USDA Natural Resources Conservation Service

Ecological site R055DY044SD
Subirrigated Sands

Last updated: 11/14/2024
Accessed: 11/21/2024

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 Subirrigated Sands ecological site is located on swales or on concave or linear side slopes of eolian sand plains, lake plains, outwash plains, as well as on till plains and lake plains mantled with eolian sands. Some areas of this site occur as small, low-relief inclusions on steeper uplands. The soils are very deep. Surface and subsoil textures typically are loamy fine sand, fine sand, sand, or loamy coarse sand but loamy sand and coarse sand also occur; these textures do not form a ribbon. Fine sandy loam, sandy loam or coarse sandy loam surface textures are allowable if <10 inches thick. Some soils have loamy or silty substratum layers deeper than 20 inches. Soil on this site is moderately well drained - redoximorphic features are deeper than 30 inches, but within a depth of 40 inches. Slopes range from 0 to 6 percent. On the landscape, this site is below the Choppy Sands and Sands ecological sites and above the Limy Subirrigated, Subirrigated, and Wet Meadow sites.

Associated sites

R055DY008SD	**Sands** Sands - This site occurs higher on the landscape. It is sand or loamy sand (fine to coarse sands) within a depth of 10 inches; the subsoil does not form a ribbon. Redoximorphic features, where present, are deeper than 40 inches.
R055DY041SD	**Choppy Sands** Choppy Sands - This site occurs on dunes with slopes >15 percent. The surface and subsoil layers do not form a ribbon.
R055DY003SD	**Subirrigated** Subirrigated - This site occurs in swales and blow-outs. It has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.
R055DY004SD	**Wet Meadow** Wet Meadow - This site is in depressions and on low-lying flats. It is poorly drained - a seasonal high water table is typically within a depth of 1.5 feet during the months of April through June; in depressions, it is frequently ponded (typically <1.5) in April and May. It typically has redoximorphic features within a depth of 18 inches. Some soils are highly calcareous. It is non-saline to slightly saline (E.C. <8) in the surface and subsoil layers. All textures are included in this site.
R055DY006SD	**Limy Subirrigated** Limy Subirrigated - This site occurs on flats that are slightly lower on the landscape. The soil is highly calcareous within a depth of 16 inches and has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.

Similar sites

R055DY003SD	**Subirrigated** Subirrigated - This site occurs in swales and blow-outs. It has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.
R055DY008SD	**Sands** Sands - This site occurs higher on the landscape. It is sand or loamy sand (fine to coarse sands) within a depth of 10 inches; the subsoil does not form a ribbon. Redoximorphic features, where present, are deeper than 40 inches.

Table 1. Dominant plant species

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

Physiographic features

This site typically occurs on uplands – eolian sand plains, lake plains, and outwash plains. Some occur on till plains and lake plains mantled with eolian sands. Some areas of this site occur as small, low-relief inclusions in steeper uplands. It is in swales or on concave or linear side slopes. Parent materials are eolian sands, sandy glaciolacustrine sediments, or sandy glaciofluvial sediments; in some areas each of these parent materials have an underlying parent material (deeper than 20 inches), either of till or of glaciolacustrine sediments containing more silt and clay. Slopes could range from 0 to 6 percent but often fall within 1 to 4 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	980–2,135 ft
Slope	1–4%
Ponding depth	0 in
Water table depth	33–60 in
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)	22-23 in
Frost-free period (actual range)	114-119 days
Freeze-free period (actual range)	127-134 days
Precipitation total (actual range)	22-23 in
Frost-free period (average)	116 days
Freeze-free period (average)	131 days
Precipitation total (average)	23 in

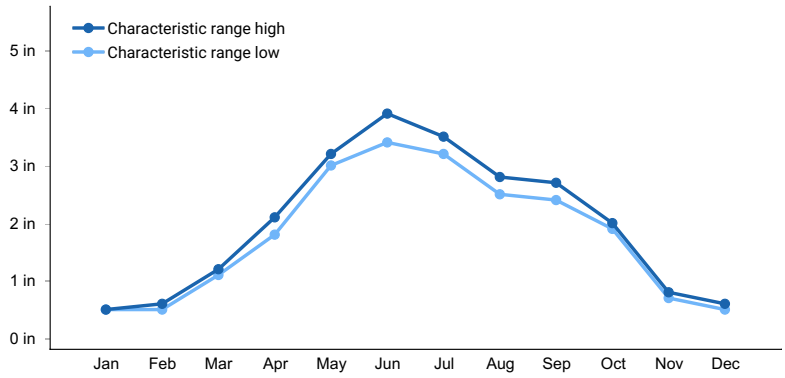


Figure 1. Monthly precipitation range

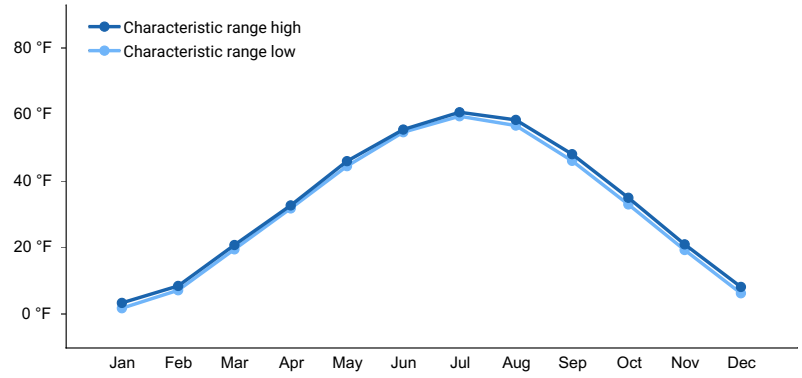


Figure 2. Monthly minimum temperature range

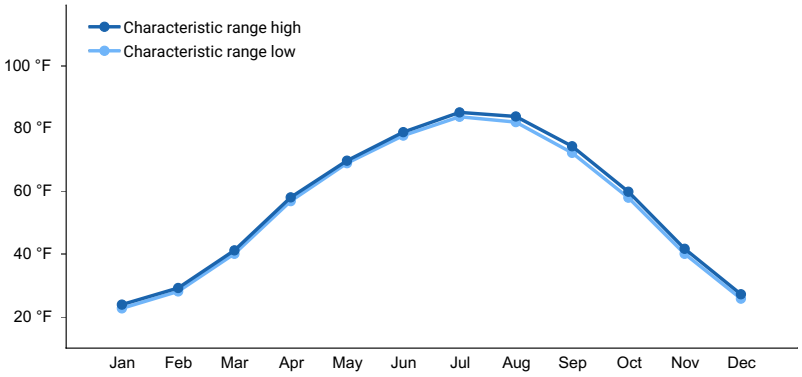


Figure 3. Monthly maximum temperature range

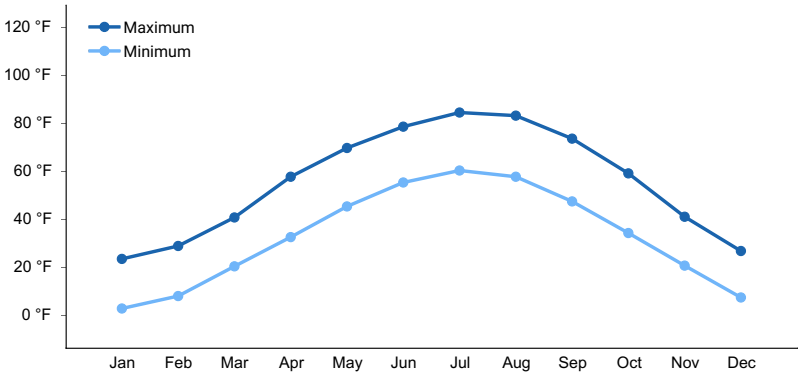


Figure 4. Monthly average minimum and maximum temperature

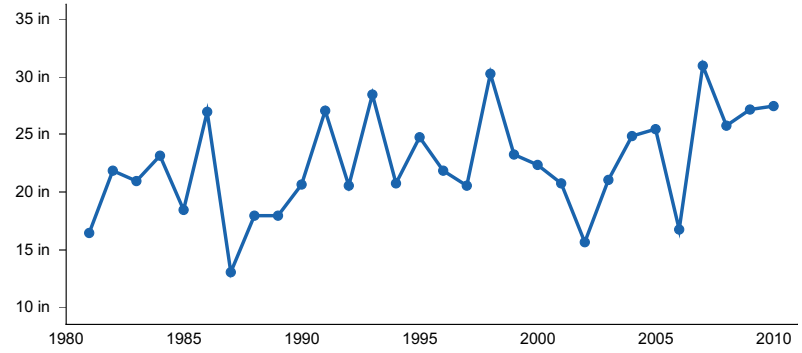


Figure 5. Annual precipitation pattern

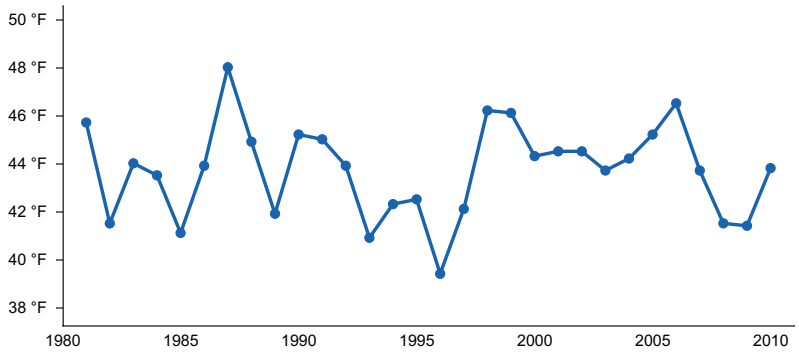


Figure 6. Annual average temperature pattern

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

Under normal climatic conditions, this site receives additional water from a regional high water table, particularly during the months of April - June. The duration of the water table can be prolonged in some soils due a loamy substratum layer which perches some water in the lower root zone and also contributes to lateral flow from surrounding uplands. During the growing season, water table depths typically are 3 to 5 feet during April through June. It commonly lowers to 4 to 6 feet during mid-summer through autumn. Surface infiltration is moderately rapid to very rapid. Saturated hydraulic conductivity through the profile typically is high. In soils with a loamy substratum, the saturated hydraulic conductivity is moderately high in that layer. Water loss is primarily through evapotranspiration. During mid-summer, percolation below the root zone may also occur. Due to the low relief landscape that typically surrounds this site, additional water received as runoff from adjacent uplands is not a major factor in the soil/hydrology/plant relationship.

Wetland description

Not Applicable.

Soil features

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

The common features of soils in this site are coarse textures to a depth >20 inches and a water table which is moderately high contributing additional water for transpiration. Surface and subsoil textures typically are loamy fine sand, fine sand, sand, or loamy coarse sand but loamy sand and coarse sand also occur; these textures do not form a ribbon. Fine sandy loam, sandy loam or coarse sandy loam surface textures are allowable if <10 inches thick. The soils are moderately well drained – redoximorphic features are visible at depth >30 inches and <40 inches. These soils are very deep; some have a loamy substratum below a depth of 20 and above 60 inches. Most soils in this site have less than 5 percent gravel throughout, but a few soils have as much as 15 percent in the upper 3 feet and as much as 35 percent in the lower substratum.

This site should show slight to no evidence of rills, wind-scoured areas, or pedestaled plants. No water flow paths are seen on this site. The soil surface is stable and intact. Subsurface soil layers are non-restrictive to water movement and root penetration. 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 Subirrigated Sands site are: Aylmer, Hecla, and Towner.

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) Eolian sands (2) Glaciolacustrine deposits (3) Glaciofluvial deposits
Surface texture	(1) Loamy fine sand (2) Fine sand (3) Loamy coarse sand
Family particle size	(1) Sandy
Drainage class	Moderately well drained
Permeability class	Rapid
Depth to restrictive layer	80 in
Soil depth	80 in
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Available water capacity (0-60in)	2.5–4.6 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.2–8.3
Subsurface fragment volume <=3" (0-40in)	0–3%
Subsurface fragment volume >3" (0-40in)	0%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-60in)	Not specified

Calcium carbonate equivalent (0-40in)	0–30%
Electrical conductivity (0-40in)	Not specified
Sodium adsorption ratio (0-40in)	Not specified
Soil reaction (1:1 water) (0-40in)	Not specified
Subsurface fragment volume <=3" (0-40in)	Not specified
Subsurface fragment volume >3" (0-40in)	Not specified

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(1.1 Bluestem/ Needlegrass). Interpretations for this site are based on 1.1 Bluestem/Needlegrass plant community. The Bluestem/Needlegrass plant community 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.

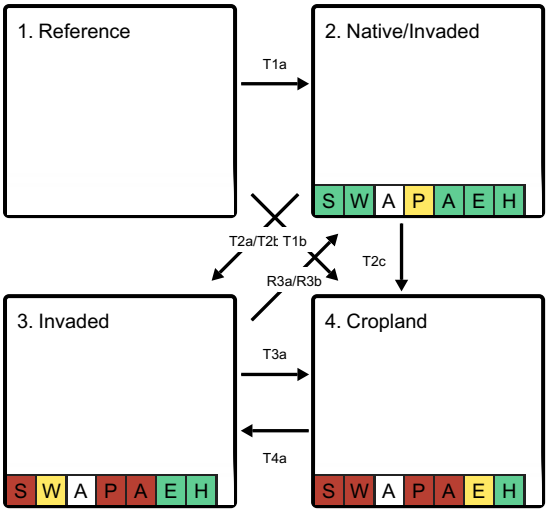
The natural disturbance regime consisted of frequent fires caused both by natural and Native American ignition sources. These fires occurred during any season of the year, but were concentrated in the spring and late summer or early fall. Lightning fires occurred most frequently in July and August while 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. Needleandthread, sand dropseed and Kentucky bluegrass if present, will begin to increase. Species such as big bluestem, sand bluestem, prairie sandreed, and porcupine grass decrease in frequency and production. Little bluestem will increase initially and then begin to decrease. In time, heavy continuous grazing will likely cause Kentucky bluegrass, if present to dominate and pioneer perennials and annuals to increase. 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 shrub species such as western snowberry. Remnant native plants may be present but are reduced in vigor. Shrubs such as western snowberry increase in this situation, especially in areas prone to snow accumulation and drift.

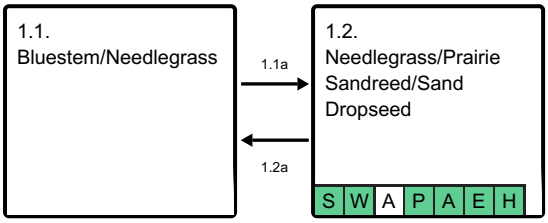
The following diagram illustrates the common states, community phases, community pathways, transitions and restoration pathways that can occur on the site.

State and transition model

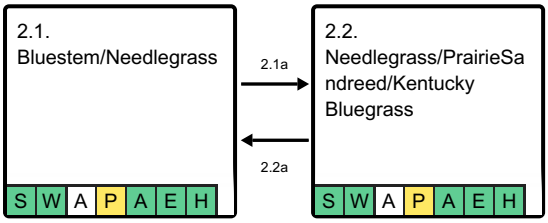
Ecosystem states



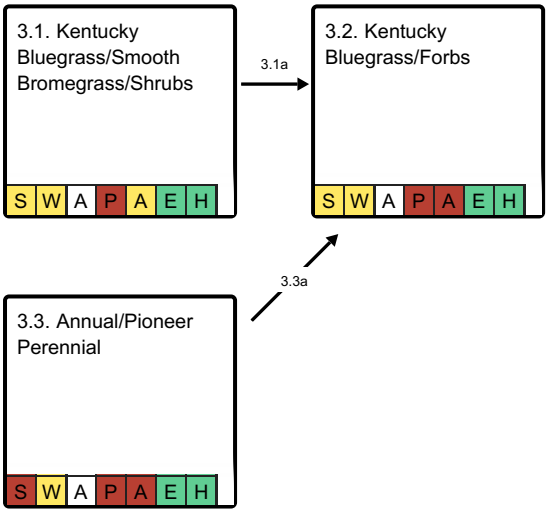
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

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

- willow (*Salix*), shrub
- western snowberry (*Symphoricarpos occidentalis*), shrub
- prairie rose (*Rosa arkansana*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- big bluestem (*Andropogon gerardii*), grass
- sand bluestem (*Andropogon hallii*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- sedge (*Carex*), grass
- longbract spiderwort (*Tradescantia bracteata*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- silky prairie clover (*Dalea villosa*), other herbaceous

Community 1.1
Bluestem/Needlegrass

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 bracted spiderwort, cudweed sagewort, heath aster, goldenrod, and silky prairie clover were present. Shrubs included prairie rose, willow and western snowberry. In this community phase, grasses and grass-likes would have constituted about 80 to 90 percent, forbs 5 to 10 percent, and shrubs 5 to 10 percent of the annual production. This is the interpretive plant community phase 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 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2110	2720	3260
Shrub/Vine	145	240	370
Forb	145	240	370
Total	**2400**	**3200**	**4000**

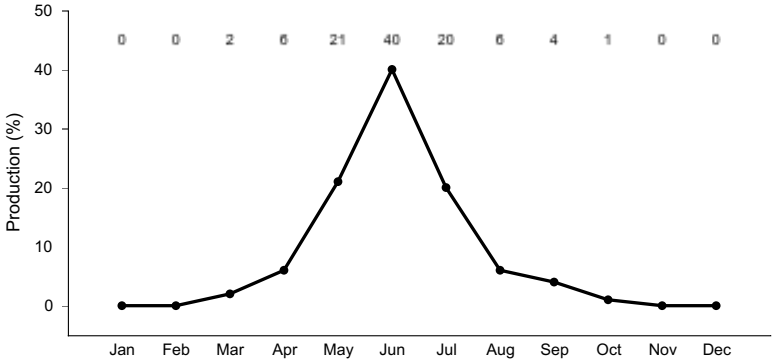


Figure 8. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 1.2
Needlegrass/Prairie Sandreed/Sand Dropseed

This plant community shift results from heavy, frequent grazing over a period of several years and/or several consecutive years of below normal precipitation. This increase in grazing pressure may have resulted from proximity to a water source, changes in fire frequency, and/or prolonged drought. Grasses and grass-like species would have still dominated this phase, but the overall productivity of these species would have been reduced and the number and amount of forbs would have increased. Needle and thread would have displaced porcupine grass to become the dominant needlegrass while Prairie sandreed, sand dropseed, and sedges would have also increased as the more palatable tall warm-season grasses were reduced by grazing pressure. Forb species such as cudweed sagewort, goldenrod, western ragweed, and heath aster would have increased.

Dominant resource concerns

- Plant productivity and health
- Plant structure and composition
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

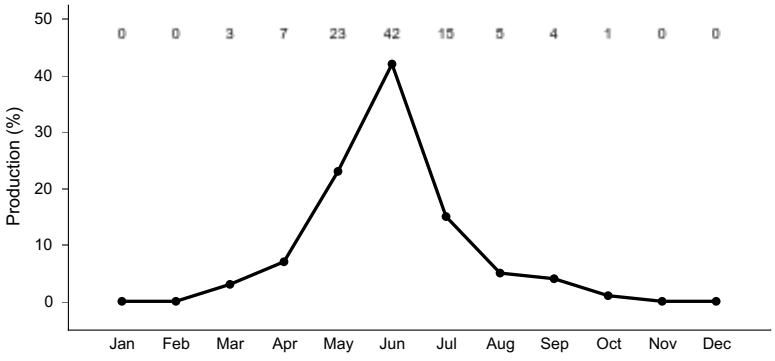


Figure 9. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

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 grazing tolerant grasses such as needleandthread, prairie sandreed and sand dropseed. This shift may have been facilitated by periods of below normal precipitation and heavy grazing.

Pathway 1.2a
Community 1.2 to 1.1

A return to normal precipitation and lighter grazing pressure allows the tall warm season grasses and porcupine

grass to return to dominance.

State 2
Native/Invaded

This state is very similar to the Reference State. The invasion of introduced cool-season sodgrasses has altered the natural range of variability for this ecological site. This state still has a strong component of warm season grasses and cool-season bunchgrass 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

- western snowberry (*Symphoricarpos occidentalis*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- needle and thread (*Hesperostipa comata*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- scouringrush horsetail (*Equisetum hyemale*), other herbaceous

Dominant resource concerns

- Organic matter depletion
- Aggregate instability
- Naturally available moisture use
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Feed and forage imbalance

Community 2.1
Bluestem/Needlegrass

This community phase most closely resembles the Reference State in appearance and ecological functions (e.g., hydrologic, biotic and soil/site stability). The warm and cool-season co-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 closely resembles the Reference State community phase 1.1 (see narrative for 1.1 Bluestem/Needlegrass). 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 species, may be a causative factor leading to the eventual dominance of cool-season introduced grasses in the Invaded State.

Dominant resource concerns

- Plant productivity and health
- Plant structure and composition
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

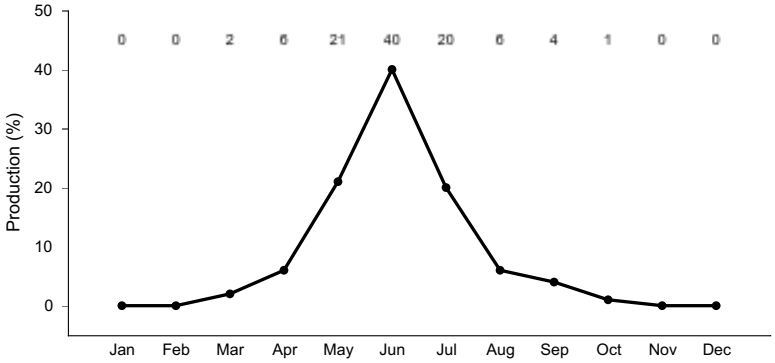


Figure 10. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 2.2
Needlegrass/PrairieSandreed/Kentucky Bluegrass

Grazing pressure reduces the mid/tall, less grazing tolerant species, while the shorter more grazing tolerant species increase. Litter amounts are reduced; energy capture shifts to slightly earlier in the growing season due to a decline in the later maturing native grass component and an increase in the earlier maturing grass-likes and non-native grasses. Kentucky bluegrass increases and may approach dominance in this community. Vegetation consists of about 80 to 90 percent grass and grass-like species, 5 to 15 percent forbs, and 2 to 5 percent shrubs. Significant grass species include Kentucky bluegrass, needle and thread, and prairie sandreed. The common forbs include western ragweed, scouring rush, and goldenrod. The common shrub would be western snowberry. This community phase is often dispersed throughout the pasture in an overgrazed/undergrazed pattern, typically referred to as patch grazing. Some areas (overgrazed) will exhibit the impacts of heavy use, while other areas (undergrazed) will have a build-up of litter and a high amount of plant decadence. This is a typical pattern found in properly stocked pastures grazed season-long. In the undergrazed patches, litter buildup reduces plant vigor and density and native seedling recruitment declines. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to small colonies. In the overgrazed patches, plant vigor is reduced; the competitive advantage goes towards the grazing tolerant species such as Kentucky bluegrass. Soil erosion is low. This community phase is approaching the threshold which would readily lead to the Invaded State. If management is significantly altered, this community phase can still be reverted back to the Bluestem/Needlegrass community. Grazing management that allows for adequate recovery periods will tend to restore the ecological functions of this site. Fire can play a role in reducing the introduced cool-season species. The combination of grazing and fire may be the most effective in moving this community phase towards a community resembling the Reference State.

Dominant resource concerns

- Organic matter depletion
- Aggregate instability
- Surface water depletion
- Naturally available moisture use
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

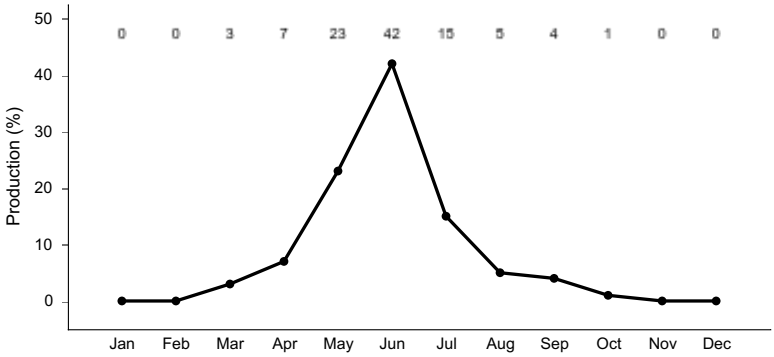


Figure 11. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Pathway 2.1a
Community 2.1 to 2.2

This community pathway is triggered by a change in the natural disturbance regime - most often caused by either heavy, continuous season-long grazing or continuous seasonal grazing without adequate recovery periods (grazing at the same season of year for extended periods during the active growing season of the dominant native grasses). Along this pathway, the timing of energy capture shifts from early to mid-summer to spring and early summer. The change in plant functional and structural groups and the composition and distribution of the vegetation causes a decrease in production and an increase in runoff with a corresponding decrease in infiltration. Nutrient cycling is restricted as the rooting depth of the vegetation decreases with the change in functional and structural groups. Plant community diversity is reduced with a loss of some native forbs and grasses.

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 from the introduced cool-season species to the native cool- and warm-season grass species. The addition of prescribed burning may expedite this shift.

State 3
Invaded

This state is the result of invasion and dominance of Kentucky bluegrass and/or smooth brome. This state is characterized by these two species and an increasing thatch layer that effectively blocks introduction of other plants into the system. Once the state is well established, even drastic events, such as high intensity fires driven by high fuel loads of litter and thatch, will not result in more than a very short-term reduction of these two species. These events may reduce the dominance of the introduced sodgrasses; but, due to the large number of rhizomes in the soil, there is no opportunity for the native species to establish and dominate before the introduced 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
- quackgrass (*Elymus repens*), grass
- goldenrod (*Solidago*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- American licorice (*Glycyrrhiza lepidota*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous

- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion
- Wind erosion
- Classic gully erosion
- Compaction
- Organic matter depletion
- Aggregate instability
- Surface water depletion
- Naturally available moisture use
- Pathogens and chemicals from manure, biosolids, or compost applications transported to surface water
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Community 3.1
Kentucky Bluegrass/Smooth Bromegrass/Shrubs

This community phase is dominated by the shade tolerant, cool-season sodgrasses including smooth brome and Kentucky bluegrass. Common forbs include goldenrod, American licorice, scurfpea, heath aster, and western yarrow. 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 in vigor and production. Infiltration is reduced and runoff is increased when compared to the Reference State but soil erosion remains low. Nutrient cycling is limited by the rooting depth of these species, the lack of leguminous forbs, and the alteration of the soil biotic community. Organic matter oxidizes in the air rather than being incorporated into the soil due to lack of animal impact and reduced soil biological activity. Energy capture into the system is restricted to a short window provided by the early season species and the high amount of dead, standing plant material. This community phase is somewhat resistant to change. Once reached, time and external resources will be needed to see any immediate recovery. The combination of both prescribed grazing and prescribed fire is most effective in moving this plant community towards State 2.

Dominant resource concerns

- Compaction
- Organic matter depletion
- Aggregate instability
- Surface water depletion
- Naturally available moisture use
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

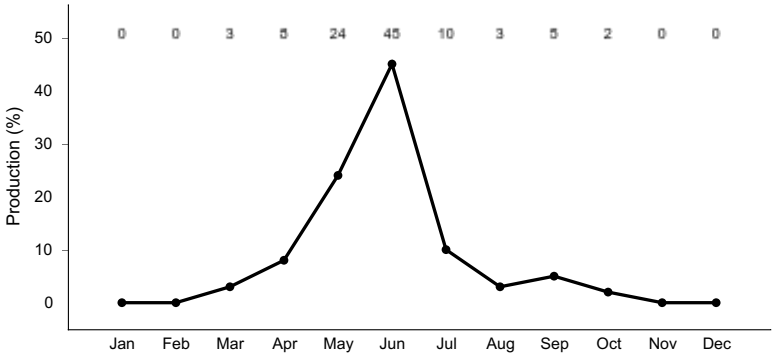


Figure 12. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Kentucky Bluegrass/Forbs

This community phase is dominated by Kentucky bluegrass with lesser amounts of sedge. Common forbs include goldenrod, western yarrow, aster, western ragweed, and a variety of introduced forbs. The longer this community phase exists, the more resistant and 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 production is limited.

Dominant resource concerns

- Compaction
- Organic matter depletion
- Aggregate instability
- Surface water depletion
- Naturally available moisture use
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

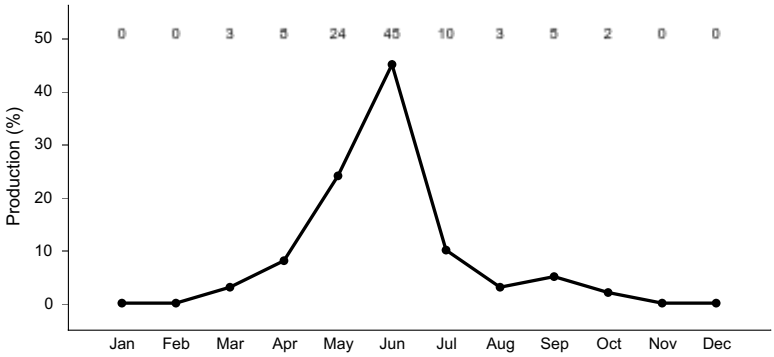


Figure 13. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.3
Annual/Pioneer Perennial

The Annual/Pioneer Perennial community phase is highly variable depending on the level and duration of disturbance related to the 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, however, the exotic cool-season perennial grasses Kentucky bluegrass, smooth brome, and/or quackgrass generally become established and dominate the community.

Dominant resource concerns

- Sheet and rill erosion
- Wind erosion
- Classic gully erosion
- Compaction
- Organic matter depletion
- Aggregate instability
- Surface water depletion
- Naturally available moisture use
- Pathogens and chemicals from manure, biosolids, or compost applications transported to surface water
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

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). 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 reduces litter cover resulting in elevated soil surface temperatures which increases evaporation rates and further reduces 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

Removal of vegetative cover and tilling for agricultural crop production.

Dominant resource concerns

- Sheet and rill erosion
- Wind erosion
- Ephemeral gully erosion
- Classic gully erosion
- Compaction
- Organic matter depletion
- Concentration of salts or other chemicals
- Aggregate instability
- Seasonal high water table
- Surface water depletion

- Naturally available moisture use
- Nutrients transported to surface water
- Nutrients transported to ground water
- Pesticides transported to surface water
- Pesticides transported to ground water
- Pathogens and chemicals from manure, biosolids, or compost applications transported to surface water
- Pathogens and chemicals from manure, biosolids, or compost applications transported to ground water
- Salts transported to surface water
- Salts transported to ground water
- Sediment transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution
- Energy efficiency of farming/ranching practices and field operations

Transition T1a
State 1 to 2

This is the transition from the native warm- and cool-season grass dominated Reference State to a state that has been invaded by introduced cool-season grass species. When propagules of Kentucky bluegrass are present, this transition occurs as natural and/or management actions favor a decline in the composition of native warm-season grasses and cool-season bunchgrasses with 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

This transition occurs with cessation of cropping practices.

Transition T2a/T2b
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 introduced grass species 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 introduced grass species 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

This transition occurs with cessation of cropping practices.

Restoration pathway R3a/R3b
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 upon 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. However, the initial application of prescribed fire can have detrimental effects on remnant native bunchgrass crowns. Damage may be reduced by adjusting prescription parameters. 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

This transition occurs with cessation of cropping practices.

Restoration pathway 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 (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-season Grasses**			480–800	
	big bluestem	ANGE	*Andropogon gerardii*	160–480	–
	sand bluestem	ANHA	*Andropogon hallii*	160–480	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	160–480	–
	switchgrass	PAVI2	*Panicum virgatum*	64–320	–
	Indiangrass	SONU2	*Sorghastrum nutans*	32–160	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–64	–
2	**Cool-season Bunchgrasses**			160–480	
	porcupinegrass	HESP11	*Hesperostipa spartea*	160–480	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	32–160	–

	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	32–160	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–96	–
3	**Mid Warm-season Grasses**			160–480	
	little bluestem	SCSC	*Schizachyrium scoparium*	160–480	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	64–320	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	32–160	–
4	**Mid Cool-season Grasses**			64–160	
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	0–160	–
	western wheatgrass	PASM	*Pascopyrum smithii*	32–160	–
5	**Short Warm-season Grasses**			32–160	
	blue grama	BOGR2	*Bouteloua gracilis*	32–160	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–64	–
6	**Other Native Grasses**			32–160	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	32–160	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	32–96	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–64	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–64	–
7	**Grass-likes**			64–320	
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	32–256	–
	Pennsylvania sedge	CAPE6	*Carex pensylvanica*	32–256	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–96	–
Forb					
8	**Forbs**			160–320	
	white sagebrush	ARLU	*Artemisia ludoviciana*	32–96	–
	flat-top goldentop	EUGR5	*Euthamia graminifolia*	32–64	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	32–64	–
	stiff goldenrod	OLRI	*Oligoneuron rigidum*	32–64	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	32–64	–
	white heath aster	SYER	*Symphyotrichum ericoides*	32–64	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	32–64	–
	purple prairie clover	DAPU5	*Dalea purpurea*	32–64	–
	silky prairie clover	DAVI	*Dalea villosa*	32–64	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–32	–
	narrowleaf stoneseed	LIIN2	*Lithospermum incisum*	0–32	–
	lobelia	LOBEL	*Lobelia*	0–32	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–32	–
	prairie milkweed	ASSU3	*Asclepias sullivantii*	0–32	–
	Forb, native	2FN	*Forb, native*	0–32	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–32	–
Shrub/Vine					
9	**Shrubs**			160–320	
	prairie willow	SAHU2	*Salix humilis*	32–128	–

	white meadowsweet	SPAL2	*Spiraea alba*	32–96	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–96	–
	prairie rose	ROAR3	*Rosa arkansana*	32–96	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	32–64	–

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:

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

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

    Dominant:

    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:**

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17. **Perennial plant reproductive capability:**
