USDA Natural Resources Conservation Service

Ecological site R055DY003SD
Subirrigated

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 ecological site is located on flats, swales, and shallow depressions on low-relief uplands – till plains, lake plains, outwash plains, and eolian sand plains; it also occurs on some lake beaches and flood plains. The soils are very deep and are somewhat poorly drained – redoximorphic features typically occur at a depth between 18 and 30 inches. Typically, the surface and upper subsoil are free of calcium carbonates; however, very slight to slight effervescence is allowable where the depth to a highly calcareous layer (strong or violent effervescence) is >16 inches. Soil salinity ranges from none to slight (E.C. <8). Sub-surface hydrology is the primary factor used in identifying this site. All textures are included in the site. Slopes range from 0 to 3 percent. On the landscape, this site is below the Loamy, Sandy, Sands, and Subirrigated Sands ecological sites and above the Wet Meadow site. The Limy Subirrigated ecological site occurs on similar landscape positions; it is highly

calcareous within a depth of 16 inches.

Associated sites

R055DY010SD	**Loamy** This site occurs higher on the landscape – primarily on till plains and lake plains, but it also occurs on outwash plains. The soil is loam, clay loam, silt loam or silty clay loam (forms a ribbon 1 to 2 inches long) to a depth >20 inches. It is deeper than 3 feet to redoximorphic features.
R055DY006SD	**Limy Subirrigated** This site occurs on similar landscape positions. It is highly calcareous in the upper part of the subsoil and has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site. It is non-saline to slightly saline (E.C. <8) in the surface and subsoil layers.
R055DY008SD	**Sands** This site occurs higher on the landscape on sand plains. It is sand or loamy sand (fine to coarse sands) within a depth of 10 inches and does not have a significant amount of gravel; the soil does not form ribbon. It is deeper than 4 feet to redoximorphic features.
R055DY009SD	**Sandy** This site occurs higher on the landscape on lake plains and till plains mantled with moderately coarse textured eolian deposits. It is fine sandy loam or sandy loam (forms a ribbon <1 inch long) to a depth >10 inches. It is deeper than 3 feet to redoximorphic features
R055DY004SD	**Wet Meadow** This site occurs in depressions and slightly below Subirrigated on 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.
R055DY044SD	**Subirrigated Sands** This site occurs slightly higher on the landscape on sand plains. It has redoximorphic features at a depth of 30 to 42 inches. The subsoil is fine sand or loamy fine sand (does not form a ribbon).

Similar sites

R055DY020SD	**Loamy Overflow** This site occurs in upland swales and on floodplains. The surface and subsoil layers form a ribbon 1 to 2 inches long. It is deeper than 30 inches to redoximorphic features.
R055DY006SD	**Limy Subirrigated** This site occurs on similar landscape positions. It is highly calcareous in the upper part of the subsoil and has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site. It is non-saline to slightly saline (E.C. <8) in the surface and subsoil layers.
R055DY044SD	**Subirrigated Sands** This site occurs slightly higher on the landscape on sand plains. It has redoximorphic features at a depth of 30 to 42 inches. The subsoil is fine sand or loamy fine sand (does not form a ribbon).

Table 1. Dominant plant species

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

Physiographic features

This site typically occurs on flats, swales, and shallow depressions on low-relief uplands – till plains, lake plains, outwash plains, and eolian sand plains; it also occurs on some lake beaches and flood plains. Slopes typically are less than 3 percent; and slope shape is typically concave.

Table 2. Representative physiographic features

Landforms	(1) Ground moraine (2) Lake plain (3) Outwash plain (4) Flood plain (5) Beach
Runoff class	Negligible to low
Flooding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to occasional
Elevation	299–649 m
Slope	0–2%
Ponding depth	0–15 cm
Water table depth	38–99 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

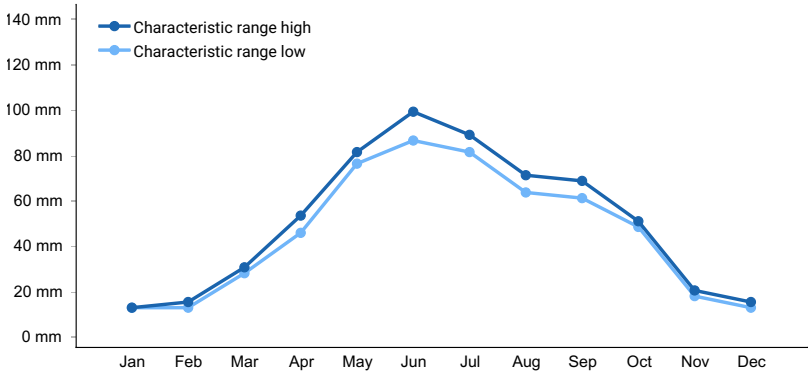


Figure 1. Monthly precipitation range

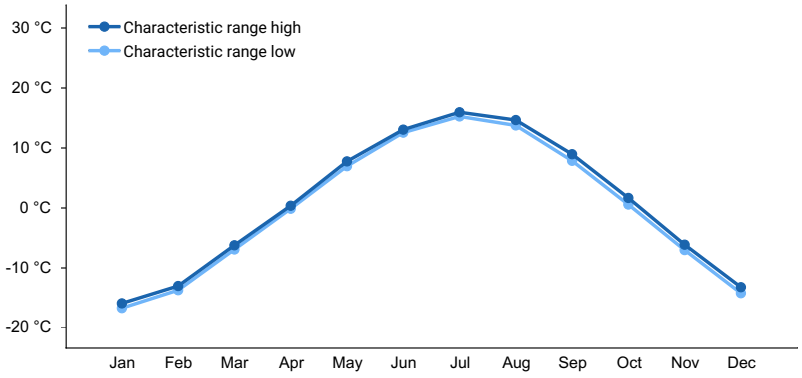


Figure 2. Monthly minimum temperature range

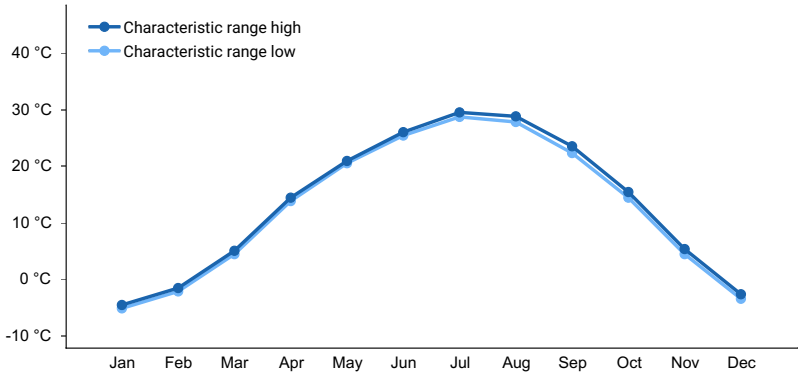


Figure 3. Monthly maximum temperature range

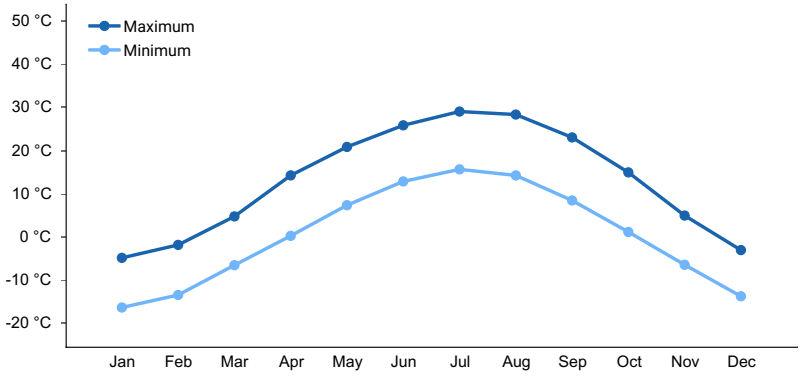


Figure 4. Monthly average minimum and maximum temperature

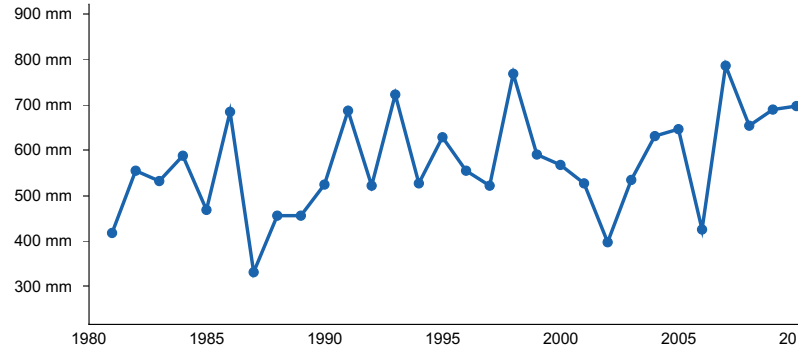


Figure 5. Annual precipitation pattern

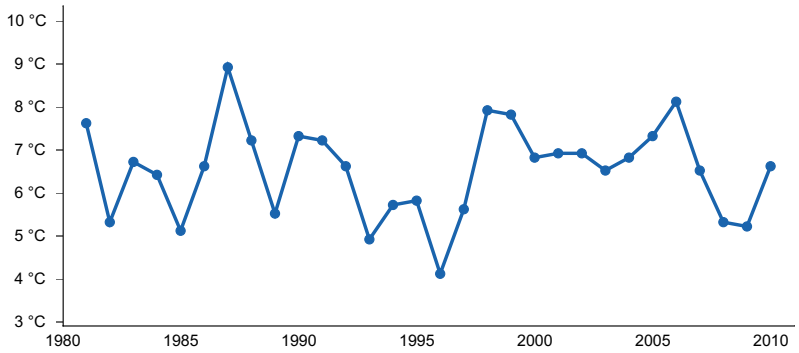


Figure 6. Annual average temperature pattern

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

Under normal climatic conditions, this site typically has no wetland functions; however, it can be closely associated with wetland sites, such as Wet Meadow. During prolonged wetter than normal periods, some wetland functions (a predominance of hydrophytic vegetation and ground water recharge) may be evident where this site occurs in shallow depressions.

The Subirrigated site does receive additional water from a seasonal high water table (endosaturation). During the growing season, water table depths typically are 1.5 to 3 feet during April through June. In mid-summer through autumn, the water table lowers a depth to 3 to 5 feet as a result of evapotranspiration and reduced precipitation. Surface infiltration ranges from moderately slow to rapid. Saturated hydraulic conductivity through the profile typically is moderately high or high, but is very high in the substratum of some coarse-textured soils. Water loss is primarily through evapotranspiration. During mid-summer, particularly during drier than normal cycles) 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 with the exception of the few areas where this site occurs as a minor component on flood plains. There, additional water may be received from occasional stream overflow. Areas of the site on lake beaches may receive additional water as lateral flow through the substratum soil materials for prolonged periods of subirrigation.

Wetland description

Not Applicable.

Soil features

Soils are in the Mollisol, Entisol, and Vertisol orders. The Mollisols are classified further as Typic Endoaquolls, Cumulic Endoaquolls, Aquic Hapludolls, Pachic Argiudolls, Glossic Natrudolls, Vertic Argiaquolls, and Typic Natraquolls. The Entisols are classified further as Typic Psammaquents, Aeric Endoaquents, and Aquertic Udfluvents. The Vertisols are classified further as Aquic Hapluderts. These soils were developed under prairie vegetation. They formed in glacial till, glaciolacustrine sediments, glaciofluvial deposits, eolian deposits, alluvium, or lake beach deposits.

The common features of soils in this site are a seasonal high water table which contributes additional water for transpiration and surface and upper subsoil layers which are leached of calcium carbonates. The soils are somewhat poorly drained - redoximorphic features typically occur at a depth between 18 and 30 inches. Depth to a highly calcareous layer (strong or violent effervescence) is >16 inches. Since sub-surface hydrology is the primary factor used in identifying this site, all textures are included. Therefore, soil physical properties associated with texture vary widely.

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. Sub-surface soil layers are non-restrictive to water movement and root penetration.

These are very deep, somewhat poorly drained, coarse to moderately fine textured soils. Saturated hydraulic conductivity is moderate to moderately slow and available water capacity is low to high. Salinity is none to very slight and sodicity is none. These soils have a high water table (1.5 to 3.5 feet from the surface) which keeps the rooting zone moist for most of the growing season. This site is on flats and swales on alluvial plains, lake plains and till plains. Slope ranges from 0 to 3 percent. This site should show slight to no evidence of rills, wind scoured areas or pedestalled plants. No water flow paths are seen on this site. The soil surface is stable and intact. Sub-surface soil layers are non-restrictive to water movement and root penetration.

Major soil series correlated to the Subirrigated site are: Badger, Bantry, Camtown, Castlewood, Doran, Garborg, Kindred, Lamoure, Ranslo, Spottswood, and Winship.

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

Table 4. Representative soil features

Parent material	(1) Till (2) Glaciolacustrine deposits (3) Glaciofluvial deposits (4) Alluvium (5) Eolian deposits
Surface texture	(1) Loam (2) Silt (3) Sand
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained
Permeability class	Moderately slow to rapid
Depth to restrictive layer	203 cm
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	12.7–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	1–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	6.5–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0–2%

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 Big Bluestem/Switchgrass Plant Community Phase (1.1). Under adverse impacts, a slow decline in vegetative vigor and composition will occur. Under favorable conditions the site has the potential to resemble the Big Bluestem/Switchgrass Plant Community Phase. This community phase and 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.

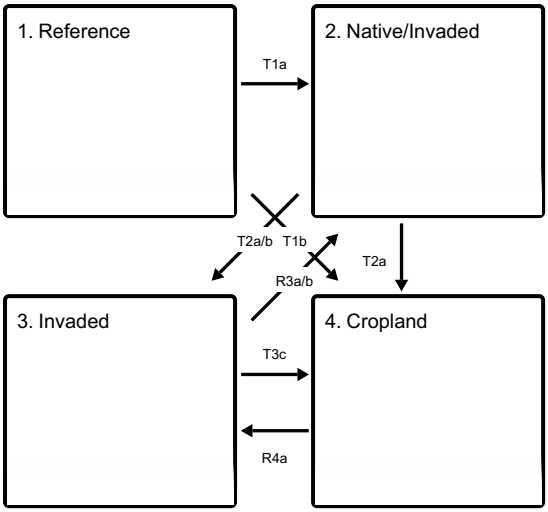
The natural disturbance regime consisted of sporadic fires caused both by natural and Native American ignition sources. These fires occurred during any season of the year, but were concentrated in the spring and late summer or early fall. Lightening fires occurred most frequently in July and August while 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. Continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the Reference State. Species such as western wheatgrass and blue grama will initially increase. Big bluestem, green needlegrass, and sideoats grama will decrease in frequency and production. In time, heavy continuous grazing will likely cause a stable dominance of Kentucky bluegrass and blue grama. These species then will have a competitive advantage which prevents other species from establishing or increasing. This plant community is less productive than the Reference State. Runoff increases and infiltration will decrease. Soil erosion will be minimal. 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. In time, shrubs such as western snowberry and chokecherry will likely increase and become co-dominant with the Kentucky bluegrass and smooth bromegrass.

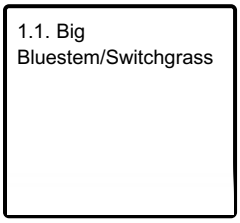
The following diagram illustrates the common states, community phases, community pathways, transitions and restoration pathways that can occur on the site. These are the most common plant community phases and states based on current knowledge and experience, and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

State and transition model

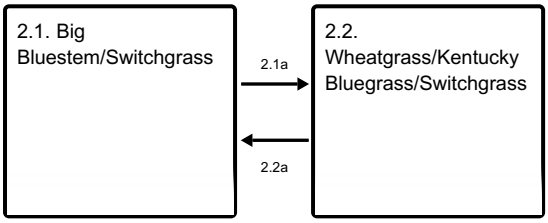
Ecosystem states



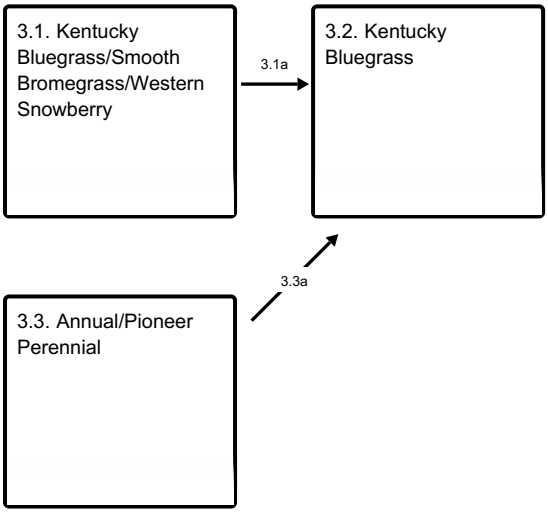
State 1 submodel, plant communities



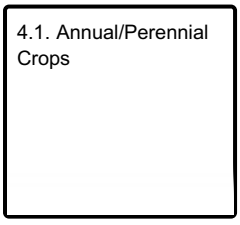
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. Plant community phases occurring within this state are diverse, stable, production and well adapted to the Northern Great Plains. Tall stature warm-season grasses dominated the state. The primary disturbance mechanisms for this site in the reference conditioned include frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. This included declines in the tall stature warm-season grass species and a corresponding increase in mid and short stature warm- and cool-season grasses. Community dynamics, nutrient cycle, water cycle and energy flow were functioning properly. Plant litter was properly distributed with very little movement off-site and natural plant mortality was very low. The diversity in plant species allowed for a high tolerance to a fluctuating water table. Run-off from adjacent sites and moderate or high available water capacity provided a favorable soil-water-plant relationship.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Community 1.1
Big Bluestem/Switchgrass

This community phase was the most dominant both temporally and spatially. The prevailing climate and weather patterns favored the development of this community phase dominated by tall warm-season such as big bluestem, switchgrass, Indiangrass, and prairie cordgrass. Other grass and grass-likes species occurring include little bluestem, northern reedgrass, slender wheatgrass western wheatgrass, Canada wildrye, sedges and rushes. A wide variety of perennial forbs were present but only in slight amounts. Forbs included American licorice, goldenrods, Maximilian sunflower, and western yarrow. Shrub species would have included rose, western snowberry and willow. This is the reference plant community phase and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3626	4714	5884
Forb	247	396	560
Shrub/Vine	50	158	280
Total	**3923**	**5268**	**6724**

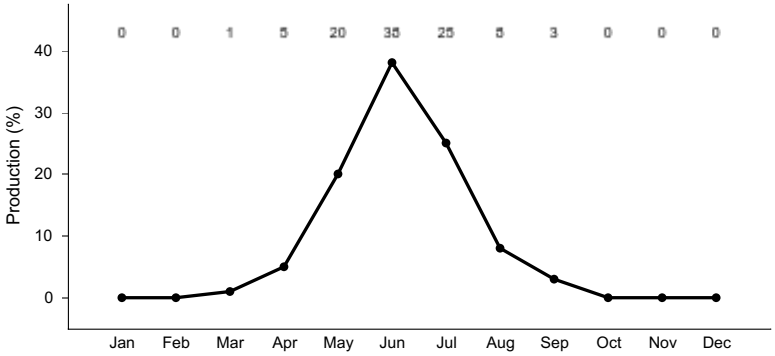


Figure 8. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

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 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 very infrequent fires. Timing of grazing coupled with weather events dictate the dynamics that occur within this state. The warm-season native grass can decline and an increase in introduced sod grasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season-long grazing.

Dominant plant species

- western snowberry (*Symphoricarpos occidentalis*), shrub
- rose (*Rosa*), shrub
- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- northern reedgrass (*Calamagrostis stricta ssp. inexpansa*), grass
- slender wheatgrass (*Elymus trachycaulus*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- American licorice (*Glycyrrhiza lepidota*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- Maximilian sunflower (*Helianthus maximiliani*), other herbaceous

Community 2.1
Big Bluestem/Switchgrass

This community phase most closely resembles the Reference State in appearance and ecological functions (e.g., hydrologic, biotic and soil/site stability). The warm-season dominated community is maintained with grazing systems that allow for adequate recovery periods following grazing events, and potentially the combination of grazing and prescribed burning which closely mimics the natural disturbance regime. This community phase is dominated by tall warm-season and mid cool-season grasses such as big bluestem, switchgrass, Indiangrass, northern reedgrass and slender wheatgrass. Other grass and grass-likes species occurring include little bluestem, western wheatgrass, Canada wildrye, and sedge. A wide variety of perennial forbs are present but only in slight amounts. 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.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3626	4714	5884
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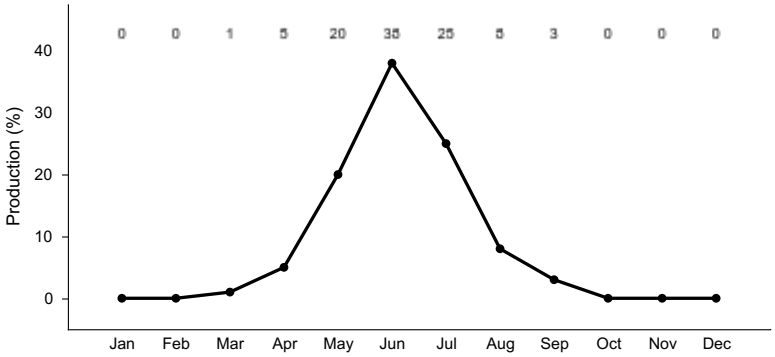

Figure 10. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Community 2.2
Wheatgrass/Kentucky Bluegrass/Switchgrass

Grazing pressure reduces the tall, less grazing tolerant species, while the mid and short stature grazing tolerant species increase. Litter amounts are reduced, and energy capture shifts to earlier in the growing season due to a decline in the warm-season grass component. Non-native grasses, such as Kentucky bluegrass tend to increase and may begin to dominate this community phase. Mid stature cool-season grasses such as western wheatgrass, northern reedgrass and slender wheatgrass still dominate with Kentucky bluegrass approaching co-dominance. The tall stature warm season species have been significantly reduced but still may be present in minor amounts. The common forbs include American licorice, goldenrod, heath aster, scurfpea, sunflower and western yarrow. Western snowberry, and rose are the principal shrubs. 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 and the competitive advantage goes towards the grazing tolerant short statured species such as Kentucky bluegrass, blue grama, and sedge. 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 Big Bluestem/Switchgrass 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. Soil erosion is low. Infiltration is reduced, while runoff is increased compared to the Reference State.

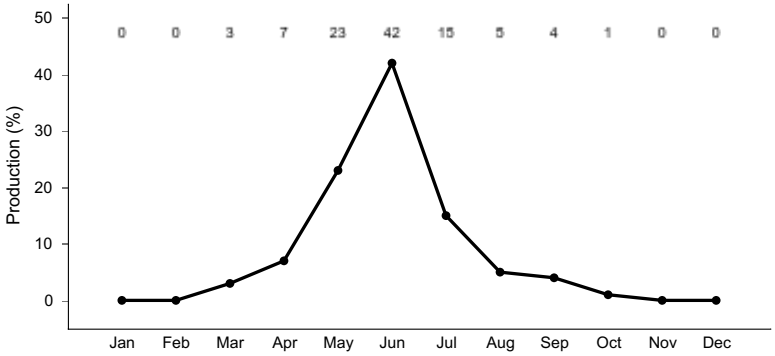

Figure 11. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

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

continuous grazing without adequate recovery periods. This change will favor the mid and short stature grazing tolerant species over the tall, less grazing tolerant warm-season grasses. Chronic heavy grazing for extended periods during the growing season will also favor this shift. Included with areas affected by a lack of adequate recovery periods may be areas that receive little or no grazing, which may also lead to the increase of introduced cool-season species. Along this pathway, the timing of energy capture shifts from mid June through July to mid May through June. 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.

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 tall and mid 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 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
- rose (*Rosa*), shrub
- chokecherry (*Prunus virginiana*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- American licorice (*Glycyrrhiza lepidota*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous

Community 3.1
Kentucky Bluegrass/Smooth Bromegrass/Western Snowberry

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. Chokecherry and rose may also increase in density and cover. Native trees such as green ash and introduced species such as Siberian elm and Russian olive may become scattered across the site. 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 the most effective in moving this plant community towards State 2.

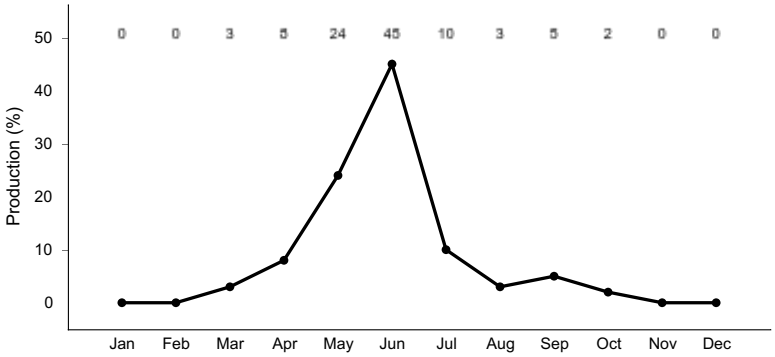

Figure 12. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Kentucky Bluegrass

This community phase is dominated by Kentucky bluegrass with lesser amounts of sedge. Common forbs would include goldenrod, western yarrow, aster, western ragweed and a variety of introduced forbs. The longer this community phase persists, 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. Production is limited to the sod forming species. Energy capture into this system is limited to single, early growing species. Runoff increases and is the highest of any plant community phase on this ecological site. Nutrient cycling is severely limited to the rooting depth of the Kentucky bluegrass and production is limited.

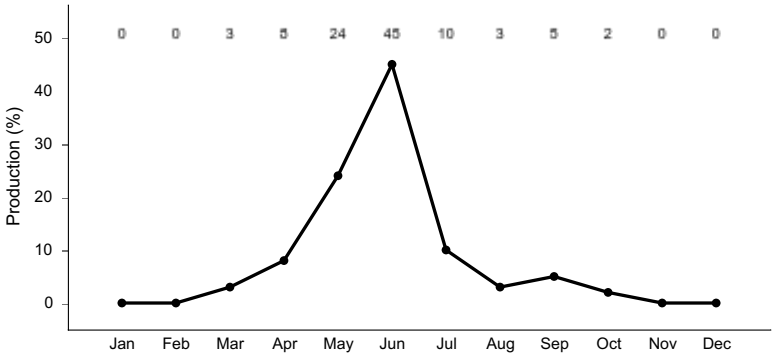

Figure 13. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

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. Overtime, 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 reduces litter cover resulting in elevated soil surface temperatures increasing evaporation rates and further 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.

Community 4.1
Annual/Perennial Crops

This plant community is the result of cropping.

Transition T1a
State 1 to 2

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

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, and 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, and 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 fine 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, and 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 T2a
State 2 to 4

This transition occurs with cessation of cropping practices being applied.

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. 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 properly timed 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 continued treatment of the introduced sodgrasses.

Transition T3c
State 3 to 4

This transition occurs with cessation of cropping practices being applied.

Restoration pathway R4a
State 4 to 3

This transition occurs with cessation of cropping practices being applied.

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	**Tall & Mid Warm-Season Grasses**			1317–2634	
	big bluestem	ANGE	*Andropogon gerardii*	1054–2107	–
	switchgrass	PAVI2	*Panicum virgatum*	527–1054	–
	Indiangrass	SONU2	*Sorghastrum nutans*	263–527	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–263	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–263	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–263	–
2	**Cool-season Grasses**			263–1317	

	Grass, perennial	2GP	*Grass, perennial*	53–527	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	53–527	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	53–527	–
	western wheatgrass	PASM	*Pascopyrum smithii*	53–263	–
	Canada wildrye	ELCA4	*Elymus canadensis*	53–263	–
3	**Grass-likes**			105–527	
	sedge	CAREX	*Carex*	105–421	–
	rush	JUNCU	*Juncus*	53–263	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–263	–
Forb					
4	**Forbs**			263–527	
	Forb, native	2FN	*Forb, native*	53–263	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	53–158	–
	scurfpea	PSORA2	*Psoralidium*	53–158	–
	western dock	RUAQ	*Rumex aquaticus*	0–105	–
	ragwort	SENEC	*Senecio*	53–105	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	53–105	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	53–105	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	53–105	–
	Canadian anemone	ANCA8	*Anemone canadensis*	53–105	–
	Indianhemp	APCA	*Apocynum cannabinum*	53–105	–
	showy milkweed	ASSP	*Asclepias speciosa*	53–105	–
	aster	ASTER	*Aster*	53–105	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	53–105	–
	white heath aster	SYER	*Symphyotrichum ericoides*	53–105	–
	vervain	VERBE	*Verbena*	53–105	–
	mint	MENTH	*Mentha*	53–105	–
	stiff goldenrod	OLRI	*Oligoneuron rigidum*	53–105	–
	Canada goldenrod	SOCA6	*Solidago canadensis*	53–105	–
	giant goldenrod	SOGI	*Solidago gigantea*	0–105	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–53	–
	cinquefoil	POTEN	*Potentilla*	0–53	–
	horsetail	EQUIS	*Equisetum*	0–53	–
	northern bedstraw	GABO2	*Galium boreale*	0–53	–
	gentian	GENTI	*Gentiana*	0–53	–
	stickseed	HACKE	*Hackelia*	0–53	–
	wood lily	LIPH	*Lilium philadelphicum*	0–53	–
	blue-eyed grass	SISYR	*Sisyrinchium*	0–53	–
Shrub/Vine					
5	**Shrubs**			53–263	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–158	–
	rose	ROSA5	*Rosa*	53–158	–

	western snowberry	SYOC	*Symphoricarpos occidentalis*	53–158	–
	willow	SALIX	*Salix*	0–53	–

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall & Mid Warm-Season Grasses**			1317–2634	
	big bluestem	ANGE	*Andropogon gerardii*	1054–2107	–
	switchgrass	PAVI2	*Panicum virgatum*	527–1054	–
	Indiangrass	SONU2	*Sorghastrum nutans*	263–527	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–263	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–263	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–263	–
2	**Cool-season Grasses**			263–1317	
	Grass, perennial	2GP	*Grass, perennial*	53–527	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	53–527	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	53–527	–
	western wheatgrass	PASM	*Pascopyrum smithii*	53–263	–
	Canada wildrye	ELCA4	*Elymus canadensis*	53–263	–
3	**Grass-likes**			105–527	
	sedge	CAREX	*Carex*	105–421	–
	rush	JUNCU	*Juncus*	53–263	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–263	–
4	**Non-Native Grasses**			53–105	
	smooth brome	BRIN2	*Bromus inermis*	53–105	–
	Kentucky bluegrass	POPR	*Poa pratensis*	53–105	–
	Grass, perennial	2GP	*Grass, perennial*	0–53	–
Forb					
5	**Forbs**			263–527	
	Forb, native	2FN	*Forb, native*	53–263	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	53–158	–
	scurfpea	PSORA2	*Psoralidium*	53–158	–
	western dock	RUAQ	*Rumex aquaticus*	0–105	–
	ragwort	SENEC	*Senecio*	53–105	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	53–105	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	53–105	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	53–105	–
	Canadian anemone	ANCA8	*Anemone canadensis*	53–105	–
	Indianhemp	APCA	*Apocynum cannabinum*	53–105	–
	showy milkweed	ASSP	*Asclepias speciosa*	53–105	–
	aster	ASTER	*Aster*	53–105	–
	wavvleaf thistle	CIUN	*Cirsium undulatum*	53–105	–

	white heath aster	SYER	*Symphyotrichum ericoides*	53–105	–
	vervain	VERBE	*Verbena*	53–105	–
	mint	MENTH	*Mentha*	53–105	–
	stiff goldenrod	OLRI	*Oligoneuron rigidum*	53–105	–
	Canada goldenrod	SOCA6	*Solidago canadensis*	53–105	–
	giant goldenrod	SOGI	*Solidago gigantea*	0–105	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–53	–
	cinquefoil	POTEN	*Potentilla*	0–53	–
	horsetail	EQUIS	*Equisetum*	0–53	–
	northern bedstraw	GABO2	*Galium boreale*	0–53	–
	gentian	GENTI	*Gentiana*	0–53	–
	stickseed	HACKE	*Hackelia*	0–53	–
	wood lily	LIPH	*Lilium philadelphicum*	0–53	–
	blue-eyed grass	SISYR	*Sisyrinchium*	0–53	–
Shrub/Vine					
6	**Shrubs**			53–263	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–158	–
	rose	ROSA5	*Rosa*	53–158	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	53–158	–
	willow	SALIX	*Salix*	0–53	–

Inventory data references

Information presented here has been derived from NRCS and other federal/state agency clipping and inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field-tested by various private, state and federal agency specialists. Those involved in developing this site description include: Stan Boltz, NRCS Range Management Specialist; David Dewald, NRCS State Biologist; Jody Forman, NRCS Range Management Specialist; Jeff Printz, NRCS State Range Management Specialist; Kevin Sedivec, Extension Rangeland Management Specialist; Shawn Dekeyser, North Dakota State University; Rob Self, The Nature Conservancy and Lee Voigt, NRCS Range Management Specialist.

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

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Approval

Suzanne Mayne-Kinney, 11/14/2024

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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

Indicators

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

   _____

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

   _____

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

   _____

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

   _____

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

---

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

---

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

---

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

---

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

---

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

---

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

---

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

---

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

---

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

---

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

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if**

their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

---

17. **Perennial plant reproductive capability:**
