USDA Natural Resources Conservation Service

Ecological site R055DY012SD
Thin Upland

Last updated: 11/14/2024
Accessed: 05/12/2025

General information

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

MLRA notes

Major Land Resource Area (MLRA): 055D–Glacial Lake Dakota

MLRA 55D is in South Dakota (92 percent) and southeastern North Dakota (8 percent). It makes up about 3,059 square miles (7,923 square kilometers). This area, which is part of the glacial till plain region, consists of a large, glacial lake plain that was drained by the James River, which flows southward through the area. The MLRA is dominantly farmland converted from prairie, but some areas of grassland remain. Agricultural drainage practices have impacted shallow depressions in many areas.

MLRA 55D has distinct boundaries. Till plains are on all sides. MLRA 55B borders the area largely to the north and is also between the Lake Dakota Plain and two prominent coteaus—the Missouri Coteau on the west and the Prairie Coteau on the east. To the south is MLRA 55C (Southern Black Glaciated Plains), which has a mesic soil temperature regime.

This area is in the Central Lowland province of the Interior Plains. Elevation ranges from 1,250 to 1,330 feet (380 to 405 meters), generally increasing from south to north. The area is characterized by mostly level to moderately sloping lake plains with many depressions and drainages. Much of the area has integrated drainage; drainage channels are poorly to moderately defined.

The glaciolacustrine sediments of the Lake Dakota Plain range from sandy to clayey and are commonly stratified. Some areas of the lake plain are mantled with wind-deposited materials, which are moderately coarse textured or sandy. Alluvial deposits and low terraces are common along the James River and its major tributaries but also occur in narrow and discontinuous strips along other streams.

Classification relationships

Major Land Resource Area (MLRA): Southern Black Glaciated Plains (55D) (USDA-NRCS, 2022)

USFS Sub-region: Located mainly within unit 332Bc and 332Ba (Cleland et al., 2007).

Ecological site concept

The Thin Loamy ecological site is located on glaciated uplands – till plains, lake plains, and escarpments. It occurs on shoulder slopes, convex rises, ridges and summits. The soils typically are very deep; however, a few soils on escarpments have shale beds as shallow 20 inches. The surface layer typically has free carbonates throughout, but the upper few inches are non-effervescent in some soils. A calcareous (slight to violent effervescence) subsoil layer occurs within a depth of 8 inches. Surface and subsoil textures typically are loam or silt loam; but clay loam, silty clay loam and cobbly loam also occur. The surface and subsoil form a ribbon 1 to 2 inches long. Soil on this site is well drained or moderately well drained. Slopes usually range from 10-20 percent. On the landscape, this site is above the Loamy, Loamy Overflow, Clayey, Sandy, and Sands ecological sites. The transition between Loamy and Thin Loamy sites is determined by depth to accumulated carbonates. Soils with slight 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. The Shallow Loamy ecological site occurs on similar landscape positions on escarpments; it has soft sedimentary shale bedrock within a depth of 20 inches.

Associated sites

R055DY011SD	**Clayey** This site occurs lower the landscape. The subsoil forms a ribbon >2 inches long. Typically, the surface and upper subsoil do not effervesce, but very slight effervescence is allowed. Where a highly calcareous subsoil layer occurs, it is deeper than 16 inches.
R055DY020SD	**Loamy Overflow** This site occurs on upland foot slopes and swales and on base slopes of escarpments; it receives significant additional water as run-on from adjacent slopes. The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055DY008SD	**Sands** This site occurs lower on the landscape on till plains mantled with loamy fine sand or fine sand eolian deposits. The soil does not form a ribbon below a depth of 10 inches. Typically, the surface and upper subsoil do not effervesce, but very slight effervescence is allowed. Where a highly calcareous subsoil layer occurs, it is deeper than 16 inches.
R055DY009SD	**Sandy** This site occurs lower on the landscape on till plains mantled with fine sandy loam or sandy loam eolian deposits. The surface and subsoil layers form a ribbon (<1 inch long) to a depth >10 inches. Typically, the surface and upper subsoil do not effervesce, but very slight effervescence is allowed. Where a highly calcareous subsoil layer occurs, it is deeper than 16 inches.
R055DY043SD	**Shallow Loamy** This site occurs on some escarpments and ridges. 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.
R055DY010SD	**Loamy** This site occurs on linear slopes - typically lower on the landscape, but some occur on broad summits. The surface and subsoil layers form a ribbon 1 to 2 inches long. Typically, the surface and upper subsoil do not effervesce, but very slight effervescence is allowed below a depth of 7 inches. The depth to slight to violent effervescence is >8 inches.

Similar sites

R055DY010SD	**Loamy** This site typically occurs on linear slopes on till plains and lake plains on run-off landscape positions; it also occurs on high terraces which are no longer impacted by flooding. The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055DY043SD	**Shallow Loamy** This site occurs on some escarpments and ridges. 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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Hesperostipa spartea*

Physiographic features

This site occurs on glaciated uplands – till plains, lake plains, and escarpments. It is on shoulder slopes, convex rises, ridges and summits. Parent materials are till (fine-loamy or coarse-loamy) or glaciolacustrine sediments (fine-silty or coarse-silty).

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Lake plain (3) Escarpment
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	299–649 m
Slope	8–17%
Ponding depth	0 cm
Water table depth	119–180 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation of MLRA 55D is 22 to 23 inches (549 to 594 millimeters). About 75 percent of the rainfall comes from high-intensity, convective thunderstorms during the growing season. Winter precipitation is typically snow. The average annual snowfall is 25 to 50 inches (635 to 1,270 millimeters). Strong winds commonly deposit the snow unevenly across the landscape. The average annual temperature is 43 to 45 degrees F (6 to 7 degrees C). The freeze-free period averages about 135 days and ranges from 120 to 150 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	114-117 days
Freeze-free period (characteristic range)	129-134 days
Precipitation total (characteristic range)	559-584 mm
Frost-free period (actual range)	114-119 days
Freeze-free period (actual range)	127-134 days
Precipitation total (actual range)	559-584 mm
Frost-free period (average)	116 days
Freeze-free period (average)	131 days
Precipitation total (average)	584 mm

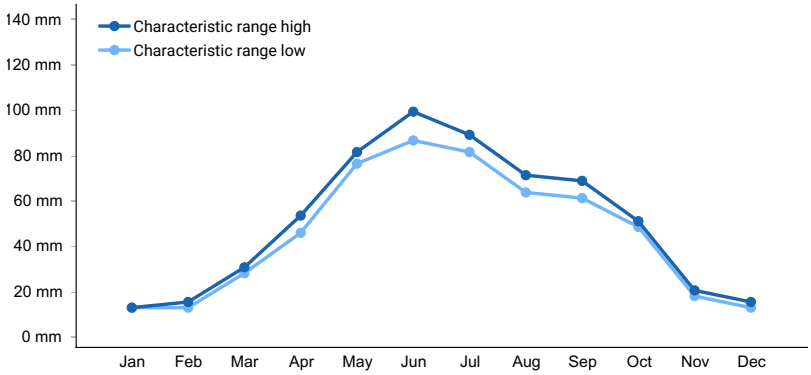


Figure 1. Monthly precipitation range

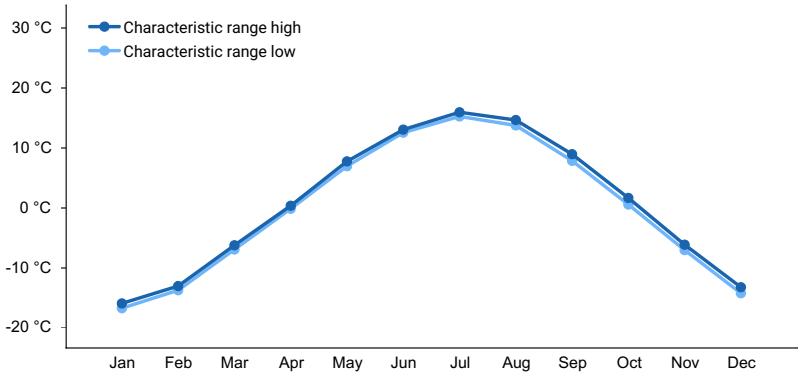


Figure 2. Monthly minimum temperature range

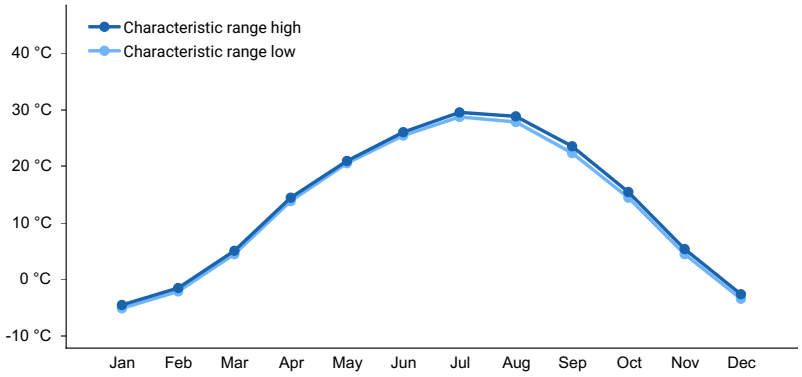


Figure 3. Monthly maximum temperature range

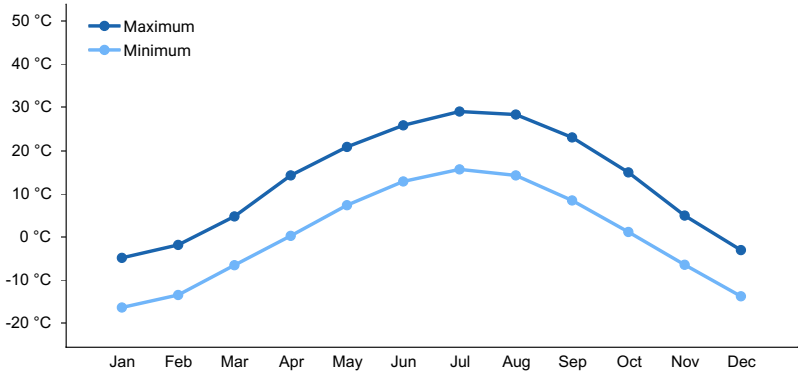


Figure 4. Monthly average minimum and maximum temperature

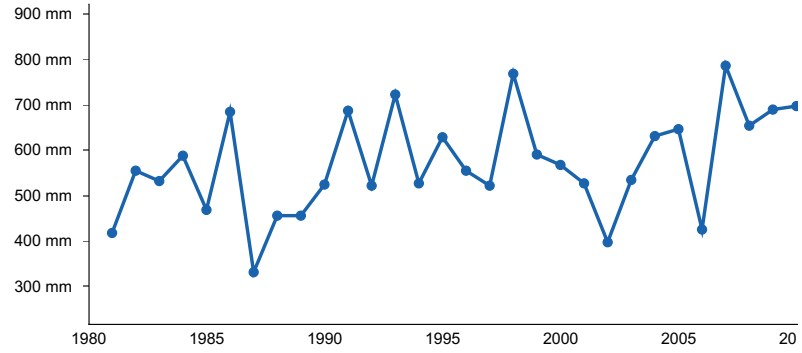


Figure 5. Annual precipitation pattern

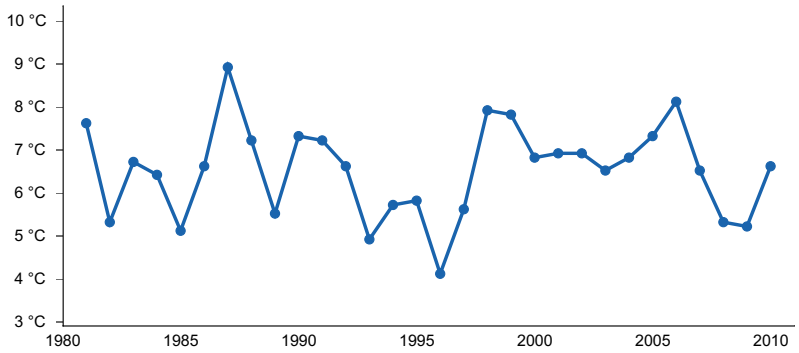


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BRITTON [USC00391049], Britton, SD
- (2) ANDOVER #2 [USC00390120], Andover, SD
- (3) TURTON [USC00398420], Turton, SD
- (4) CONDE [USC00391917], Conde, SD
- (5) REDFIELD [USC00397052], Redfield, SD
- (6) MELLETTE 4 W [USC00395456], Northville, SD
- (7) ABERDEEN [USW00014929], Aberdeen, SD
- (8) COLUMBIA 8 N [USC00391873], Columbia, SD

Influencing water features

This site does not receive additional water as runoff from adjacent slopes; it is on a run-off landscape position. Neither does it receive significant additional water from a seasonal high water table. Depth to the water table is commonly deeper than 6 feet throughout the growing season. On some soils with slopes less than 6 percent, the water table may be as shallow as 4 feet during the months of April through June; and deeper than 6 feet the rest of the growing season. Surface infiltration is moderately slow or moderate. Saturated hydraulic conductivity throughout the profile is moderately high. Water loss is through percolation below the root zone and evapotranspiration.

Wetland description

Not Applicable.

Soil features

Soils associated are in the Mollisol and Inceptisol orders. The Mollisols are classified further as Typic Calciudolls. The Inceptisols are classified further as Typic Eutrudepts. These soils were developed under prairie vegetation. They formed in till or glaciolacustrine sediments.

The common features of soils in this site are the medium and moderately fine textures throughout (surface and subsoil layers form a ribbon 1 to 2 inches long) and an accumulation of calcium carbonate within a depth of 8 inches. The soils typically are very deep; however, a few soils on escarpments have shale beds as shallow 20 inches. The drainage class is well drained or moderately well drained. Where present, redoximorphic features are typically deeper than 4 feet; however, on low-relief rises, they may be visible as shallow as 2.5 feet. Surface textures typically are loam or silt loam; but very fine sandy loam, clay loam, and silty clay loam also occur.

It is not uncommon to have some pedestaling of plants due to the inherent instability of the soils. Water flow paths are broken, irregular in appearance, or discontinuous. There is a risk of rills and eventually gullies if vegetative cover is not adequate. Crypto-biotic crusts are present. Sub-surface soil layers are non-restrictive to water movement and root penetration. These soils are highly susceptible to water erosion and, to a lesser degree, wind 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.

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

Major soil series correlated to the Thin Loamy site are: Balaton, Buse, Esmond, Langhei, Sisseton, and Zell. Also, currently included in South Dakota is the Huffton soil; however, it has soil chemistry properties outside the described range (see Site Development and Testing Plan below).

Access Web Soil Survey (http://websoilsurvey.nrcs.gov/app/) for specific local soils information.

Table 4. Representative soil features

Parent material	(1) Till (2) Glaciolacustrine deposits
Surface texture	(1) Loam (2) Silt loam (3) Clay loam (4) Fine sandy loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	203 cm
Soil depth	203 cm
Surface fragment cover <=3"	1–8%
Surface fragment cover >3"	0–2%
Available water capacity (0-152.4cm)	15.75–19.81 cm
Calcium carbonate equivalent (0-101.6cm)	7–31%
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.5
Subsurface fragment volume <=3" (0-101.6cm)	1–7%
Subsurface fragment volume >3" (0-101.6cm)	0%

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 1.1 Bluestem/ Needlegrass/ Sideoats Grama plant community. The 1.1 Bluestem/Needlegrass/Sideoats Grama plant community 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.

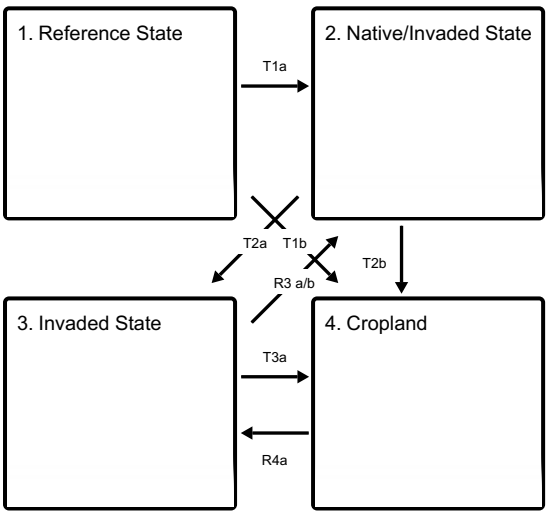
This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence, causes this site to depart from the reference plant community. Species such as western wheatgrass and blue grama and, if present, Kentucky bluegrass will initially increase. Little bluestem will initially remain in the plant community but will decline with continued disturbance. Western wheatgrass will increase initially and then begin to decrease. Porcupine grass and/or green needlegrass, plains muhly, and sideoats grama 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. Remnant little bluestem plants may be present but are reduced in vigor. Shrubs such as western snowberry and silverberry 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.

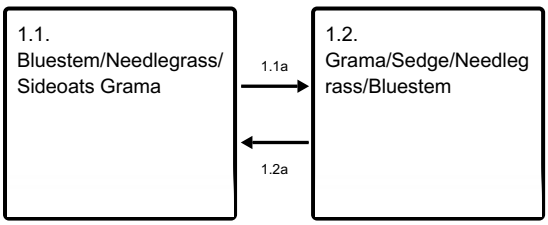
The following diagram illustrates the common states, community phases, community pathways, transitions and restoration pathways that can occur on the site.

State and transition model

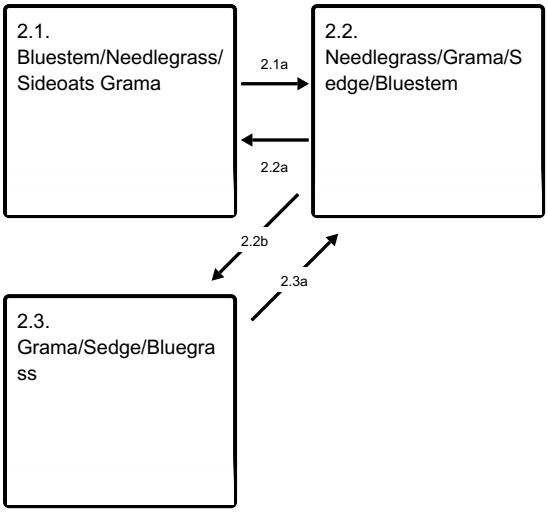
Ecosystem states



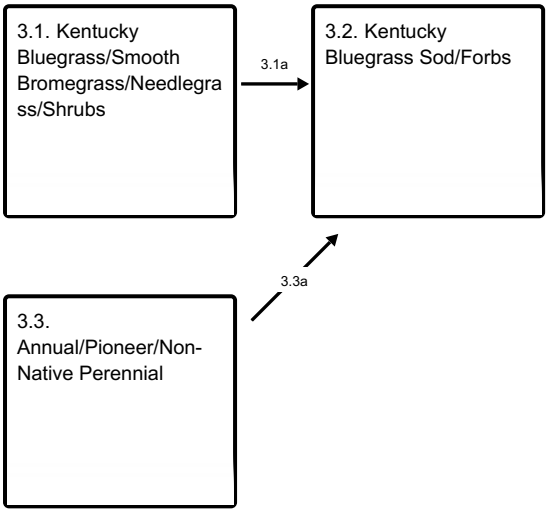
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

This state represents the natural range of variability that dominated the dynamics of this ecological site. Historically, this state was dominated by mid statured warm and cool season bunch grasses. The primary disturbance mechanisms for this site in the reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Dominance would have shifted between the warm/cool season mid statured bunchgrass phase and the short statured warm season/grass-like phase due to changes in precipitation patterns, fire frequency, and grazing frequency/intensity Individual species would have varied greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Slight shifts would have occurred in the timing of energy capture, hydrologic function and nutrient cycling between plant community phases within State 1. High basal density, minimal bare ground, and deep root systems resulted in low runoff rates and high infiltration. Overall, the ecological processes were functioning near optimum levels.

Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- American vetch (*Vicia americana*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous

- upright prairie coneflower (*Ratibida columnifera*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous
- blazing star (*Liatris*), other herbaceous

Community 1.1
Bluestem/Needlegrass/Sideoats Grama

This plant community phase consisted of about 85% grasses or grass-like plants, 10% forbs and 5% shrubs. Little bluestem, porcupine grass, green needlegrass and sideoats grama dominated this plant community phase with lesser amounts of needleandthread, plains muhly, Canada wildrye, prairie junegrass, blue grama and red threeawn. Minor amounts of big bluestem and prairie sandreed would have been present. Major forbs and shrubs included American vetch, gayfeather, goldenrods, prairie coneflower, scurfpea, western yarrow, fringed sagewort, leadplant and rose. This represents the plant community phase upon which interpretations are primarily based. Community dynamics, nutrient cycling, water cycle and energy flow were functioning at near optimum levels. Dominance by bunchgrasses, minimal bare ground, litter in contact with the soil surface and deep rooted plants would have resulted in high infiltration rates and minimal runoff. Due to the balance between warm and cool season grasses, energy capture would have been spread across the entire growing season. Natural plant mortality was low. The diversity in plant species allowed for high drought tolerance.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1407	2195	3430
Forb	118	185	252
Shrub/Vine	45	86	129
Total	**1570**	**2466**	**3811**

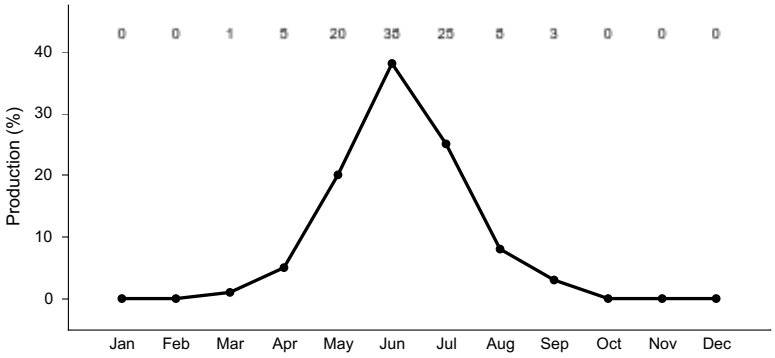


Figure 8. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Community 1.2
Grama/Sedge/Needlegrass/Bluestem

This plant community shift results from heavy, frequent grazing over a period of several years and/or several consecutive years of below normal precipitation. This increase in grazing pressure may have resulted from proximity to a water source, changes in fire frequency and/or prolonged drought. Grasses and grass-like species would have still dominated this phase but the overall productivity of these species would have been reduced and the number and amount of forbs would have increased. Big bluestem, little bluestem, sideoats grama, western wheatgrass and the needlegrasses were reduced in amount but were still present within the plant community. Less palatable forbs such as silverleaf scurfpea, cudweed sagewort, prairie coneflower and green sagewort become more prevalent in the plant community. Shrubs such as fringed sagewort and broom snakeweed would have been the principal shrubs. The shift to the shallower rooted, short statured blue grama and sedges coupled with an increase in bare ground results in lower infiltration rates and higher soil surface temperatures as compared to plant community phase 1.1. This reduction in infiltration would have resulted in a short term increase in the number and size of water flow patterns. While the timing of energy capture would have remained similar to that of plant

community phase 1.1, total energy capture may have been slightly reduced due to a decrease in overall leaf area.

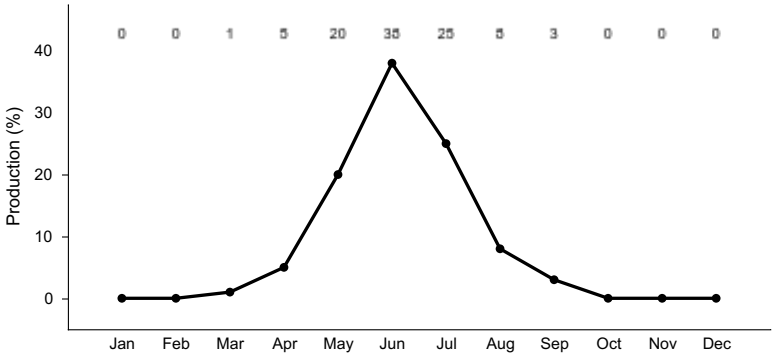


Figure 9. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Pathway 1.1a
Community 1.1 to 1.2

Repeated heavy grazing either due to proximity to water or following short term fire intervals followed by intense grazing will convert the dominance to short stature grasses such as blue grama and upland sedges. This shift may have been facilitated by periods of below normal precipitation.

Pathway 1.2a
Community 1.2 to 1.1

A return to normal precipitation patterns, grazing and fire regime allows for recovery of mid statured cool and warm-season grasses.

State 2
Native/Invaded State

This state is 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 still has a strong component of warm and cool season bunch grass species, 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 of fires and grazing coupled with weather events dictate the dynamics that occur within this state. The warm-season native grass 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.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- upright prairie coneflower (*Ratibida columnifera*), other herbaceous
- blazing star (*Liatris*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous

Community 2.1
Bluestem/Needlegrass/Sideoats Grama

This community phase most closely resembles plant phase 1.1in appearance and ecological functions (e.g.,

hydrologic, biotic and soil/site stability). The warm-season dominated community is maintained with grazing systems that allow for adequate recovery periods following grazing events, and potentially the combination of grazing and prescribed burning which closely mimics the natural disturbance regime. This community phase is dominated by mid warm-season and mid cool-season bunch grasses such as little bluestem, porcupine grass, needleandthread, and sideoats grama. Other grass and grass-likes species occurring include green needlegrass, prairie Junegrass, western wheatgrass, slender wheatgrass, bearded wheatgrass, blue grama, and sedge. Grasses and grass-like species comprise about 85% of the plant community production. A variety of leguminous and non-leguminous perennial forbs include such as prairie coneflower, gayfeather, scurfpea and goldenrod. Forbs would constitute about 10% of the plant community. Shrubs such as leadplant, rose and fringed sagewort would comprise about 5% of the plant community. The ecological processes are functioning at levels very close to those of plant community phase 1.1. Slight departure might be noted within the functional/structural indicator due to the present of a functional/structural group(s) not expected for the site. The basic difference between this community phase and 1.1 of the Reference State is the presence of minor amounts of introduced cool-season grasses and forbs. This is likely a naturally nitrogen deficient plant community, but perhaps less so than the Reference State. A change in the nutrient cycle on this ecological site possibly due to the introduction of non-native leguminous species such as sweet clover may be a causative factor leading to the eventual dominance of cool-season introduced grasses in the Invaded State.

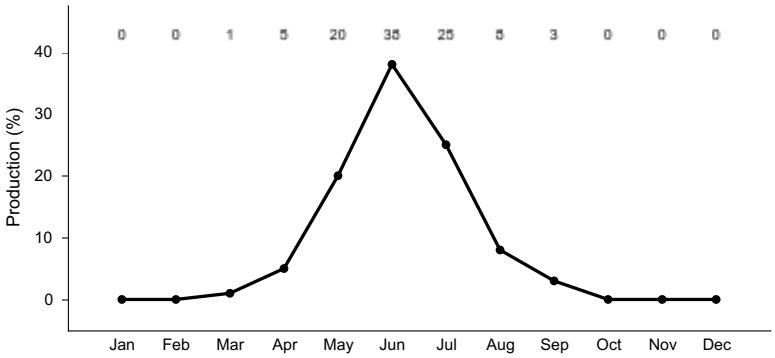


Figure 10. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Community 2.2
Needlegrass/Grama/Sedge/Bluestem

Cool season bunch grasses such as porcupine grass and needleandthread become dominant as the mid statured warm season bunch grasses succumb to the pressure of heavy late season grazing. Kentucky bluegrass will begin to increase. This community phase is often dispersed throughout the site, in an overgrazed/undergrazed pattern, typically referred to as patch grazing. Some areas (overgrazed) will exhibit the impacts of heavy use, while other areas (undergrazed) will have a build-up of litter and a high amount of plant decadence. This is a typical pattern found in properly stocked, season-long grazed pastures. In the undergrazed patches, litter buildup reduces plant vigor and density, and native seedling recruitment declines. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to small colonies. In the overgrazed patches, plant vigor is reduced and the competitive advantage shifts toward the grazing tolerant short statured species such as Kentucky bluegrass, blue grama, and sedge. Common forbs within this plant community phase include; prairie coneflower, scurfpea, goldenrod, heath aster, green sagewort, cudweed sagewort and wavyleaf thistle. Leadplant, rose and fringed sage are the principal shrubs. Energy capture for this plant community phase would shift to earlier in the growing season due to the increased presence of cool season grasses. As blue grama and sedges become more dominant, infiltration rates would begin to decrease and runoff would increase. A shift in the dominant functional/structural group would also be noted with the mid statured warm season bunchgrasses being replaced by the mid statured cool season bunchgrasses.

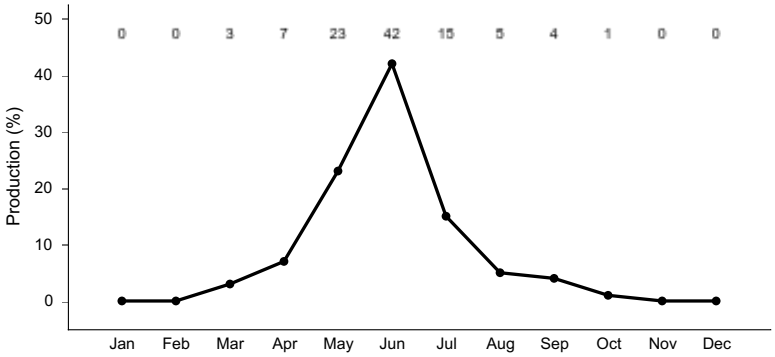


Figure 11. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 2.3
Grama/Sedge/Bluegrass

This plant community shift results from heavy continuous or heavy continuous season-long grazing over a period of several years. Blue grama becomes the dominant grass with lesser amounts of upland sedges and Kentucky bluegrass. These grazing tolerant short statured grasses and grass-likes out compete and replace species such as big bluestem, little bluestem, western wheatgrass and the needlegrasses. Common forbs would include goldenrod, green sagewort, western salsify, heath aster, western yarrow, scurfpea and western ragweed. Fringed sagewort, and prairie rose are the principal shrubs. The shift in the plant community composition results in changes to how the ecological processes function on this site. Infiltration for this plant community phase is reduced when compared to plant community phases 1.1 and 2.1. Since the ratio of warm-season to cool-season plants within this community phase is similar to 2.1, the timing of energy capture is not altered but overall energy capture would be less due to the reduction in total leaf surface area available to capture solar energy. This plant community phase represents an “at risk” plant community. Due to the amount of Kentucky bluegrass present and the reduced competitive abilities of the associated native species, the possibility exists for this community to cross a threshold and transition to State 3, Invaded State. Therefore, caution needs to be applied when developing and implementing restoration strategies for this plant community phase.

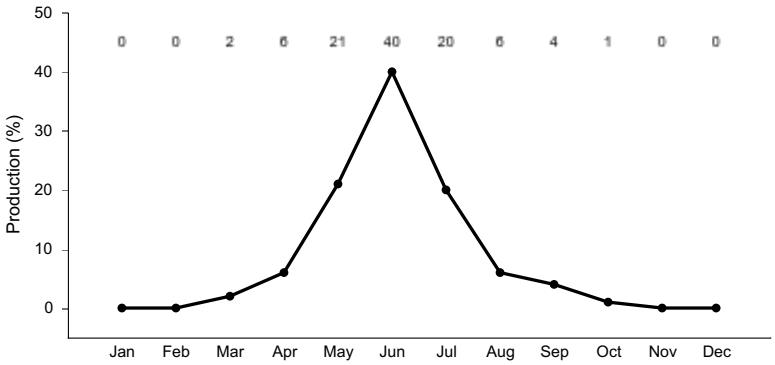


Figure 12. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Pathway 2.1a
Community 2.1 to 2.2

Heavy continuous grazing or heavy late seasonal grazing will shift this plant community from a dominance of warm season bluestems to a dominance of cool season needlegrasses and sedges.

Pathway 2.2a
Community 2.2 to 2.1

Prescribed grazing with adequate recovery periods will shift the competitive advantage to the mid statured warm season bunch grasses.

Pathway 2.2b
Community 2.2 to 2.3

Heavy continuous grazing or heavy continuous season-long grazing allows the grazing tolerant short stature grasses and sedges to become more competitive and dominant

Pathway 2.3a
Community 2.3 to 2.2

This community pathway is initiated by implementation of prescribed grazing management which includes adequate recovery periods following each grazing event, and stocking levels which match the available resources. If properly implemented, this will shift the competitive advantage from the introduced cool-season species to the mid warm and cool-season bunchgrass species. Kentucky bluegrass will remain in this community at varying amounts dependant on the level of management. Caution should be exercised when initiating this restoration pathway to ensure the Kentucky bluegrass doesn't increase, resulting in unexpectedly crossing the threshold to State 3, Invaded State.

State 3
Invaded State

This state is the result of invasion and dominance of Kentucky bluegrass and/or smooth bromegrass. This state is characterized by these two species and an increasing litter layer that effectively blocks introduction of other plants into the system and/or prevents existing native plants from effectively competing for resources. Once this state is well established, even drastic events such as high intensity fires driven by high fine fuel loads of litter 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.

Dominant plant species

- western snowberry (*Symphoricarpos occidentalis*), shrub
- silverberry (*Elaeagnus commutata*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- goldenrod (*Solidago*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- upright prairie coneflower (*Ratibida columnifera*), other herbaceous
- western ragwort (*Packera hesperia*), other herbaceous
- curlycup gumweed (*Grindelia squarrosa*), other herbaceous

Community 3.1
Kentucky Bluegrass/Smooth Bromegrass/Needlegrass/Shrubs

This plant community is dominated by Kentucky bluegrass (60 to 70% of total production) but remnants of little bluestem and porcupine grass are still present. Forbs, such as goldenrod, heath aster, scurfpea, and prairie coneflower may make up to 5 to 15% of the production. Shrubs including silverberry and western snowberry are present making up as much as 20 to 35% of the total production. With continued non-use, smooth bromegrass may increase, becoming the dominant herbaceous component. The presence of a thick litter layer is common for this plant community phase. This heavy litter layer intercepts sunlight and cools the soil surface, favoring the shade tolerant cool-season invasive grasses and shrubs. The thick litter layer also intercepts precipitation from small rainfall events making them ineffective for plant growth. Initial infiltration rates may be similar to the reference plant community. However, field observations have noted that the root mat formed by the Kentucky bluegrass sod tends to be hydrophobic until completely saturated. In addition, due to the shallow rooting depth of the dominant species, infiltration rates will decline as downward movement of water is limited by reduced soil porosity below the rooting zone. Energy capture is shifted to early May through mid June and is reduced due to the high amount of plant litter

and reduced plant vigor.

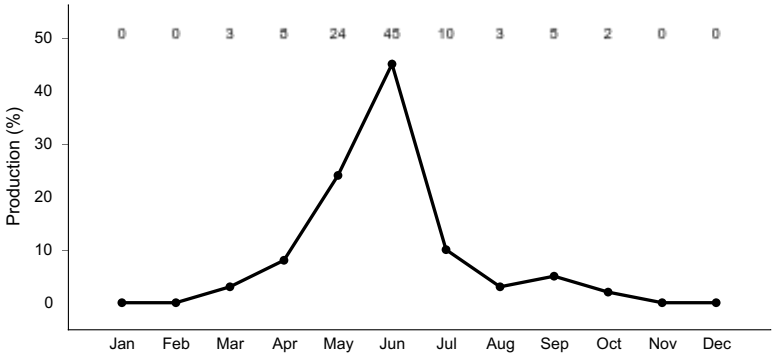


Figure 13. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Kentucky Bluegrass Sod/Forbs

This plant community is dominated by Kentucky bluegrass. Forbs may include western ragweed, goldenrod, pussytoes, gumweed, and green sage. Shrubs would include fringed sagewort and western snowberry. Due to the continuous, heavy grazing pressure, Kentucky bluegrass forms a dense sod. This dense Kentucky bluegrass sod greatly reduces infiltration and increases runoff. Due to the lack of bare ground and the dense sod, soil erosion is minimal. However, due to higher runoff, gullies may form on adjacent sites such as loamy and loamy overflow. Energy capture is shifted to early May through mid June.

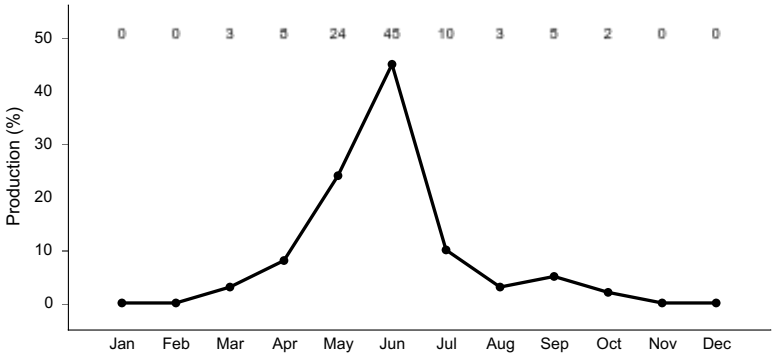


Figure 14. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.3
Annual/Pioneer/Non-Native Perennial

The community phase is highly variable depending on the level and duration of disturbance related to the T4 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. Over time, introduced cool-season perennial grasses and possibly invasive noxious weeds will begin to establish on this site.

Pathway 3.1a
Community 3.1 to 3.2

Heavy continuous grazing or heavy continuous season-long grazing will result in a shift to plant community phase 3.2.

Pathway 3.3a
Community 3.3 to 3.2

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.

State 4
Cropland

This state is the result of annual cropping

Transition T1a
State 1 to 2

This is the transition from the native warm-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 warm and cool season bunch grasses and an increase in cool-season sodgrasses. This transition is compounded by a change in the historic grazing and fire regime where native herbivores would follow periodic fires with grazing. This historic grazing/fire sequence has largely been replaced by chronic season-long or heavy late season grazing. Complete rest from grazing and suppression of fire can also lead to this transition. The threshold between states is crossed when Kentucky bluegrass, smooth brome, and other introduced species become established on the site. These species typically are part of functional/structural groups that were not present in the Reference State.

Transition T1b
State 1 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Transition T2a
State 2 to 3

Non-use and no fire. Lack of disturbances shifts the competitive advantage to the non-native species.

Transition T2b
State 2 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Restoration pathway R3 a/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. Caution with the first series of burns is needed so as not to damage crowns of remnant native grasses. R3b - This pathway requires the use of range seeding using native species adapted to this site. 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, possibly in conjunction with prescribed burning 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 grasses, management objectives must include the maintenance of those species, the associated reference state functions, and continued treatment of the introduced sodgrasses or the seeding will revert to 3.1.

Transition T3a

State 3 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Restoration pathway R4a
State 4 to 3

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

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid Warm-season Grasses**			247–912	
	little bluestem	SCSC	*Schizachyrium scoparium*	370–616	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	49–173	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	25–123	–
2	**Needlegrass**			247–616	
	porcupinegrass	HESP11	*Hesperostipa spartea*	123–616	–
	green needlegrass	NAVI4	*Nassella viridula*	123–247	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	49–247	–
	shortbristle needle and thread	HECU9	*Hesperostipa curtiseta*	0–123	–
3	**Tall Warm-season Grasses**			49–197	
	big bluestem	ANGE	*Andropogon gerardii*	25–197	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	25–197	–
4	**Other Native Grasses**			25–247	
	Grass, perennial	2GP	*Grass, perennial*	0–123	–
	blue grama	BOGR2	*Bouteloua gracilis*	25–123	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	25–123	–
	western wheatgrass	PASM	*Pascopyrum smithii*	49–123	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	25–49	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–49	–
	spikeoat	AVHO3	*Avenula hookeri*	0–49	–
5	**Grass-likes**			25–123	
	sedge	CAREX	*Carex*	25–123	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–49	–
Forb					
6	**Forbs**			123–247	
	Forb, perennial	2FP	*Forb, perennial*	0–74	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–74	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	25–49	–
	blazing star	LIATR	*Liatris*	25–49	–
	scurfpea	PSORA2	*Psoralidium*	25–49	–

	cutleaf anemone	PUPAM	*Pulsatilla patens ssp. multifida*	25–49	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	25–49	–
	goldenrod	SOLID	*Solidago*	25–49	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	25–49	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–49	–
	Forb, annual	2FA	*Forb, annual*	0–49	–
	prairie clover	DALEA	*Dalea*	25–49	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	25–49	–
	American vetch	VIAM	*Vicia americana*	25–49	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–25	–
	spiny phlox	PHHO	*Phlox hoodii*	0–25	–
	milkvetch	ASTRA	*Astragalus*	0–25	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–25	–
	onion	ALLIU	*Allium*	0–25	–
	pussytoes	ANTEN	*Antennaria*	0–25	–
	field sagewort	ARCA12	*Artemisia campestris*	0–25	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–25	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–25	–
Shrub/Vine					
7	**Shrubs**			49–123	
	leadplant	AMCA6	*Amorpha canescens*	25–74	–
	prairie sagewort	ARFR4	*Artemisia frigida*	25–49	–
	silverberry	ELCO	*Elaeagnus commutata*	0–49	–
	rose	ROSA5	*Rosa*	25–49	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–25	–
	dwarf false indigo	AMNA	*Amorpha nana*	0–25	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–25	–

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; David Dewald, NRCS State Biologist; Jody Forman, 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.

MLRA 55D was split from MLRA 55B in 2022. Many of the site concepts for this MLRA are borrowed from neighboring MLRA 55B pending further vegetation and soils validation.

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Approval

Suzanne Mayne-Kinney, 11/14/2024

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)	
Contact for lead author	
Date	11/14/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

   _____

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

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

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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

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:

    Sub-dominant:

    Other:

    Additional:

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

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**