production Areas in South Dakota are found within this MLRA.

Camping: Fort Ramson State Park, Pipestem Reservoir, Jamestown Reservoir, Spiritwood Lake, Clausen Springs, Little Yellowstone and other public and private campgrounds are found within the MLRA. Limited, primitive camping is available on wildlife management areas.

Recreation: The North Country Trail enters the MLRA in Ransom County, ND turns north along the eastern edge of the MLRA and then dissects the MLRA through the Lonetree WMA. The trail is open to hikers, bikers, and horseback riders. The MLRA has one, 63-mile Scenic Drive starting north of Valley City and heading south to Kathryn, Fort Ransom and Lisbon through the Sheyenne River Valley.

Wood products

To be developed.

Other products

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

Other information

Site Development and Testing Plan
• Further investigation is needed on areas that have become wooded. During the MLRA update, a few map units with a wooded phase of Barnes or Heimdal soils were identified. While these have been removed as a distinct map unit phase, the current State and Transition Model does not adequately represent the wooded conditions of some areas of this site.
• Further investigation may be needed areas of this site on outwash plains. The available water capacity in these areas is lower than on other areas where this site occurs. This may impact the plant community during extended drier than normal periods.
• Further investigation is needed on occasionally flooded La Prairie soils with slopes exceeding 6 percent. No field investigation of the plant community has been completed to determine if Loamy or Loamy Overflow should be the representative ES; tentatively, these components have been assigned to Loamy. MLRA map units needing investigation are:
 Buse-Barnes-La Prairie, occasionally flooded loams, 6 to 15 percent slopes (map unit 2q4h4)
 Buse-Barnes-La Prairie, occasionally flooded loams, 6 to 35 percent slopes (map unit 2q4h9)
 Esmond-Heimdal-La Prairie, occasionally flooded loams, 6 to 15 percent slopes (map unit 2q4tp)
 Esmond-Heimdal-La Prairie, occasionally flooded loams, 6 to 35 percent slopes (map unit 2q4tq)
• 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.

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. Those involved in developing this site description include: Stan Boltz, NRCS Range Management Specialist; Michael D. Brand, State Land Dept., Director Surface Management; David Dewald, NRCS State Biologist; Paul Drayton, NRCS District Conservationist; Jody Forman, NRCS Range Management Specialist; Dennis Froemke, NRCS Range Management Specialist; Jeff Printz, NRCS State Range Management Specialist; Kevin Sedivec, Extension Rangeland Management Specialist; Shawn Dekeyser, North Dakota State University; Rob Self, The Nature Conservancy and Lee Voigt, NRCS Range Management Specialist, Bruce Wight, NRCS Forester, and Craig Stange, NRCS State Forester.
Data Source Number of Records Sample Period State Counties
SCS-RANGE-417 15 1969 – 1972 ND Foster, Sargent, Stutsman

Other references

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

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://wcc.nrcs.usda.gov)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (http://nasis.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.

The Nature of Eastern North Dakota: Pre-1880 Historical Ecology. 2006. Severson, Kieth E. and Carolyn Hull Sieg. North Dakota Institute for Regional Studies.

Royer, R. A., 2003. Butterflies of North Dakota: An Atlas and Guide: Minot State University, Minot, ND.

Knudson, W. and R. L. Post. 1963. Butterflies of Bottineau County. 29 pp.

Minnesota Department of natural Resources, Managing Your Woodland For Ruffed

North Dakota Division of Tourism, Accessed on July 30, 2019. Available at https://www.ndtourism.com/sports-recreation

North Dakota Parks and Recreation Department, Accessed on July 20, 2019. https://www.parkrec.nd.gov/business/

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

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Approval

Joel Brown, 6/01/2021

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)	Jeff Printz, Stan Boltz, Lee Voigt, Jody Forman
Contact for lead author	Jeff.printz@nd.usda.gov 701-530-2080
Date	02/10/2012
Approved by	Joel Brown
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

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2. **Presence of water flow patterns:** None.

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3. **Number and height of erosional pedestals or terracettes:** None.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5% or less.

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5. **Number of gullies and erosion associated with gullies:** None.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

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7. **Amount of litter movement (describe size and distance expected to travel):** None on lesser slopes. Movement of short distances may be observable on slopes > 15%.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability averages 6. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

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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/surface layer.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool- and warm-season grasses) with fine and coarse roots positively influences infiltration.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

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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: Mid, cool-season bunchgrasses >

    Sub-dominant: Mid, cool-season grasses = tall and mid warm-season grasses >

    Other: Forbs > short warm-season grasses = grass-likes = shrubs > short cool-season grasses

    Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass do not fit into reference plant community F/S groups.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or**

decadence): None.

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14. **Average percent litter cover (%) and depth (in):** In contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Representative value = 2800 lbs/ac air dry with a range of 1600 to 3600 lbs./acre air dry depending on growing conditions.

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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/local noxious weeds, Kentucky bluegrass, smooth bromegrass, Russian olive, Siberian elm, Eastern red cedar.

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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers.
