USDA Natural Resources Conservation Service

Ecological site R055DY008SD
Sands

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 Sands ecological site is located on uplands – typically on eolian sand sheets, sandy lake plains, and outwash plains; it also occurs on eolian mantled till plains. It is on back slopes, shoulder slopes, and summits of rises and hills. The soils are very deep. Surface and subsoil textures (to depth of more than 20 inches) typically range from loamy fine sand to coarse sand; however, fine sandy loam or sandy loam surface layers are allowable if <10 inches thick. The subsoil may form a ball, but it does not ribbon. Some soils have loamy or silty material at a depth below 20 inches. Soil on this site is well drained to excessively drained. Slopes range from 0 to 25 percent. On the landscape, this site is above the Subirrigated Sands and Sandy Claypan ecological sites. The Sandy ecological site occurs on similar landscape positions; it is fine sandy loam or sandy loam to a depth >10 inches. The Choppy

Sands site occurs on adjacent dune areas with >15% slopes. These Choppy Sands sites are wind-worked; as a result, the topsoil has been eroded. Where Thin Loamy ecological sites are associated, they are above the Sands site on the landscape.

Associated sites

R055DY012SD	**Thin Upland** This site occurs on higher, convex slopes on till plains and lake plains – a run-off landscape position. The surface and subsoil layers form a ribbon 1 to 2 inches long. It is highly calcareous (strong or violent effervescence) within a depth of 8 inches.
R055DY001SD	**Shallow Marsh** This site occurs in deep depressions which have frequent ponding through most of the growing season. All textures are included in this site.
R055DY044SD	**Subirrigated Sands** This site occurs lower on the landscape. It has redoximorphic features at a depth of 30 to 40 inches. The subsoil does not form a ribbon.
R055DY009SD	**Sandy** This site occurs on similar landscape positions. It has fine sandy loam or sandy loam textures (forms a ribbon <1 inch long) to a depth >10 inches.
R055DY041SD	**Choppy Sands** This site occurs on dunes with slopes >15 percent. The surface and subsoil layers do not form a ribbon.
R055DY042SD	**Sandy Claypan** This site occurs lower on the landscape. It has a root-restrictive claypan (forms a ribbon <1 inch long) at a depth of 6 to 16 inches.

Similar sites

R055DY041SD	**Choppy Sands** This site occurs on dunes with slopes >15 percent. The surface and subsoil layers do not form a ribbon.
R055DY009SD	**Sandy** This site occurs on similar landscape positions. It has fine sandy loam or sandy loam textures (forms a ribbon <1 inch long) to a depth >10 inches.
R055DY044SD	**Subirrigated Sands** This site occurs lower on the landscape. It has redoximorphic features within a depth of 40 inches. The subsoil does not form a ribbon.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Hesperostipa comata* (2) *Calamovilfa longifolia*

Physiographic features

This site occurs on uplands – typically on eolian sand sheets, sandy lake plains, and outwash plains. Some areas are on till plains mantled with eolian sands. Typically, it is on back slopes, shoulder slopes, and summits of rises and hills. The parent materials are coarse textured to a depth of 20 inches or more. Slopes range from 4 to 9 percent.

Table 2. Representative physiographic features

Landforms	(1) Sand sheet (2) Lake plain (3) Outwash plain
Runoff class	Negligible to low

Flooding frequency	None
Ponding frequency	None
Elevation	299–651 m
Slope	4–9%
Ponding depth	0 cm
Water table depth	122–196 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

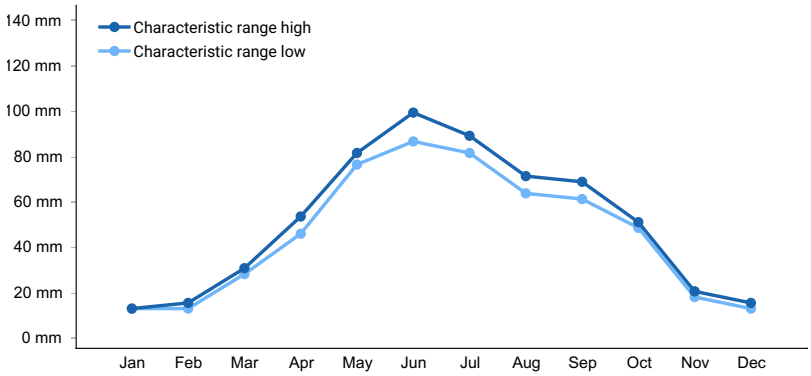


Figure 1. Monthly precipitation range

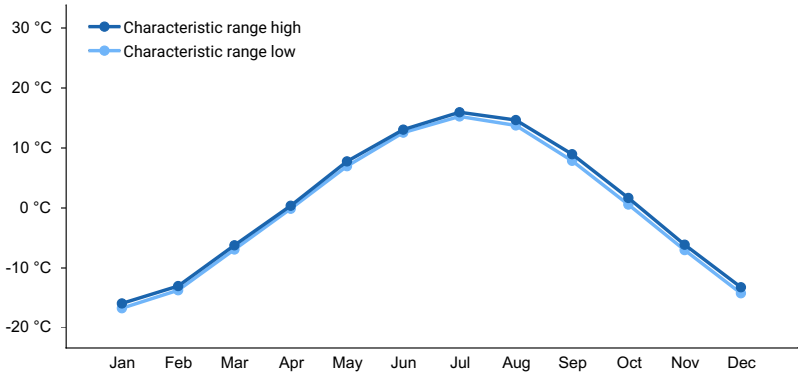


Figure 2. Monthly minimum temperature range

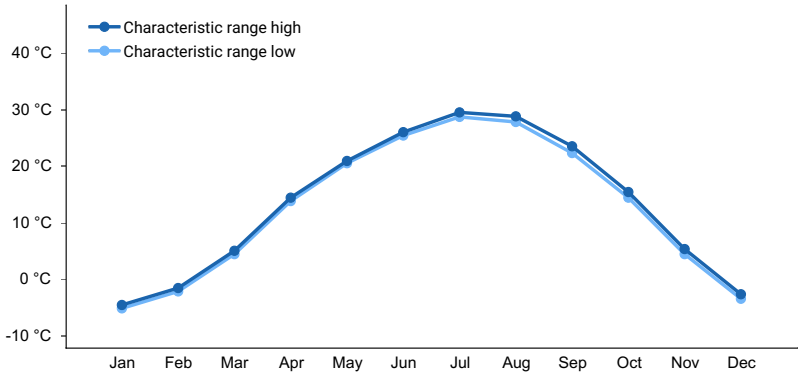


Figure 3. Monthly maximum temperature range

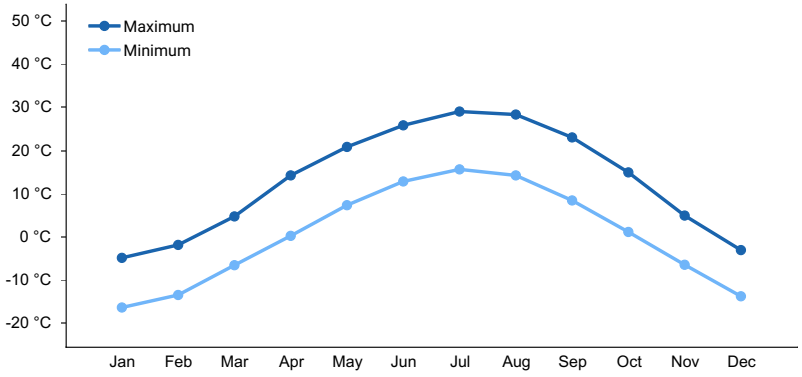


Figure 4. Monthly average minimum and maximum temperature

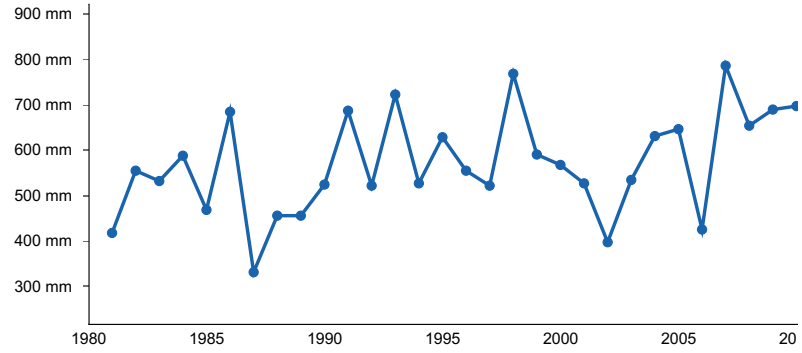


Figure 5. Annual precipitation pattern

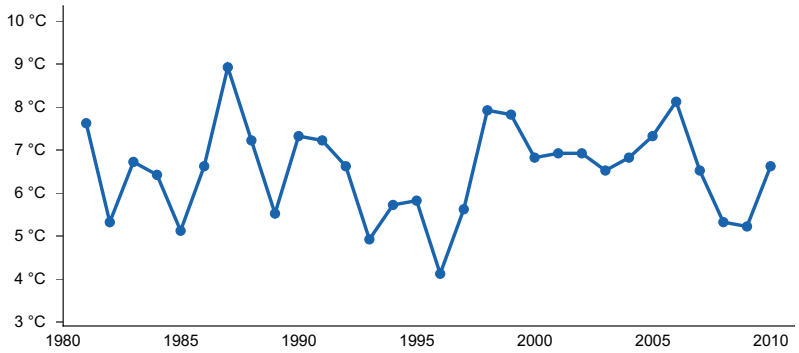


Figure 6. Annual average temperature pattern

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 significant additional water, either as runoff from adjacent slopes or from a seasonal high water table. Depth to the water table exceeds 4 feet in the spring and commonly exceeds 6 feet in the summer months. Surface infiltration is moderately rapid to very rapid. Saturated hydraulic conductivity is high in the sandy materials. Where a contrasting texture is present below a depth 20 inches, it is moderately high in that layer. Water loss is through percolation below the root zone and through evapotranspiration.

Wetland description

Not Applicable.

Soil features

Soils associated are in the Mollisol and Entisol orders. The Mollisols are classified further as Calcic Hapludolls and Entic Hapludolls. The Entisols are classified further as Typic Udipsamments. These soils were developed under prairie vegetation. They formed in glaciolacustrine deposits, glaciofluvial deposits, eolian sands, or eolian sands over till.

The common features of soils in this site are coarse, non-gravelly textures within a depth of 10 inches (soil may form a ball, but it does not form a ribbon) that extend to a depth exceeding 20 inches and limited available water capacity. The soils are very deep; some have medium or moderately fine textured soil materials below a depth of 20 inches and within a depth of 40 inches. They are well drained to possibly excessively drained. The surface layer is most commonly loamy fine sand, fine sand, or coarse sandy loam; but loamy sand and loamy coarse sand also occur. A few soils included in this site have a fine sandy loam surface layer that is <10 inches thick.

This site should show slight to no evidence of rills, wind-scoured areas, or pedestaled plants. Water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact. These soils are susceptible to wind erosion. Loss of the soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to the Sands site are Dickey and Maddock.

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

information.

Table 4. Representative soil features

Parent material	(1) Glaciofluvial deposits (2) Eolian deposits (3) Glaciolacustrine deposits
Surface texture	(1) Loamy fine sand (2) Loamy sand (3) Fine sandy loam
Drainage class	Well drained
Permeability class	Rapid
Soil depth	51–102 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	7.62–12.7 cm
Calcium carbonate equivalent (0-101.6cm)	0–12%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	6.4–8.2
Subsurface fragment volume <=3" (0-101.6cm)	0–4%
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 the Reference State. The Reference State has been determined by study of rangeland relic 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. Lightening 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.

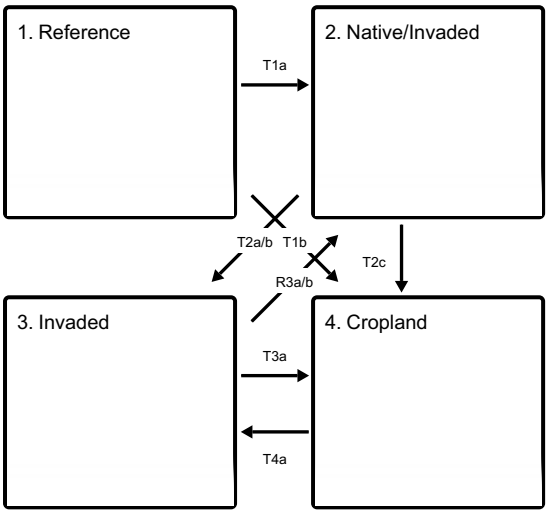
This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence causes this site to depart from the reference plant community. Species such as needleandthread, blue grama and threadleaf sedge will initially increase. Species such as sand bluestem and prairie sandreed decrease in frequency and production. In time, heavy continuous grazing will likely cause blue

grama and threadleaf sedge to dominate and other pioneer perennials and annuals to increase. In this case, runoff will increase and infiltration will decrease. Heavy disturbance through improper grazing, wildfire, excessive defoliation or any type of physical disturbance can lead to serious erosion problems (blowout) on these fragile soils. 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 as well as shrubs species such as western snowberry. Remnant native plants may be present but are reduced in vigor.

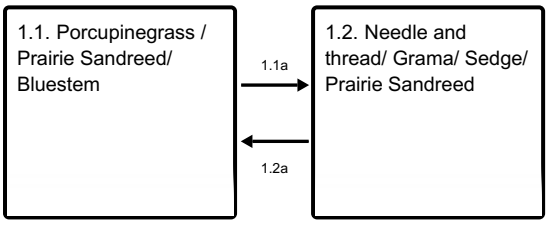
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best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

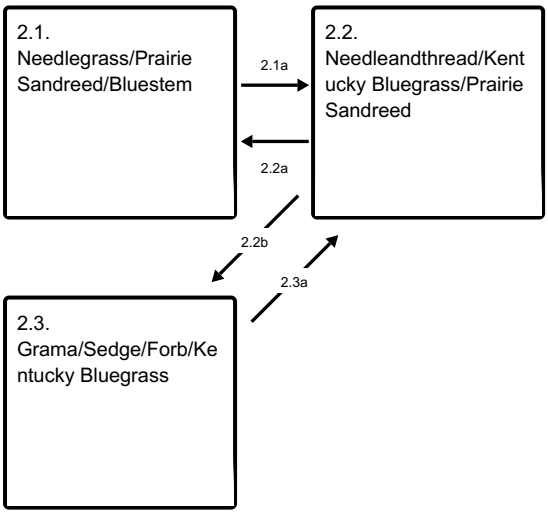
Ecosystem states



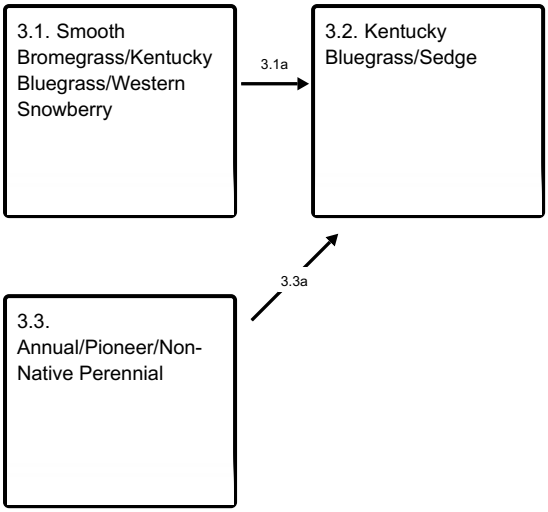
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

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

- needle and thread (*Hesperostipa comata*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- big bluestem (*Andropogon gerardii*), grass
- sand bluestem (*Andropogon hallii*), grass
- blue grama (*Bouteloua gracilis*), grass
- sedge (*Carex*), grass
- American vetch (*Vicia americana*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- goldenrod (*Solidago*), other herbaceous

Community 1.1
Porcupinegrass / Prairie Sandreed/ Bluestem

This community phase was the most dominant both temporally and spatially. The prevailing climate and weather patterns favored the development of this community phase. Mid statured cool-season bunchgrass such as needle and thread and porcupine grass would have been co-dominants with tall warm-season grasses such as prairie sandreed, big bluestem, and sand bluestem. Other grass and grass-like species included sand dropseed, sideoats grama, prairie Junegrass, western wheatgrass, Canada wildrye, blue grama, and sedge. A variety of leguminous and non-leguminous perennial forbs including American vetch, dotted gayfeather, goldenrod, purple prairie clover, and scurfpea were present. Shrubs included fringed sagewort, leadplant and western snowberry. In this community phase, grasses and grass-likes would have constituted about 85 to 95 percent, forbs 5 to 10 percent, and shrubs 1 to 5 percent of the annual production. This represents the plant community phase upon which interpretations are primarily based and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. Community dynamics, nutrient cycling, water cycle, and energy flow were functioning at near optimum levels. A good component of 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	1849	2608	3127
Forb	140	219	308
Shrub/Vine	28	87	151
Total	**2017**	**2914**	**3586**

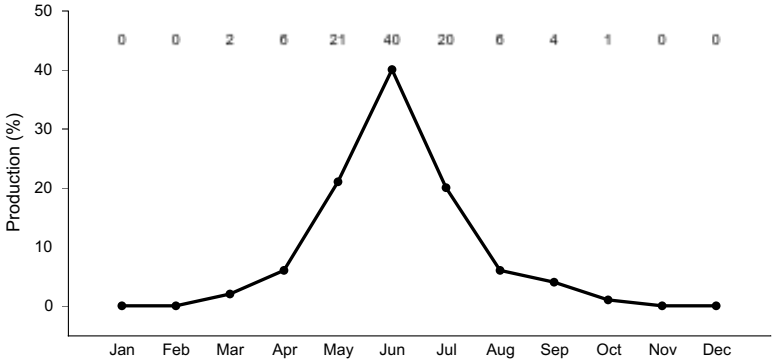


Figure 8. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 1.2
Needle and thread/ Grama/ Sedge/ Prairie Sandreed

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 species would have increased. Needle and thread would have displaced porcupine grass to become the dominant needlegrass while blue grama, sand dropseed, and sedges would have also increased. Prairie sandreed and the bluestems would have decreased but still be present. Forb species such as green sagewort, goldenrod, western ragweed, western yarrow, and prairie coneflower would have increased. 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 on steeper slopes. 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.

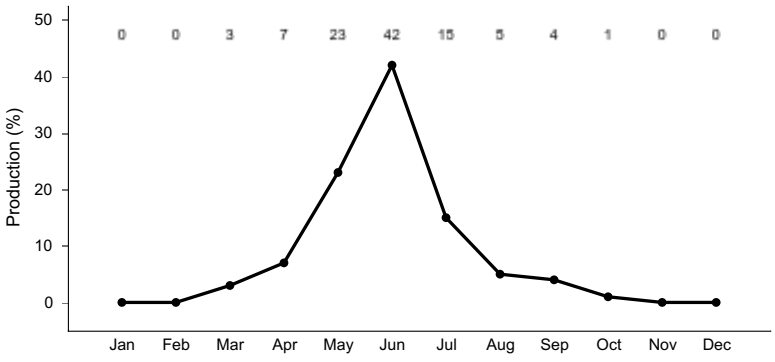


Figure 9. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

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 porcupine grass as well as the prairie sandreed and bluestem species.

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 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.

Dominant plant species

- needle and thread (*Hesperostipa comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- big bluestem (*Andropogon gerardii*), grass
- sand bluestem (*Andropogon hallii*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- American vetch (*Vicia americana*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous

Community 2.1
Needlegrass/Prairie Sandreed/Bluestem

This community phase most closely resembles plant phase 1.1 in appearance and ecological function (e.g., hydrologic, biotic and soil/site stability). This 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 plant community phase is characterized by co-dominance of mid statured, cool-season bunchgrass such as needle and thread and porcupine grass and tall warm-season grasses such as prairie sandreed, needle and thread, big bluestem, and sand bluestem. Other grass and grass-like species would include sand dropseed, sideoats grama, prairie Junegrass, western wheatgrass, Canada wildrye, blue grama, and sedge. Non-native cool- season grasses such as Kentucky bluegrass and smooth bromegrass would be present in very small amounts. Grasses and grass-likes would constitute about 85 to 95 percent of this phase. A variety of leguminous and non-leguminous perennial forbs would constitute from 5 to 10 percent and included American vetch, dotted gayfeather, goldenrod, purple prairie clover, and scurfpea were present. Shrubs comprise about 1 to 5 percent of the plant community by weight and would include fringed sagewort, leadplant and western snowberry. The ecological processes are functioning at levels very close to those of plant community phase 1.1. Slight departure may be noted within the functional/structural indicator due to the presence 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.

Table 6. Annual production by plant type

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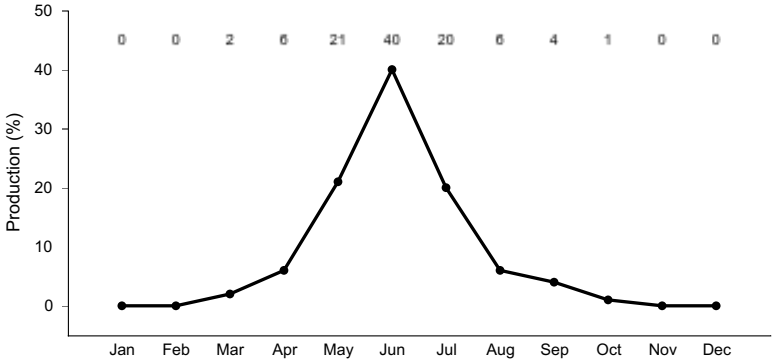

Figure 11. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 2.2
Needleandthread/Kentucky Bluegrass/Prairie Sandreed

This plant community phase is characterized by a decline in porcupine grass, sand bluestem, and big bluestem and a corresponding increase in the more grazing tolerant needleandthread, sand dropseed, sedges and Kentucky bluegrass. Forbs such as western yarrow, goldenrod, green sagewort, and cudweed sagewort will increase while the leguminous forbs may decrease. The shrub component remains fairly constant however fringed sagewort may increase. Although grasses and grass-likes still comprise 60 to 80 percent of the production, the forb component would increase to 15 to 30 percent of the production with shrubs contributing from 5 to 10 percent. The ecological processes are functioning at levels very close to those of plant community phase 2.1 but some departures begin to occur. Energy capture is shifted to earlier in the growing season due to the decline in the warm-season component of the plant community. Nutrient cycling may be reduced due to the decline in the number and amount of native legumes in the community. Infiltration rates may be slightly reduced due to the reduction in the bunchgrass component as well as the reduction in deep rooted, tall statured warm-season grasses. Departure will be noted within the functional/structural indicator due to the presence of a functional/structural group(s) not expected for the site.

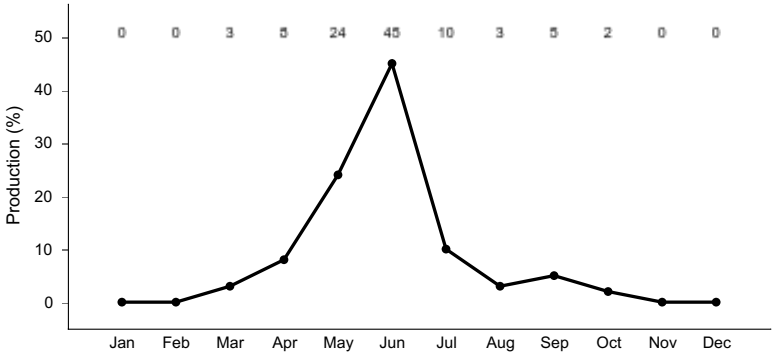

Figure 12. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 2.3
Grama/Sedge/Forb/Kentucky 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. Grazing tolerant forbs also increase. These grazing tolerant short grasses such as blue grama and Kentucky bluegrass along with the grass-likes out compete the taller statured grass species. 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. Grasses and grass-likes would be co-dominants in this phase with shrubs still comprising 5 to 10 percent of the community. Although greatly reduced in amount and extent, the needlegrasses and tall statured warm season grasses would still be present in limited amounts but may not be readily observable. The shift in the plant community composition results in changes to how the ecological processes function on this site. Due to the increase in short statured grasses and grass-likes, Infiltration for this 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 exercised when developing and implementing restoration strategies for this plant community phase.

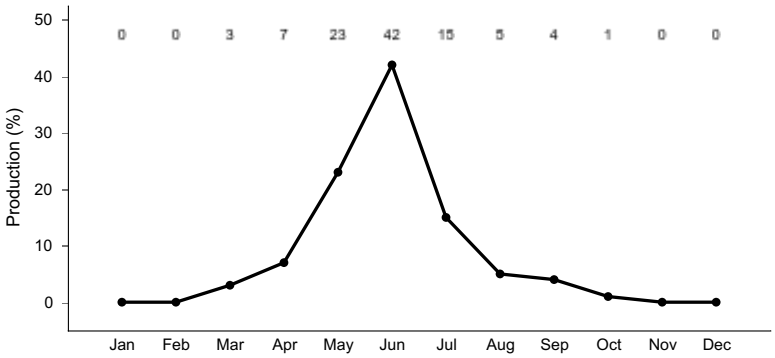

Figure 13. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Pathway 2.1a
Community 2.1 to 2.2

Heavy continuous grazing or heavy late seasonal grazing will shift this plant community from a dominance of needlegrasses and prairie sandreed to a dominance of grazing tolerant needleandthread and Kentucky bluegrass.

Pathway 2.2a
Community 2.2 to 2.1

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 away from the introduced cool-season species and back to the mid statured bunchgrasses and tall statured rhizomatous grasses. The addition of properly timed prescribed burning may expedite this shift.

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 remnant native cool-season bunchgrass species and tall statured warm season grasses. 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 that management actions don't favor Kentucky bluegrass resulting in unexpectedly crossing the threshold to State 3, Invaded State.

State 3
Invaded

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 thatch layer that effectively blocks introduction of other plants into the system. Once the state is well established, even drastic events such as high intensity fires driven by high fuel loads of litter and thatch will not result in more than a very short term reduction of these two species. These events may reduce the dominance of the sodgrasses, but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish and dominate before the sodgrasses rebound and again dominate the system. This state also includes the Annual, Pioneer Perennial community phase which is highly variable depending on the disturbance which causes this transition (T4). Over time, the Annual, Pioneer Perennial community phase will likely become dominated by introduced cool-season grasses, and shift to the Kentucky bluegrass community phase (3.2).

Dominant plant species

- western snowberry (*Symphoricarpos occidentalis*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass

Community 3.1
Smooth Bromegrass/Kentucky Bluegrass/Western Snowberry

This community phase is dominated by the cool-season sodgrasses including smooth brome and Kentucky bluegrass. Western snowberry can increase and become a major component in this community phase. Remnants of native warm- and cool-season grasses are still present, but greatly reduced. Infiltration may be reduced and runoff is increased when compared to the Reference State. Nutrient cycling is limited by the rooting depth of these species, the lack of leguminous forbs, and the alteration of the soil biotic community. Energy capture into the system is restricted to a short window provided by the early season species and heavy litter layer which reduces the amount of sunlight reaching the grass plant crowns. This further favors the shade tolerant introduced species and shrubs.

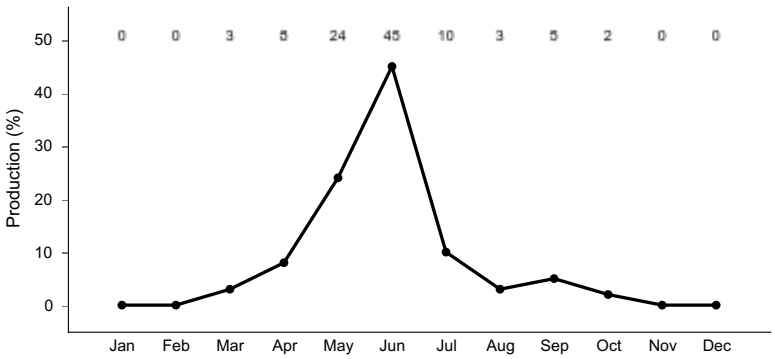

Figure 14. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Kentucky Bluegrass/Sedge

This community phase is dominated by Kentucky bluegrass with lesser amounts of sedge. Grazing tolerant forbs such as cudweed sagewort, western ragweed and western yarrow are also present. The longer this community phase exists the more resilient it becomes. Natural or management disturbances that reduce the cover of Kentucky bluegrass are very short lived due to the abundance of rhizomes of Kentucky bluegrass in the soil and the lack of propagules of other species present. Production is limited to the sod forming species. Energy capture into this system is limited to one early growing species. Runoff increases and is the highest of any plant community phase on this ecological site. Nutrient cycling is severely limited due to the shallow rooting depth of the Kentucky bluegrass and lack of leguminous forbs.

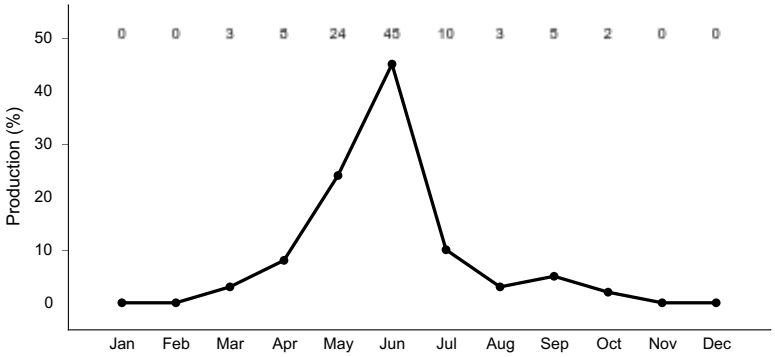

Figure 15. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.3
Annual/Pioneer/Non-Native Perennial

The Annual, Pioneer Perennial 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, the introduced cool-season perennial grasses will begin to establish on this site.

Pathway 3.1a
Community 3.1 to 3.2

This pathway is initiated by heavy continuous season-long grazing. The heavy continuous grazing favors those plants which can tolerate repeated defoliation (Kentucky bluegrass and sedges). Smooth brome will decrease with heavy use due to its elevated growth point. Western snowberry will experience mechanical damage and will decrease in production and cover. Grazing pressure will reduce litter cover resulting in elevated soil surface temperatures increasing evaporation rates and reducing biological activity.

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 with the primary difference being the lack of western snowberry and remnant native grass species.

State 4
Cropland

This state is the result of annual cropping.

Transition T1a
State 1 to 2

This is the transition from the native 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/b
State 2 to 3

T2a - Complete rest from grazing and elimination of fire are the two major contributors to this transition, especially when smooth brome is present. The opportunity for high intensity spring burns is severely reduced by early green-up and increased moisture and humidity at the soil surface. Plant litter accumulation tends to favor the more shade tolerant introduced grass species. The nutrient cycle is also impaired; the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns, thereby shifting competitive advantage to shade tolerant introduced grass species. Studies indicate that soil biological activity is altered; this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in sodgrass dominance. 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. T2b - Heavy, continuous season-long grazing is the primary driver of this transition. The very grazing- tolerant species have the competitive advantage during this transition. The opportunity for high intensity spring burns (which can serve to reduce the introduced cool-season species) is severely reduced by early green-up and the lack of fuel. The nutrient cycle is impaired due to a shift from perennial native legumes to introduced biennial legumes and the lack of available carbon for soil biota due to accumulation in the surface layer root mat. These two factors result in reduced soil biological activity. Studies indicate that soil biological activity is altered; this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in sodgrass dominance. 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.

Transition T2c
State 2 to 4

Removal of vegetative cover and tilling for agricultural crop production

Restoration pathway R3a/b
State 3 to 2

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

reference state functions, and the continued treatment of the introduced sodgrasses.

Transition T3a
State 3 to 4

Removal of vegetative cover and tilling for agricultural crop production

Transition T4a
State 4 to 3

This transition occurs with cessation of cropping practices.

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	**Needlegrass**			437–874	
	porcupinegrass	HESP11	*Hesperostipa spartea*	437–729	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	146–291	–
2	**Tall Warm-season Grasses**			437–729	
	prairie sandreed	CALO	*Calamovilfa longifolia*	291–729	–
	big bluestem	ANGE	*Andropogon gerardii*	58–437	–
	sand bluestem	ANHA	*Andropogon hallii*	58–437	–
3	**Short Warm-season Grasses**			146–291	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	58–233	–
	blue grama	BOGR2	*Bouteloua gracilis*	29–146	–
4	**Mid Warm-season Grasses**			29–204	
	little bluestem	SCSC	*Schizachyrium scoparium*	29–146	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–87	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–87	–
5	**Other Native Grasses**			29–146	
	Grass, perennial	2GP	*Grass, perennial*	0–146	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	29–146	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–87	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–87	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–87	–
6	**Grass-likes**			58–233	
	sedge	CAREX	*Carex*	58–233	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–146	–
Forb					
7	**Forbs**			146–291	
	Forb, native	2FN	*Forb, native*	29–146	–
	field sagewort	ARCA12	*Artemisia campestris*	29–87	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	29–87	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	29–87	–

	stiff sunflower	HEPA19	*Helianthus pauciflorus*	29–87	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	29–58	–
	dotted blazing star	LIPU	*Liatris punctata*	29–58	–
	stoneseed	LITHO3	*Lithospermum*	29–58	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	29–58	–
	purple prairie clover	DAPU5	*Dalea purpurea*	29–58	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	29–58	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	29–58	–
	soft-hair marbleseed	ONBEB	*Onosmodium bejariense var. bejariense*	29–58	–
	scurfpea	PSORA2	*Psoralidium*	29–58	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	29–58	–
	goldenrod	SOLID	*Solidago*	29–58	–
	white heath aster	SYER	*Symphyotrichum ericoides*	29–58	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	29–58	–
	American vetch	VIAM	*Vicia americana*	29–58	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	29–58	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–29	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–29	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–29	–
Shrub/Vine					
8	**Shrubs**			29–146	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–87	–
	leadplant	AMCA6	*Amorpha canescens*	29–87	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	29–87	–
	prairie sagewort	ARFR4	*Artemisia frigida*	29–58	–
	rose	ROSA5	*Rosa*	29–58	–
	prairie willow	SAHU2	*Salix humilis*	0–58	–
	white meadowsweet	SPAL2	*Spiraea alba*	29–58	–

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			437–874	
	porcupinegrass	HESP11	*Hesperostipa spartea*	437–729	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	146–291	–
2	**Tall Warm-season Grasses**			437–729	
	prairie sandreed	CALO	*Calamovilfa longifolia*	291–729	–
	big bluestem	ANGE	*Andropogon gerardii*	58–437	–
	sand bluestem	ANHA	*Andropogon hallii*	58–437	–
3	**Short Warm-season Grasses**			146–291	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	58–233	–
	blue grama	BOGR2	*Bouteloua gracilis*	29–146	–
4	**Mid Warm-season Grasses**			29–204	

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	little bluestem	SCSC	*Schizachyrium scoparium*	29–146	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–87	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–87	–
5	**Other Native Grasses**			29–146	
	Grass, perennial	2GP	*Grass, perennial*	0–146	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	29–146	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–87	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–87	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–87	–
6	**Grass-likes**			58–233	
	sedge	CAREX	*Carex*	58–233	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–146	–
7	**Non-Native Grasses**			29–58	
	Kentucky bluegrass	POPR	*Poa pratensis*	29–58	–
	Grass, perennial	2GP	*Grass, perennial*	0–29	–
	smooth brome	BRIN2	*Bromus inermis*	0–29	–
Forb					
8	**Forbs**			146–291	
	Forb, native	2FN	*Forb, native*	29–146	–
	field sagewort	ARCA12	*Artemisia campestris*	29–87	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	29–87	–
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	stoneseed	LITHO3	*Lithospermum*	29–58	–
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	upright prairie coneflower	RACO3	*Ratibida columnifera*	29–58	–
	goldenrod	SOLID	*Solidago*	29–58	–
	white heath aster	SYER	*Symphyotrichum ericoides*	29–58	–
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	scarlet beeblossom	GACO5	*Gaura coccinea*	29–58	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–29	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–29	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–29	–
Shrub/Vine					

Shrub/Vine					
9	**Shrubs**			29–146	
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	prairie sagewort	ARFR4	*Artemisia frigida*	29–58	–
	rose	ROSA5	*Rosa*	29–58	–
	prairie willow	SAHU2	*Salix humilis*	0–58	–
	white meadowsweet	SPAL2	*Spiraea alba*	29–58	–

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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Lee Voigt, NRCS Range Management Specialist
Ezra Hoffman, Ecological Site Specialist, NRCS

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:**
