Ecological site R055DY006SD
Limy 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 Limy Subirrigated ecological site is located on low-relief areas of till plains, lake plains, outwash plains, and sand plains - on flats, slight rises, and slightly convex slopes adjacent to shallow depressions. In addition, it occurs on some low terraces of drainageways and a few areas occur on upland seeps. The soils are very deep. The dark-colored surface soil is more than 7 inches thick and typically has calcium carbonate (slight to moderate effervescence). The subsoil is highly calcareous (violent effervescence) within a depth of 16 inches. The soils are somewhat poorly drained – redoximorphic features typically occur at a depth between 18 and 30 inches. Since carbonate accumulation and a seasonal high water table are the primary factors used in identifying this site, soil texture is not a criteria in site identification. Soil salinity is none to slight to a depth of >30 inches; sodicity is also low to that depth. Slope is typically less than 3 percent; however, areas of seeps have slopes up to 6 percent. On the landscape, this site is below the Loamy and Subirrigated Sands ecological sites and above the Saline Lowland, Wet Meadow, and Shallow Marsh sites. The Subirrigated ecological site has concave slopes; it does not have a highly calcareous subsoil within a depth of 16 inches.

Associated sites

R055DY001SD	**Shallow Marsh** This site occurs in deep depressions which have frequent ponding through most of the growing season. All textures are included in this site.
R055DY044SD	**Subirrigated Sands** This site occurs on slightly higher, better drained positions on sand plains and outwash plains. It is not highly calcareous in the surface or upper subsoil layers.
R055DY007SD	**Saline Lowland** This site occurs on similar and lower landscape positions. It has an accumulation of salts in the surface and subsoil layer (E.C. >8). A claypan is allowed in Saline Lowland sites if E.C. is >8 and the soil is poorly drained. All textures are included in this site.
R055DY010SD	**Loamy** This site occurs on somewhat higher, better drained positions on till plains and lake plains. The surface and upper subsoil are typically non-calcareous, but slight effervescence is allowed where the depth to strong or violent effervescence is >16 inches. The surface layer and subsoil form a ribbon 1 to 2 inches long. It is >30 inches to redoximorphic features.
R055DY003SD	**Subirrigated** This site occurs on concave flats and in shallow depressions which have occasional, brief ponding early in the growing season. It is >16 inches to a highly calcareous subsoil. All textures are included in this site.
R055DY004SD	**Wet Meadow** This site occurs in depressions and slightly below Limy 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.

Similar sites

R055DY007SD	**Saline Lowland** This site occurs on similar and lower landscape positions. It has an accumulation of salts in the surface and subsoil layer (E.C. >8). A claypan is allowed in Saline Lowland sites if E.C. is >8 and the soil is poorly drained. All textures are included in this site.
R055DY003SD	**Subirrigated** This site occurs on concave flats and in shallow depressions which have occasional, brief ponding early in the growing season. It is >16 inches to a highly calcareous subsoil. All textures are included in this site.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on level, nearly level and slight rises on till plains and lake plains, and on slightly convex slopes adjacent to shallow depressions.

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Lake plain (3) Outwash plain (4) Drainageway (5) Ground moraine (6) Seep
Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	299–649 m
Slope	0–2%
Ponding depth	0 cm
Water table depth	48–109 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

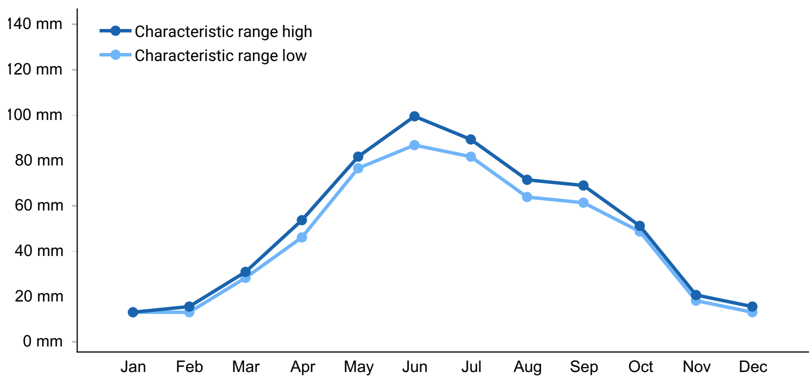


Figure 1. Monthly precipitation range

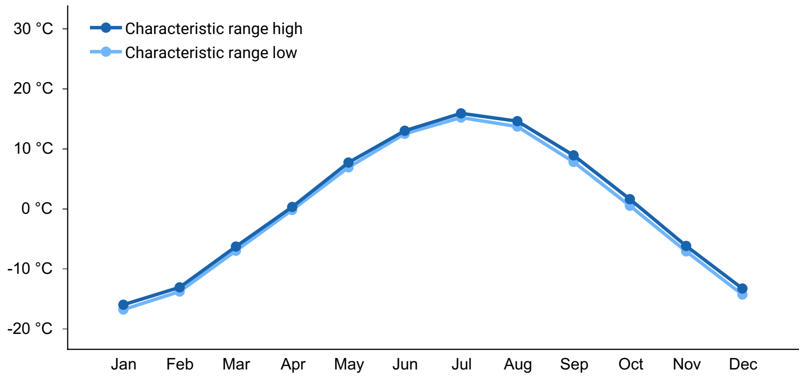


Figure 2. Monthly minimum temperature range

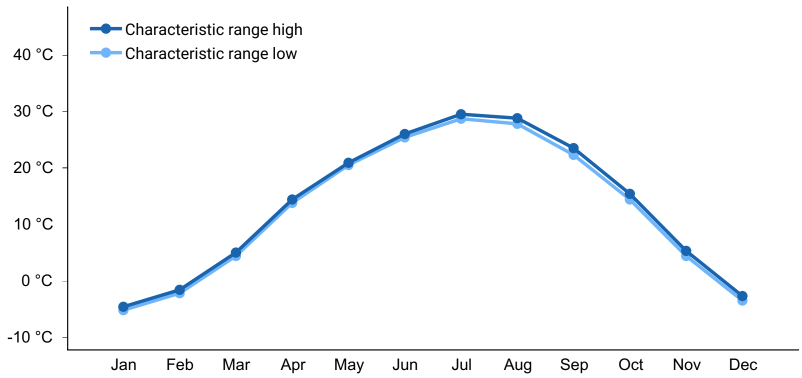


Figure 3. Monthly maximum temperature range

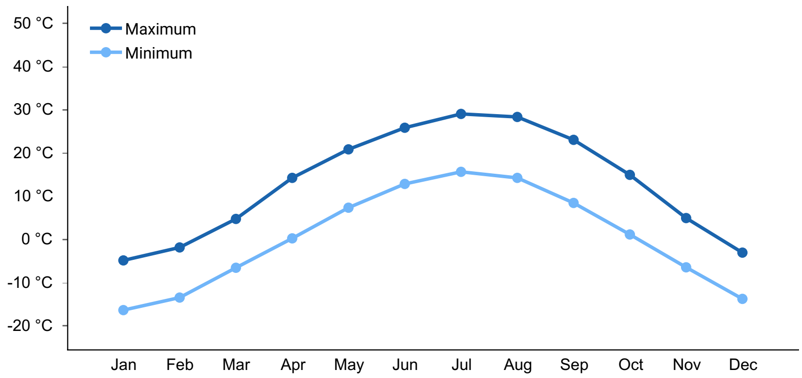


Figure 4. Monthly average minimum and maximum temperature

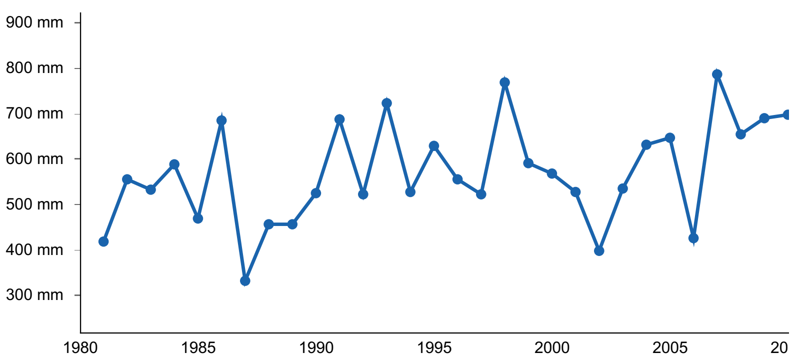


Figure 5. Annual precipitation pattern

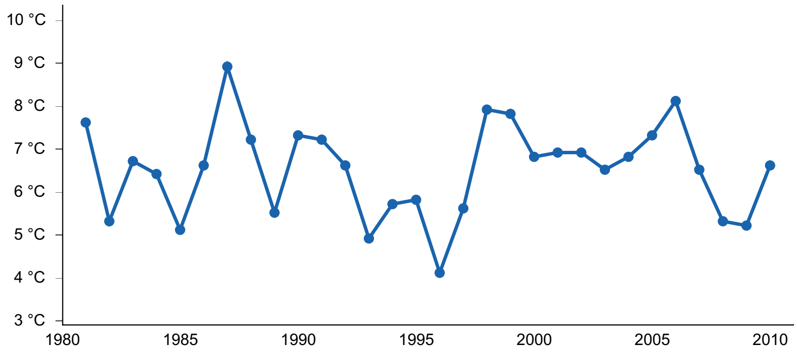


Figure 6. Annual average temperature pattern

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 wetter sites, like Subirrigated, or Wet Meadow.

The Limy 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 3.5 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. Water loss is primarily through evapotranspiration. During mid-summer, particularly during drier than normal cycles) percolation below the root zone may also occur.

Soil features

Soils associated with this site are in the Mollisol order and are classified further as Aeric Calciaquolls. These soils were developed under prairie vegetation. Typically, they formed in glacial till, glaciolacustrine sediments, glaciofluvial deposits, or eolian deposits; a few formed in alluvium along drainageways.

The common features of soils in this site are a highly calcareous subsoil within a depth of 16 inches and a seasonal high water table which contributes additional water for transpiration. This site is somewhat poorly drained – redoximorphic features typically occur at a depth between 18 and 30 inches. These soils are very deep. Since sub-surface hydrology and calcium carbonate accumulation are the primary factors used in identifying this site, all textures are included. Therefore, soil physical properties associated with texture vary widely.

Soil salinity is none to slight (E.C. <8) to a depth >30 inches; sodicity is also low to that depth. Both salinity and sodicity may increase to moderate below that depth in some moderately fine to moderately coarse textured soils .

Soil reaction typically is neutral to moderately alkaline (pH 6.6 to 8.4) in the surface layer and slightly or moderately alkaline (pH 7.4 to 8.4) below. Calcium carbonate content is typically less than 15 percent in the surface layer; it is greater than 15 percent in highly calcareous subsoil. In the substratum, it decreases to less than 15 percent in moderately fine and moderately coarse texture soils; it may be less than 5 percent in coarse-textured soils.

Soils on this site are moderately susceptible to highly susceptible to wind erosion. 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.

Major soil series correlated to the Limy Subirrigated site are: Bearden, Cubden, Divide, Glyndon, Grimstad, Hamerly, Moritz, Ulen, and Wyndmere.

Table 4. Representative soil features

Parent material	(1) Till (2) Glaciolacustrine deposits (3) Glaciofluvial deposits (4) Eolian sands (5) Alluvium
Surface texture	(1) Loam (2) Silt loam (3) Loamy fine sand (4) Silty clay loam (5) Fine sandy loam
Drainage class	Somewhat poorly drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	203 cm
Soil depth	203 cm
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	0–1%
Available water capacity (0-152.4cm)	12.95–19.81 cm
Calcium carbonate equivalent (0-101.6cm)	6–37%
Electrical conductivity (0-101.6cm)	1–7 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.5
Subsurface fragment volume <=3" (0-101.6cm)	0–5%
Subsurface fragment volume >3" (0-101.6cm)	0%

Ecological dynamics

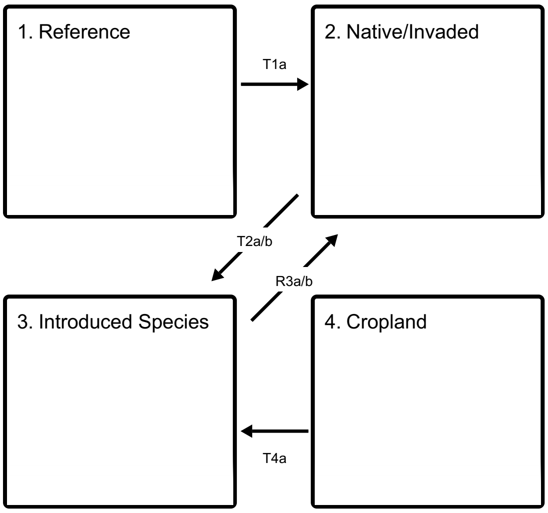
The site developed under Northern Great Plains climatic conditions, and included natural influence of large herding herbivores and sporadic fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a slow decline in vegetative vigor and composition will occur. Under favorable conditions this site has the potential to resemble the Reference State. Interpretations for this site are based on the Little Bluestem/Big Bluestem/Needlegrass Plant Community Phase (1.1). 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 causes this site to depart from the Little Bluestem/Big Bluestem/Needlegrass Plant Community Phase (2.1). Initially little bluestem will increase. Kentucky bluegrass will increase in frequency and density. Kentucky bluegrass may eventually form into a dense sod under heavy continuous grazing. Grasses such as little bluestem, big bluestem, switchgrass and Indiangrass will decrease in frequency and production and can eventually be removed from the site. A lack of disturbance (i.e, non- use and fire suppression) will cause litter levels and plant decadence/mortality to increase resulting in an increase of Kentucky bluegrass and smooth bromegrass.

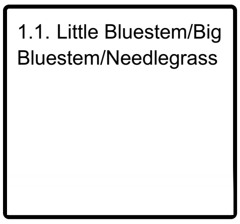
The following diagram illustrates the common states, community phases, community pathways, transitions and restoration pathways that can occur on the site. The Reference State has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term 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. 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

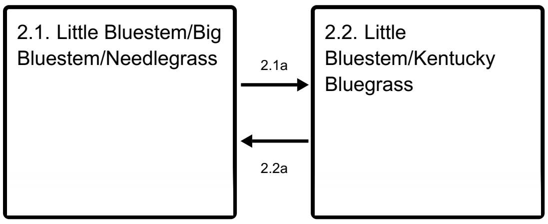
Ecosystem states



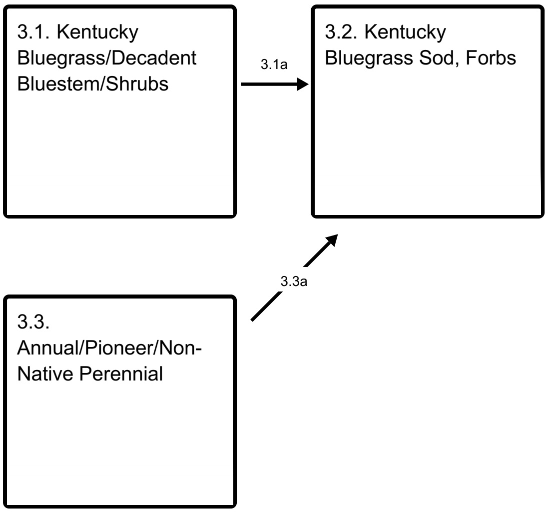
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

This state represents the natural range of variability that dominated the dynamics of this ecological site. This state was diverse, stable, productive and well adapted to the Northern Great Plains. The high water table supplied much of the moisture for plant growth. Plant litter was properly distributed with little movement and natural plant mortality was very low. This was a sustainable state in terms of soil stability, watershed function and biologic integrity. This state was dominated by warm-season grasses, with lesser amounts of cool-season grasses. The primary disturbance mechanisms for this site in the reference condition included sporadic 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. Mid and tall statured grass species could have declined with a corresponding increase in short statured warm-season grasses and cool-season grass-like species occurring.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- big bluestem (*Andropogon gerardii*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- green needlegrass (*Nassella viridula*), grass

Community 1.1
Little Bluestem/Big 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 dominated by tall and mid warm-season and mid cool-season grasses such as little bluestem, big bluestem, and porcupine grass and/or green needlegrass. Other grass and grass-like species included switchgrass, Indiangrass, sideoats grama, western wheatgrass, slender wheatgrass and sedge. A variety of native perennial forbs were present but only in slight amounts. Interpretations are based primarily on this plant community phase. It is further described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. This was a naturally nitrogen deficient plant community.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3144	4035	5459
Forb	219	336	476
Shrub/Vine	–	112	230
Total	**3363**	**4483**	**6165**

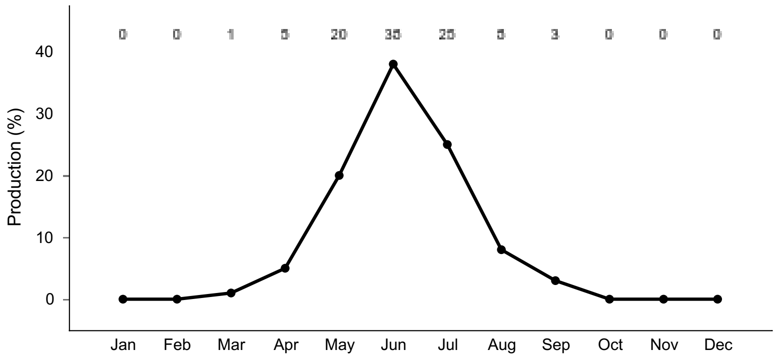


Figure 8. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

State 2
Native/Invaded

This state is very similar to the reference state. The invasion of introduced species 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 infrequent fires. Grazing coupled with weather events dictate the dynamics that occur within this state. Fire could still play an important role, but is typically not utilized or is suppressed. The warm-season native grasses 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

- little bluestem (*Schizachyrium scoparium*), grass
- big bluestem (*Andropogon gerardii*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 2.1
Little Bluestem/Big 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-season grass 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 and mid warm-season grasses, and mid cool-season grasses such as little bluestem, big bluestem, and porcupine grass and/or green needlegrass. Other grass and grass-like species include switchgrass, Indiangrass, sideoats grama, western wheatgrass, slender wheatgrass and sedge. A variety of native 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 and biological activity 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 (State 3).

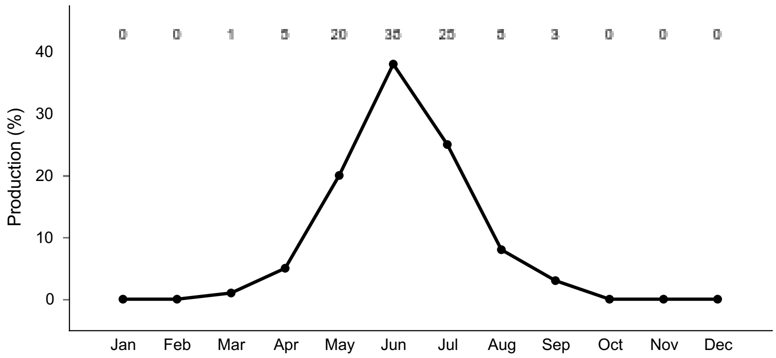


Figure 9. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Community 2.2
Little Bluestem/Kentucky Bluegrass

Grazing pressure reduces the tall, less grazing tolerant species, while the shorter more grazing tolerant species increase. Litter amounts are reduced, and energy capture shifts to slightly earlier in the growing season due to a decline in the warm-season grass component. Non-native grasses, such as Kentucky bluegrass and smooth bromegrass tend to increase and may begin to dominate this community phase. In the early stages of this community phase, little bluestem will initially increase along with the increase of introduced cool-season grasses. In many situations with inadequate recovery periods, the little bluestem will also begin to decline over time, facilitating the change to the Invaded State. Significant grass and grass-like species include little bluestem, green needlegrass, western wheatgrass, slender wheatgrass, Kentucky bluegrass and sedge. Other grasses present include big bluestem, switchgrass, porcupine grass, and sideoats grama. Indiangrass and northern reedgrass are largely absent. The common forbs include American licorice, cudweed sagewort, goldenrod, silverleaf scurfpea, and western yarrow. Western snowberry and prairie 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. 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 Little Bluestem/Big 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 method to move this community phase towards a community resembling the interpretive plant community. Soil erosion is low. Infiltration is reduced, while runoff is increased compared to the interpretive plant community.

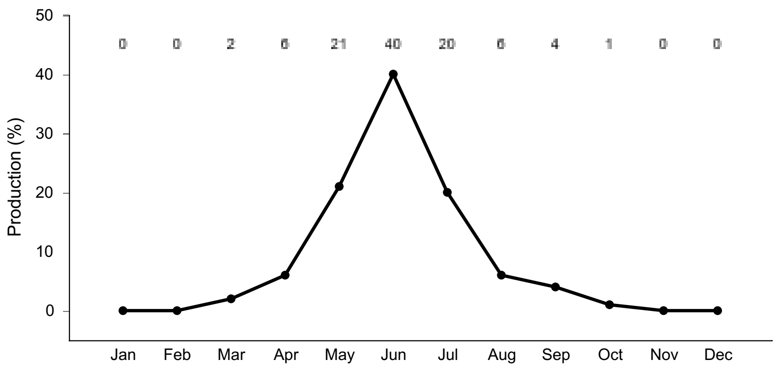


Figure 10. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

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. 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 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 native forb diversity and minor grass components.

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
Introduced Species

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass 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 Kentucky bluegrass. These events may reduce the dominance of Kentucky bluegrass, but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish and dominate before Kentucky bluegrass rebounds and again dominates 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 Sod, Forbs Plant Community Phase (3.2).

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- big bluestem (*Andropogon gerardii*), grass

Community 3.1
Kentucky Bluegrass/Decadent Bluestem/Shrubs

This community phase is dominated by Kentucky bluegrass. Big bluestem and other native warm- and cool-season native grass species are still present, but much reduced in vigor and production. Western snowberry can increase and become a major component in this community phase. Common forbs include American licorice, cudweed sagewort, western yarrow, and silverleaf scurfpea. Infiltration is reduced and runoff is increased when compared to the Reference State. Soil erosion is low. Much of the plant nutrients are tied up in the excessive litter. Organic matter oxidizes in the air rather than being incorporated into the soil due to the absence of animal impact and reduced soil biological activity. Typically, bunchgrasses (little bluestem) develop dead centers and rhizomatous grasses form small colonies because of a lack of tiller stimulation. Nutrient cycling is limited by the rooting depth of the Kentucky bluegrass and the alteration of the soil biotic community. Energy capture into the system is restricted to a short window provided by the early season species and the high amount of dead, standing plant material. This plant community is somewhat resistant to change without a combination of prescribed grazing and prescribed burning. The combination of both grazing and fire is most effective in moving this plant community towards the Native/Invaded State. Once this plant community is reached, time and external resources will be needed to see any immediate recovery in diversity.

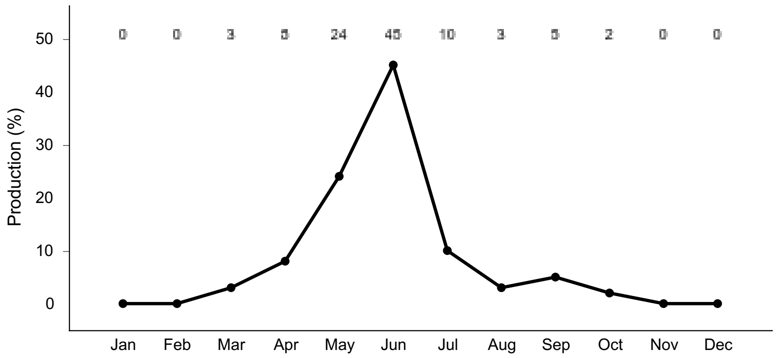


Figure 11. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Kentucky Bluegrass Sod, Forbs

This community phase is dominated by Kentucky bluegrass with lesser amounts of sedge. Some native and non-native forbs can increase in production and cover as well. The dominant grass is Kentucky bluegrass, with common forbs including cudweed sagewort, goldenrod, aster, western ragweed, western yarrow, and a variety of introduced forbs. The longer this community phase exists the more resistant 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 one 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.

Community 3.3
Annual/Pioneer/Non-Native Perennial

This 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 plant succession following cropland abandonment. This plant community will initially include a variety of annual forbs and grasses. Over time, the introduced cool-season perennial grasses will begin to establish on this site.

Pathway 3.1a
Community 3.1 to 3.2

This pathway is initiated by heavy continuous season-long grazing. The heavy continuous grazing favors those plants which can tolerate repeated defoliation (Kentucky bluegrass and sedges). 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 reduction of biological activity.

Pathway 3.3a
Community 3.3 to 3.2

With grazing and time, the grazing tolerant Kentucky bluegrass will continue to increase leading to community phase 3.2. In the absence of grazing, this pathway will lead to a community phase resembling 3.1 with the primary difference being the lack of western snowberry and remnant native grass species.

State 4
Cropland

This state is the result of annual cropping

Transition T1a

State 1 to 2

This was the transition from the native warm-season grass dominated reference state to a state that has been invaded by introduced species. When propagules of Kentucky bluegrass are present, this transition occurs as natural and/or management actions favored a decline in the composition of warm-season rhizomatous grasses and an increase in cool-season sodgrasses. This transition was 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 hasten this transition. The threshold between states was crossed when Kentucky bluegrass, smooth bromegrass, and other introduced species became established on the site. These species occupy functional/structural groups that were not present in the Reference State.

Transition T2a/b
State 2 to 3

Constraints to recovery. T2a - Complete rest from grazing or extended periods of very light grazing and elimination of fire are the two major contributors to this transition. 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 fuel. The nutrient cycle is impaired due to the lack of available carbon for soil biota due to accumulation in the surface layer root mat. This results 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.

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 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. If successful, the resultant plant community may have a relatively higher amount of warm-season grasses than the interpretive plant community. 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 T4a
State 4 to 3

This transition occurs with cessation of cropping practices being applied.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid Warm-season Grasses**			897–1569	
	little bluestem	SCSC	*Schizachyrium scoparium*	673–1569	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–224	–
2	**Tall Warm-season Grasses**			448–897	
	big bluestem	ANGE	*Andropogon gerardii*	224–897	–
	switchgrass	PAVI2	*Panicum virgatum*	90–448	–
	Indiangrass	SONU2	*Sorghastrum nutans*	90–448	–
3	**Needlegrass**			224–538	
	porcupinegrass	HESP11	*Hesperostipa spartea*	224–538	–
	green needlegrass	NAVI4	*Nassella viridula*	224–538	–
4	**Wheatgrass**			90–359	
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	45–359	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	45–359	–
	western wheatgrass	PASM	*Pascopyrum smithii*	45–359	–
5	**Other Native Grasses**			45–224	
	Grass, perennial	2GP	*Grass, perennial*	0–224	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	0–224	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–135	–
	saltgrass	DISP	*Distichlis spicata*	0–90	–
6	**Grass-likes**			45–224	
	sedge	CAREX	*Carex*	45–224	–
	rush	JUNCU	*Juncus*	0–135	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–135	–
Forb					
7	**Forbs**			224–448	
	sunflower	HELIA3	*Helianthus*	45–224	–
	Forb, native	2FN	*Forb, native*	45–224	–
	goldenrod	SOLID	*Solidago*	45–179	–
	white heath aster	SYER	*Symphyotrichum ericoides*	45–135	–
	ragwort	SENEC	*Senecio*	45–90	–
	blue lettuce	LATA	*Lactuca tatarica*	45–90	–
	tall blazing star	LIAS	*Liatris aspera*	45–90	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	45–90	–
	western yarrow	ACMIO	*Achillea millefolium var.*	45–90	–

			occidentalis		
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	45–90	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	45–90	–
	aster	ASTER	*Aster*	45–90	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	45–90	–
	horsetail	EQUIS	*Equisetum*	45–90	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	45–90	–
	Canadian anemone	ANCA8	*Anemone canadensis*	0–45	–
	cinquefoil	POTEN	*Potentilla*	0–45	–
	Nuttall's violet	VINU2	*Viola nuttallii*	0–45	–
Shrub/Vine					
8	**Shrubs**			0–224	
	prairie rose	ROAR3	*Rosa arkansana*	45–135	–
	willow	SALIX	*Salix*	0–135	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–135	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	45–90	–
	redosier dogwood	COSE16	*Cornus sericea*	0–45	–
	chokecherry	PRVI	*Prunus virginiana*	0–45	–

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. Many of the site concepts for this MLRA are borrowed from neighboring MLRA 55B. Developed by 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

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://hpccsun.unl.edu)

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://wcc.nrcs.usda.gov)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (http://nasis.nrcs.usda.gov)

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

United States Department of Agriculture, Natural Resources Conservation Service. 2022. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture, Agriculture Handbook 296.

USDA, NRCS, Various Published Soil Surveys.

Contributors

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
Rob Self, The Nature Conservancy
Shawn Dekeyser, North Dakota State University
Lee Voigt, NRCS Range Management Specialist
Ezra Hoffman, Ecological Site Specialist, NRCS

Approval

Suzanne Mayne-Kinney, 11/14/2024

Rangeland health reference sheet

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

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

Indicators

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

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

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

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

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

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

---

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

---

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

---

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

---

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

---

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

---

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

---

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

---

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

---

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

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state**

for the ecological site:

17. **Perennial plant reproductive capability:**