USDA Natural Resources Conservation Service

Ecological site R055DY043SD
Shallow Loamy

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

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 Shallow Loamy ecological site is located on escarpments and uplands dissected by streams and rivers. The soils are shallow (10 to 20 inches) to soft sedimentary shale bedrock. The surface layer is dark colored to a depth of 7 inches or more. Typically, the texture above the shale is loam or clay loam, but silt loam and silty clay loam also occur; the soil forms a ribbon 1 to 2 inches long. Some soils are channery at the surface - most are channery in the layer just above the bedded shale. Soil on this site is well drained. Slopes range from 9 to 35 percent. On the landscape, this site is above the Clayey, Loamy, Loamy Overflow, and Thin Claypan ecological sites. The Thin Loamy ecological site occurs on similar landscape positions; it is deeper than 20 inches to soft sedimentary shale bedrock and is highly calcareous near the surface.

Associated sites

R055DY020SD	**Loamy Overflow** Loamy Overflow - This site occurs on base slopes with less than 6 percent slope – a run-on position. The soil is >40 inches to soft sedimentary shale bedrock. The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055DY010SD	**Loamy** Loamy - This site is lower on the landscape on linear slopes with slopes >6%. The soil is >20 inches to soft sedimentary shale bedrock. The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055DY015SD	**Thin Claypan** Thin Claypan - This site is lower on the landscape. The soil is >20 inches to soft sedimentary shale bedrock. It has a root-restrictive claypan layer within a depth of 6 inches and accumulated salts within 16 inches.
R055DY012SD	**Thin Upland** Thin Loamy - This site occurs on similar or higher landscape positions. It is >20 inches to bedded shale and is highly calcareous (strong or violent effervescence) within a depth of 8 inches.
R055DY011SD	**Clayey** Clayey - This site is lower on the landscape. The soil is >20 inches to soft sedimentary shale bedrock. The subsoil forms a ribbon >2 inches long.

Similar sites

R055DY011SD	**Clayey** Clayey - This site is lower on the landscape. The soil is >20 inches to soft sedimentary shale bedrock. The subsoil forms a ribbon >2 inches long.
R055DY016SD	**Very Shallow** Very Shallow - This site is on similar landscape positions. The soil is <10 inches to soft sedimentary shale bedrock.
R055DY012SD	**Thin Upland** Thin Loamy - This site occurs on similar or higher landscape positions. It is >20 inches to bedded shale and is highly calcareous (strong or violent effervescence) within a depth of 8 inches.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on escarpments and uplands. It is on ridges, upper side slopes, and nose slopes. These typically occur above river valleys or stream flood plains. The parent material is a thin cap of till or colluvium over soft shale residuum. Slopes typically range from 9 to 35 percent.

Table 2. Representative physiographic features

Landforms	(1) Escarpment (2) Moraine
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	299–651 m
Slope	9–35%

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

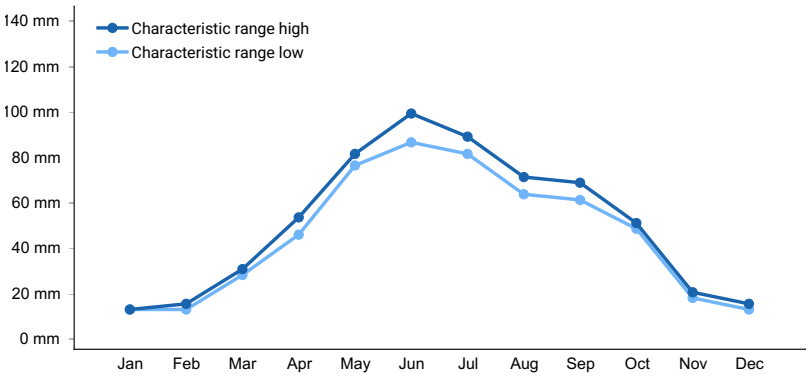


Figure 1. Monthly precipitation range

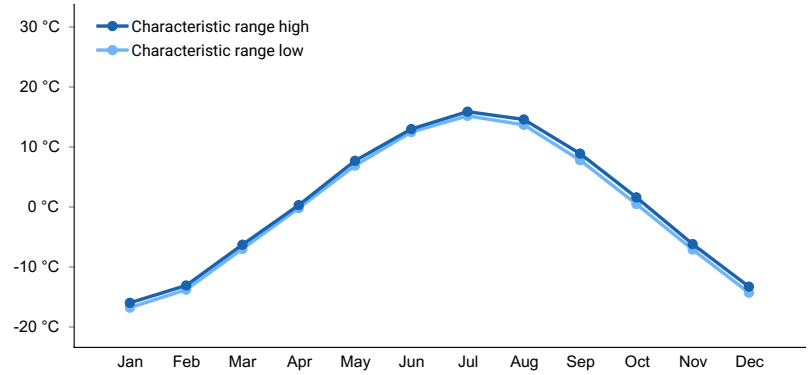


Figure 2. Monthly minimum temperature range

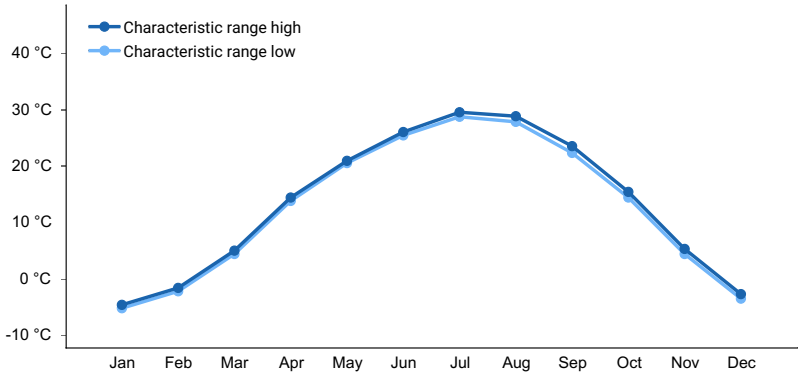


Figure 3. Monthly maximum temperature range

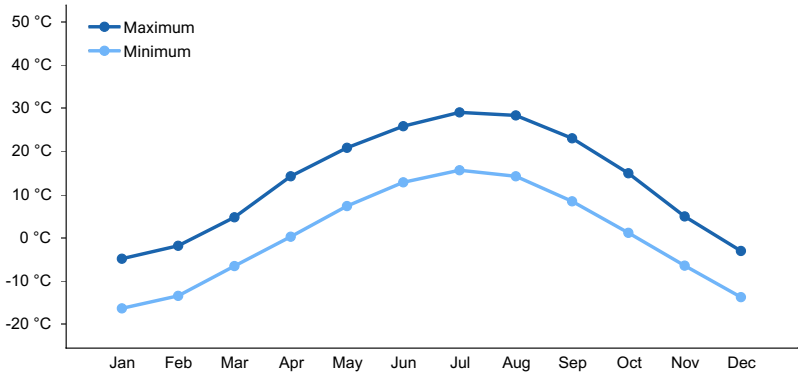


Figure 4. Monthly average minimum and maximum temperature

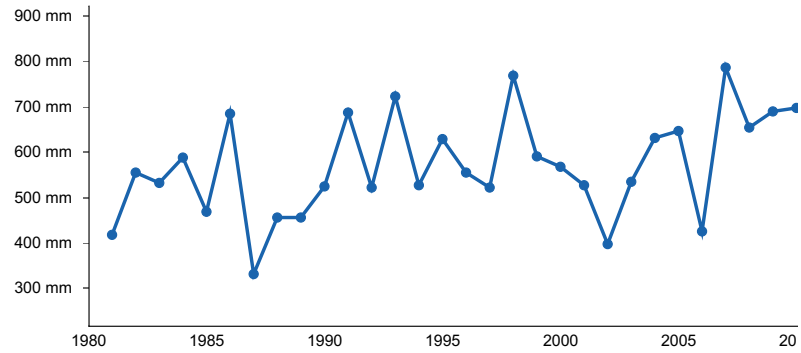


Figure 5. Annual precipitation pattern

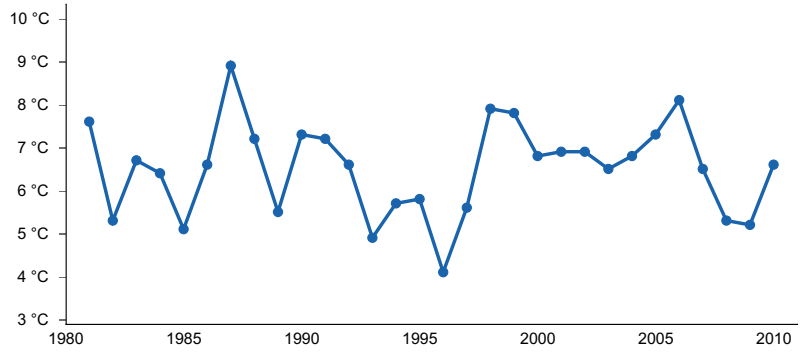


Figure 6. Annual average temperature pattern

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.

Wetland description

Not Applicable.

Soil features

Soils associated with Shallow Loamy ES are in the Mollisol order and are classified further as Entic Hapludolls. These soils formed in a thin cap of till or colluvium over soft shale residuum. They are well drained. The common features of soils in this site are a medium or moderately fine texture (forms a ribbon 1 to 2 inches long) and a shallow depth (10 to 20 inches) to a root-restrictive layer of soft sedimentary shale bedrock. Typically, the texture above the restrictive layer is loam or clay loam, but silt loam and silty clay loam also occur. Some soils are channery at the surface; most are channery in the layer just above the bedded shale.

Above the shale bedrock, soil salinity is none or very slight (E.C. <2); sodicity is typically none; soil reaction is slightly acid to moderately alkaline (pH 6.1 to 8.4) in most soils and calcium carbonate content is none to moderate.

It is common 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. The shale bedrock is 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.

Major soil series correlated to the Shallow Loamy site are: Kloten.

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) Residuum–shale
Surface texture	(1) Loam (2) Clay loam (3) Silt loam (4) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	25–76 cm
Soil depth	25–76 cm
Surface fragment cover <=3"	0–6%
Surface fragment cover >3"	0–5%
Available water capacity (0-152.4cm)	7.37–14.48 cm

Calcium carbonate equivalent (0-101.6cm)	0–10%
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0–16%
Subsurface fragment volume >3" (0-101.6cm)	0–5%

Ecological dynamics

The site developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores, frequent fire, and other biotic and abiotic factors that typically influence soil/site development. 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 Bluestem/Needlegrass/Sideoats Grama Community Phase (1.1). This 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.

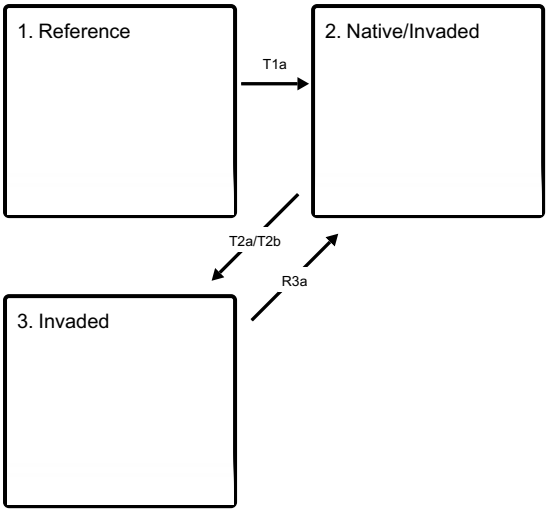
The natural disturbance regime consisted of frequent fires caused both by natural and Native American ignition sources. These fires occurred during any season of the year, but were concentrated in the spring and late summer or early fall. Lightning fires occurred most frequently in July and August while 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.

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.

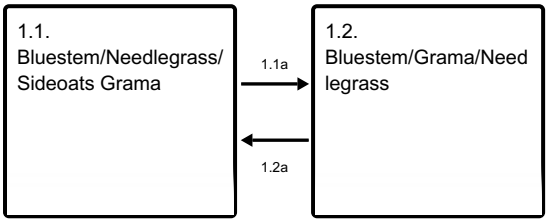
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best 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.

State and transition model

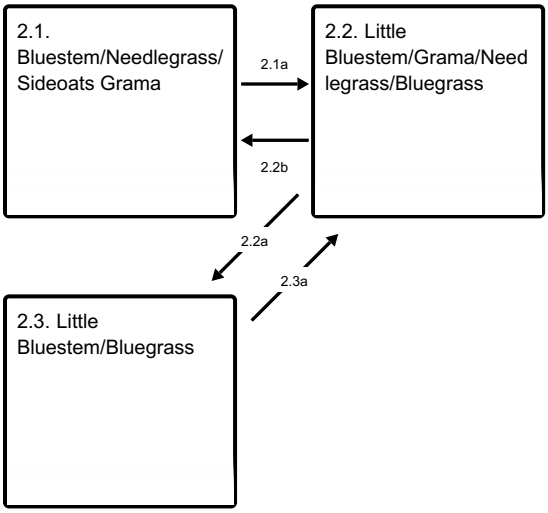
Ecosystem states



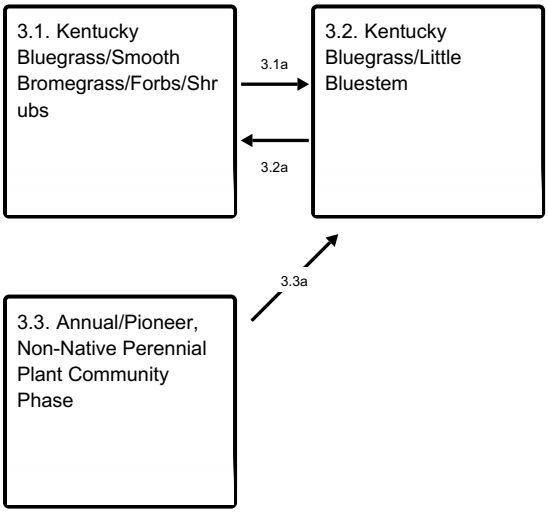
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

This state represents the natural range of variability that dominated the dynamics of this ecological site. This state was dominated by warm-season grasses, with cool-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and/or above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. In some locations, this site likely received relatively heavy grazing pressure. Tall warm-season grasses would have declined, and cool-season bunchgrasses and short to mid-statured warm-season grasses would have increased. Today, a similar state (State 2) can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- green needlegrass (*Nassella viridula*), grass
- goldenrod (*Solidago*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous

Community 1.1
Bluestem/Needlegrass/Sideoats Grama

Interpretations are based primarily on the Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (this is also considered to be climax). The potential vegetation was about 80 percent grasses or grass-like plants, 10 percent forbs, and 8 percent shrubs. The community was dominated by warm-season grasses, with cool-season grasses being subdominant. The major grasses included little bluestem, big bluestem, Indiangrass, sideoats grama, porcupine grass, and green needlegrass. Other grass or grass-like species included plains muhly, prairie sandreed, Canada wildrye, slender wheatgrass, needle and thread, western wheatgrass, blue grama, and threadleaf sedge. This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high drought tolerance. This was a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1457	2096	2690
Shrub/Vine	112	185	280
Forb	112	185	280
Total	**1681**	**2466**	**3250**

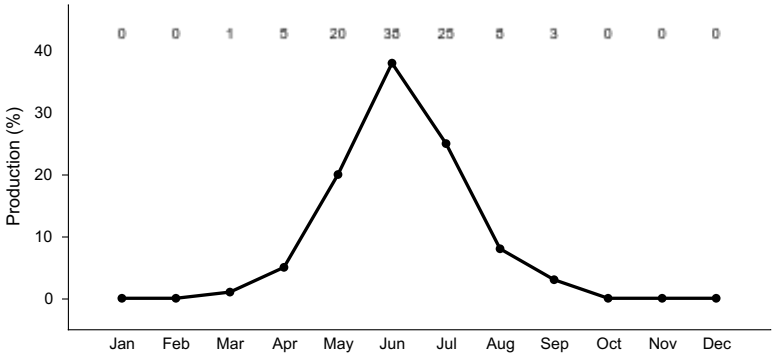


Figure 8. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Community 1.2
Bluestem/Grama/Needlegrass

This plant community evolved under heavy continuous grazing due to proximity to perennial water sources or from over utilization during extended drought periods. The potential plant community was made up of approximately 75 percent grasses and grass-like species, 20 percent forbs, and 5 percent shrubs. Dominant grasses included little bluestem, blue grama, and needleandthread. Grasses of secondary importance included western wheatgrass, prairie sandreed, plains muhly, blue grama, and threadleaf sedge. Forbs commonly found in this plant community included goldenrod, cudweed sagewort, heath aster, scurfpea, western ragweed, and western yarrow. When compared to the Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), little bluestem and blue grama increased. Production of tall warm-season and mid cool-season bunchgrasses was reduced. This plant community was moderately resistant to change. The herbaceous species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term. Most of the components of the ecological processes would have been functioning at optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses would have been reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allowed for an increase in shorter-statured (and shallower rooted) species.

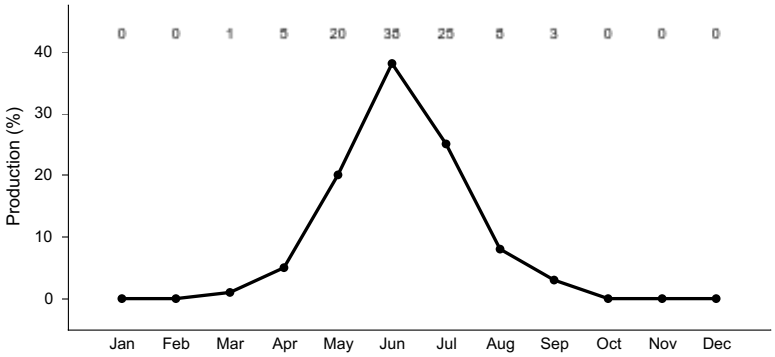


Figure 9. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

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 shift the dominance to shorter statured 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 tall

warm-season grasses.

State 2
Native/Invaded

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
- green needlegrass (*Nassella viridula*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- threadleaf sedge (*Carex filifolia*), grass
- goldenrod (*Solidago*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous

Community 2.1
Bluestem/Needlegrass/Sideoats Grama

This community phase most closely resembles plant phase 1.1 in 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, green needlegrass, and sideoats grama. Other grass and grass-likes species occurring include needle and thread, 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 species 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 Phase 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.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
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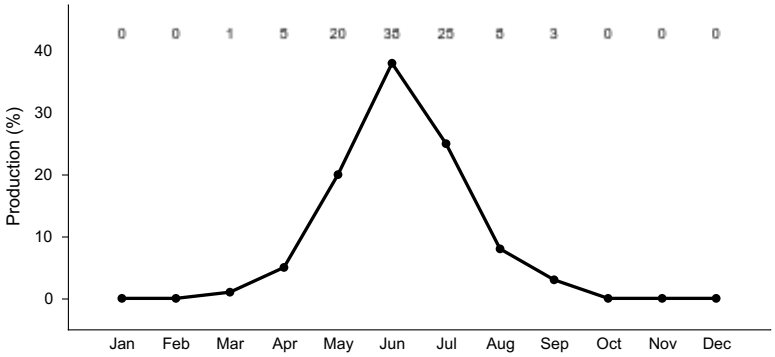

Figure 11. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Community 2.2
Little Bluestem/Grama/Needlegrass/Bluegrass

This plant community is a result of heavy continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 20 percent forbs, and 5 percent shrubs. Dominant grasses include little bluestem, blue grama, and Kentucky bluegrass. Grasses of secondary importance include western wheatgrass, plains muhly, needleandthread, and threadleaf sedge. Forbs commonly found in this plant community include goldenrod, cudweed sagewort, heath aster, scurfpea, western ragweed, and western yarrow. When compared to the Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), production of tall and mid warm-season grasses is reduced while the production of the short statured warm and cool season grasses has increased. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. Most of the components of the ecological processes are functioning at optimum levels. However, the vigor and reproductive capability of the tall and mid warm-season and mid cool season bunchgrasses are reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allows for an increase in shorter-statured (and shallower rooted) species. The introduction of non-native invasive species such as Kentucky bluegrass and smooth bromegrass results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers, and the structure will begin to be modified. These changes favor the shallow-rooted species, and hasten their eventual dominance if steps are not taken to reduce these species.

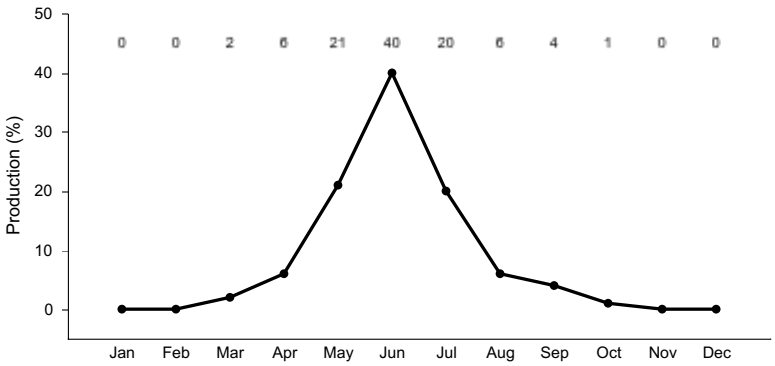

Figure 12. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 2.3
Little Bluestem/Bluegrass

This plant community is a result of heavy continuous grazing or of over utilization during extended drought periods. The potential plant community is made up of approximately 70 percent grasses and grass-like species, 25 percent forbs, and 5 percent shrubs. Dominant grasses and grass-likes include Kentucky bluegrass and threadleaf sedge with remnant little bluestem plants still present and readily visible although reduced in extent. Grass species of secondary importance include blue grama, western wheatgrass, and needleandthread. Forbs commonly found in this plant community include goldenrod, cudweed sagewort, heath aster, scurfpea, western ragweed, pussytoes, and western yarrow. When compared to the Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), Kentucky bluegrass and sedge have increased. Production of mid and tall warm- and cool-season grasses is reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. A reduction of the dominant functional groups as found in the interpretive plant community phase allows for an increase in shorter-statured (and shallower rooted) species. The introduction of non-native invasive species such as Kentucky bluegrass and smooth bromegrass results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers, and the structure will begin to be modified. These changes favor the shallow-rooted species, and hasten their eventual dominance if steps are not taken to reduce these species.

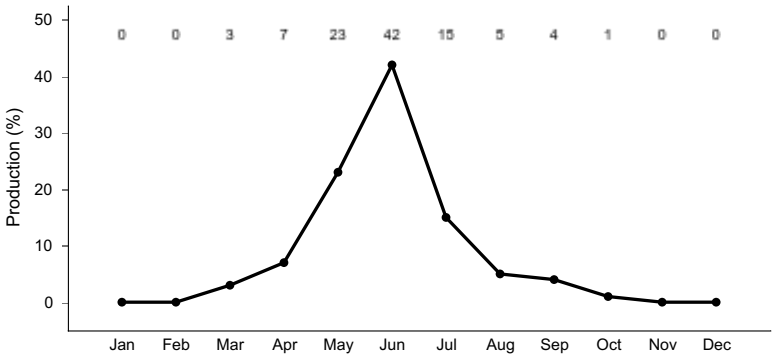

Figure 13. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Pathway 2.1a
Community 2.1 to 2.2

Heavy continuous grazing or heavy late seasonal grazing coupled with stocking levels well above the carrying capacity for extended portions of the growing season will shift the competitive advantage to the more grazing tolerant mid and short statured species.

Pathway 2.2b
Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) will shift the competitive advantage back toward the taller statured components of the plant community. This pathway may be expedited by including prescribed burning along with prescribed grazing.

Pathway 2.2a
Community 2.2 to 2.3

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year), or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will a shift towards a community dominated by the most grazing tolerant species.

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

This state is a result of encroachment mainly by invasive, introduced cool-season grasses. The ecological processes are not functioning, especially the biotic processes and the hydrologic functions. The introduced cool-season grasses cause reduced infiltration and increased runoff. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early green-up and increased moisture and humidity at the soil surface; grazing pressure alone cannot cause a reduction in sodgrass dominance. Production is limited to the sod forming species. Infiltration continues to decrease and runoff increases; energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by the shallow root depths of the dominant species.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- little bluestem (*Schizachyrium scoparium*), grass

Community 3.1
Kentucky Bluegrass/Smooth Bromegrass/Forbs/Shrubs

This plant community phase is a result of extended periods of non-use and no fire or occasionally light levels of grazing over several years. It is characterized by dominance of smooth bromegrass and Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. When dominated by smooth bromegrass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced. The dominance of these introduced species has been shown to alter the biotic component of the soil, as well as organic matter levels and eventually the soil structure. These alterations perpetuate the dominance of Kentucky bluegrass and smooth bromegrass and tend to make establishment of native species extremely difficult.

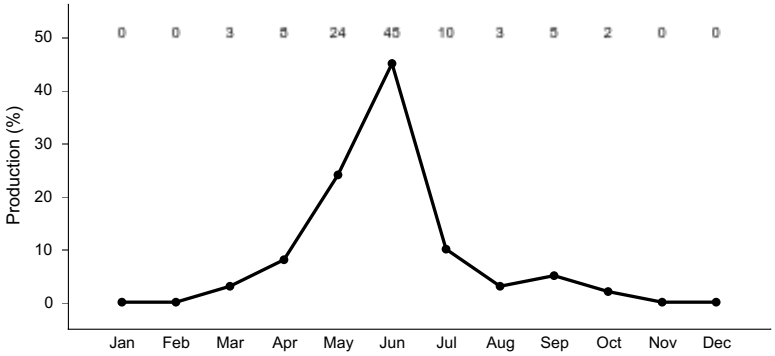

Figure 14. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Kentucky Bluegrass/Little Bluestem

such as extended periods of below-average precipitation combined with heavy continuous grazing. It is characterized by a dominance of Kentucky bluegrass and sedges, and occasionally with a remnant population of little bluestem. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick root mat or layer can sometimes accumulate at the soil surface. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. The period that palatability is high is relatively short, as Kentucky bluegrass matures rapidly. Energy capture is also reduced and shifted to early and mid-spring. Biological activity in the soil is likely reduced significantly in this phase.

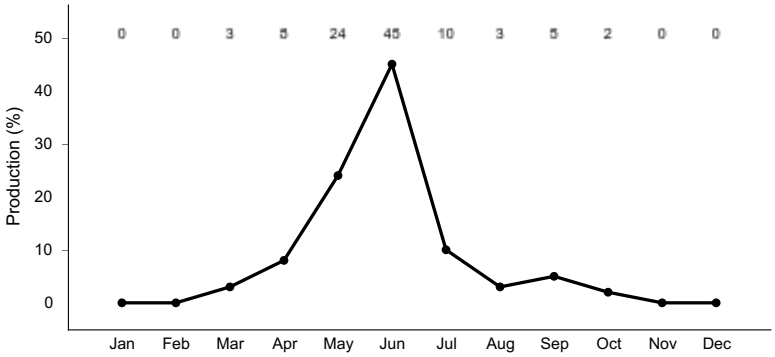

Figure 15. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.3
Annual/Pioneer, Non-Native Perennial Plant Community Phase

This plant community developed under continuous heavy grazing or other excessive disturbances such as abandonment after cropping, seeding of introduced species, or invasion and dominance of noxious weed species. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include non-native invasive and/or early seral species. In the case of a seeding, refer to the corresponding Forage Suitability Group description for adapted species and expected production (production estimates in the Forage Suitability Group description may be unrealistically high due to the degraded soil condition of the site at this phase).

Pathway 3.1a
Community 3.1 to 3.2

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year) will favor the highly grazing tolerant species such as Kentucky bluegrass.

Pathway 3.2a
Community 3.2 to 3.1

Non-use and no fire for extended periods of time (typically for 10 or more years) will result in the accumulation of excessive plant litter. This will change the micro-climate and sunlight capture at the soil surface and shift the competitive advantage to the highly shade tolerant species such as Kentucky bluegrass and/or smooth bromegrass.

Pathway 3.3a
Community 3.3 to 3.2

With the passage of time, probably regardless of the type of management, this plant community will gradually convert to dominance by Kentucky bluegrass.

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 T2a/T2b
State 2 to 3

T2a Non-use and no fire for extended periods of time (typically for 10 or more years) will result in the accumulation of excessive plant litter. This will change the micro-climate and sunlight capture at the soil surface and shift the competitive advantage to the highly shade tolerant species such as Kentucky bluegrass. T2b Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year) or a combination of disturbances such as extended periods of below average precipitation, coupled with heavy grazing, will likely shift this community across a threshold leading to an increase in grazing tolerant introduced species.

Restoration pathway R3a
State 3 to 2

Long-term prescribed grazing with proper stocking rates, animal densities and adequate recovery periods between grazing events may lead this plant community phase over a threshold to the Native/Invaded State (State 2). 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.

Additional community tables

Table 7. 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**			493–863	
	little bluestem	SCSC	*Schizachyrium scoparium*	247–616	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	123–370	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	49–247	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	25–123	–
2	**Cool-season Bunchgrasses**			370–863	
	porcupinegrass	HESP11	*Hesperostipa spartea*	247–616	–
	green needlegrass	NAVI4	*Nassella viridula*	49–247	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	25–123	–
	Canada wildrye	ELCA4	*Elymus canadensis*	25–74	–
3	**Tall Warm-season Grasses**			247–493	
	big bluestem	ANGE	*Andropogon gerardii*	123–370	–

	big bluestem	ANGE	*Andropogon gerardii*	123–370	
	prairie sandreed	CALO	*Calamovilfa longifolia*	25–123	–
	Indiangrass	SONU2	*Sorghastrum nutans*	25–123	–
4	**Wheatgrass**			49–123	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	25–123	–
	western wheatgrass	PASM	*Pascopyrum smithii*	25–123	–
5	**Other Native Grasses**			49–123	
	Grass, perennial	2GP	*Grass, perennial*	0–123	–
	blue grama	BOGR2	*Bouteloua gracilis*	25–74	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	25–74	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–49	–
6	**Grass-likes**			49–123	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	25–74	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	25–74	–
Forb					
7	**Forbs**			123–247	
	Forb, native	2FN	*Forb, native*	25–74	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	25–74	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	25–49	–
	blazing star	LIATR	*Liatris*	25–49	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	25–49	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–49	–
	scurfpea	PSORA2	*Psoralidium*	25–49	–
	eastern pasqueflower	PUPA5	*Pulsatilla patens*	25–49	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	25–49	–
	goldenrod	SOLID	*Solidago*	25–49	–
	white heath aster	SYER	*Symphyotrichum ericoides*	25–49	–
	American vetch	VIAM	*Vicia americana*	25–49	–
	purple prairie clover	DAPU5	*Dalea purpurea*	25–49	–
	milkvetch	ASTRA	*Astragalus*	0–25	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–25	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–25	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–25	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–25	–
	onion	ALLIU	*Allium*	0–25	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–25	–
	pussytoes	ANTEN	*Antennaria*	0–25	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–25	–
Shrub/Vine					
8	**Shrubs**			123–247	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–99	–
	leadplant	AMCA6	*Amorpha canescens*	25–99	–

	prairie sagewort	ARFR4	*Artemisia frigida*	25–49	–
	chokecherry	PRVI	*Prunus virginiana*	0–49	–
	smooth sumac	RHGL	*Rhus glabra*	0–49	–
	rose	ROSA5	*Rosa*	25–49	–
	snowberry	SYMPH	*Symphoricarpos*	25–49	–
	American plum	PRAM	*Prunus americana*	0–25	–

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid Warm-season Grasses**			493–863	
	little bluestem	SCSC	*Schizachyrium scoparium*	247–616	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	123–370	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	49–247	–
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3	**Tall Warm-season Grasses**			247–493	
	big bluestem	ANGE	*Andropogon gerardii*	123–370	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	25–123	–
	Indiangrass	SONU2	*Sorghastrum nutans*	25–123	–
4	**Wheatgrass**			49–123	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	25–123	–
	western wheatgrass	PASM	*Pascopyrum smithii*	25–123	–
5	**Other Native Grasses**			49–123	
	Grass, perennial	2GP	*Grass, perennial*	0–123	–
	blue grama	BOGR2	*Bouteloua gracilis*	25–74	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	25–74	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–49	–
6	**Grass-likes**			49–123	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	25–74	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	25–74	–
7	**Non-Native Grasses**			25–99	
	smooth brome	BRIN2	*Bromus inermis*	0–49	–
	Kentucky bluegrass	POPR	*Poa pratensis*	25–49	–
	Grass, perennial	2GP	*Grass, perennial*	0–25	–
Forb					
8	**Forbs**			123–247	
	Forb, native	2FN	*Forb, native*	25–74	–

	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	25–74	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	25–49	–
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	eastern pasqueflower	PUPA5	*Pulsatilla patens*	25–49	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	25–49	–
	goldenrod	SOLID	*Solidago*	25–49	–
	white heath aster	SYER	*Symphyotrichum ericoides*	25–49	–
	American vetch	VIAM	*Vicia americana*	25–49	–
	purple prairie clover	DAPU5	*Dalea purpurea*	25–49	–
	milkvetch	ASTRA	*Astragalus*	0–25	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–25	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–25	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–25	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–25	–
	onion	ALLIU	*Allium*	0–25	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–25	–
	pussytoes	ANTEN	*Antennaria*	0–25	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–25	–
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9	**Shrubs**			123–247	
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	leadplant	AMCA6	*Amorpha canescens*	25–99	–
	prairie sagewort	ARFR4	*Artemisia frigida*	25–49	–
	chokecherry	PRVI	*Prunus virginiana*	0–49	–
	smooth sumac	RHGL	*Rhus glabra*	0–49	–
	rose	ROSA5	*Rosa*	25–49	–
	snowberry	SYMPH	*Symphoricarpos*	25–49	–
	American plum	PRAM	*Prunus americana*	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.

Other references

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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:**
