Ecological site R055DY013SD
Claypan

Last updated: 11/14/2024
Accessed: 05/10/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 055D–Glacial Lake Dakota

MLRA 55D is in South Dakota (92 percent) and southeastern North Dakota (8 percent). It makes up about 3,059 square miles (7,923 square kilometers). This area,
which is part of the glacial till plain region, consists of a large, glacial lake plain that was drained by the James River, which flows southward through the area. The MLRA is dominantly farmland converted from prairie, but some areas of grassland remain. Agricultural drainage practices have impacted shallow depressions in many areas.

MLRA 55D has distinct boundaries. Till plains are on all sides. MLRA 55B borders the area largely to the north and is also between the Lake Dakota Plain and two prominent coteaus—the Missouri Coteau on the west and the Prairie Coteau on the east. To the south is MLRA 55C (Southern Black Glaciated Plains), which has a mesic soil temperature regime.

This area is in the Central Lowland province of the Interior Plains. Elevation ranges from 1,250 to 1,330 feet (380 to 405 meters), generally increasing from south to north. The area is
characterized by mostly level to moderately sloping lake plains with many depressions and drainages. Much of the area has integrated drainage; drainage channels are poorly to moderately defined.

The glaciolacustrine sediments of the Lake Dakota Plain range from sandy to clayey and are commonly stratified. Some areas of the lake plain are mantled with wind-deposited materials, which are moderately coarse textured or sandy. Alluvial deposits and low terraces are common along the James River and its major tributaries but also occur in narrow and
discontinuous strips along other streams.

Classification relationships

Major Land Resource Area (MLRA): Southern Black Glaciated Plains (55D) (USDA-NRCS, 2022)

USFS Sub-region: Located mainly within unit 332Bc and 332Ba (Cleland et al., 2007).

Ecological site concept

The Claypan ecological site is located on linear back slopes, concave foot slopes, and flats on ground moraines and lake plains. Although the soil parent materials are very deep; a moderately root-restrictive, dense claypan layer occurs in the upper part of the subsoil (at a depth of 6 to 14 inches). The texture of the claypan layer typically is clay loam, clay, or silty clay, but loam or silty clay loam are included. The subsoil forms a ribbon 1 to >2 inches long. The texture of the surface layer is loam, silt loam, silty clay loam, or fine sandy loam. Generally, soil on this site is moderately well drained, but somewhat poorly drained is allowed. Salt accumulations may occur at a depth >16 inches. Slopes range from 0 to 6 percent. On the landscape, this site is below the Loamy and Clayey ecological sites. The Thin Claypan site is in adjacent micro-lows; it has a dense claypan layer within a depth of 6 inches. The

Loamy Overflow ecological site occurs on similar landscape positions, but it does not have a dense claypan layer.

Associated sites

R055DY020SD	**Loamy Overflow** This site occurs in upland swales; it does not have a root-restrictive claypan layer. The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055DY015SD	**Thin Claypan** This site occurs in micro-lows. It has a root-restrictive claypan layer at a depth <6 inches and typically has accumulated salts at a depth <16 inches.
R055DY011SD	**Clayey** This site occurs somewhat higher on the landscape. The subsoil forms a ribbon >2 inches long; but it is not root-restrictive. Soil salinity is none to very slight (E.C. <4) to a depth >20 inches.
R055DY010SD	**Loamy** This site occurs somewhat higher on the landscape. The subsoil forms a ribbon 1 to 2 inches long; it is not root-restrictive. Soil salinity is none to very slight (E.C. <4) to a depth >20 inches.

Similar sites

R055DY011SD	**Clayey** This site occurs somewhat higher on the landscape. The subsoil forms a ribbon >2 inches long; but it is not root-restrictive. Soil salinity is none to very slight (E.C. <4) to a depth >20 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site most commonly occurs on glaciated uplands – ground moraines and lake plains. This site is typically on linear back slopes, concave foot slopes, swales, and flats. On ground moraines the parent material is either fine-loamy, coarse-loamy, or clayey till. On lake plains the parent material is either silty, loamy, or clayey glaciolacustrine sediments. Slopes range from 0 to 3 percent.

Table 2. Representative physiographic features

Landforms	(1) Lake plain (2) Till plain (3) Ground moraine
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	980–2,130 ft
Slope	0–2%
Ponding depth	0 in
Water table depth	36–60 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation of MLRA 55D is 22 to 23 inches (549 to 594 millimeters). About 75 percent of the rainfall comes from high-intensity, convective thunderstorms during the growing season. Winter precipitation is typically snow. The average annual snowfall is 25 to 50 inches (635 to 1,270 millimeters). Strong winds commonly deposit the snow unevenly across the landscape. The average annual temperature is 43 to 45 degrees F (6 to 7 degrees C). The freeze-free period averages about 135 days and ranges from 120 to 150 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	114-117 days
Freeze-free period (characteristic range)	129-134 days
Precipitation total (characteristic range)	22-23 in
Frost-free period (actual range)	114-119 days
Freeze-free period (actual range)	127-134 days
Precipitation total (actual range)	22-23 in
Frost-free period (average)	116 days
Freeze-free period (average)	131 days
Precipitation total (average)	23 in

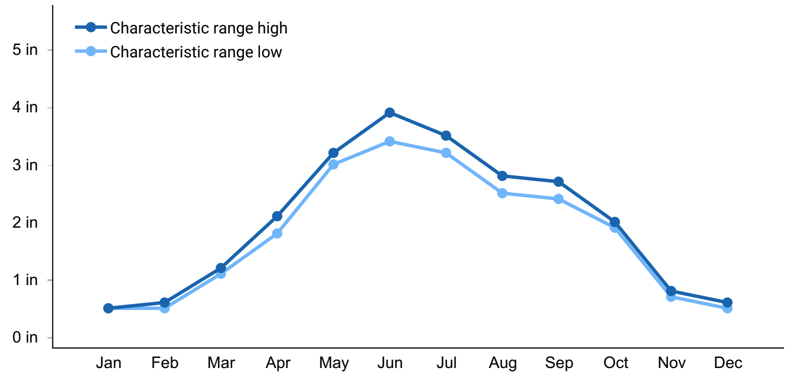


Figure 1. Monthly precipitation range

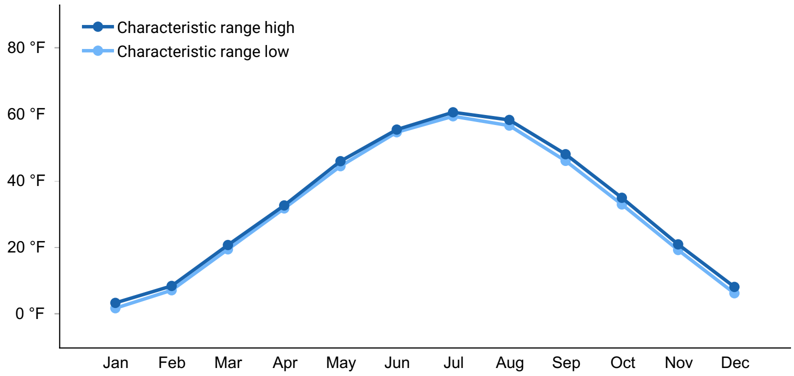


Figure 2. Monthly minimum temperature range

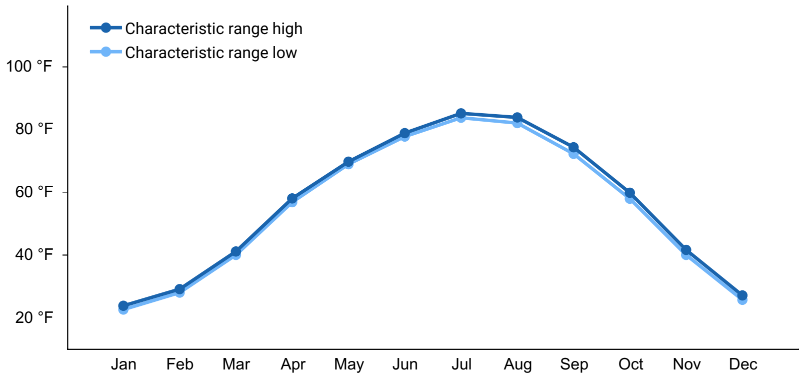


Figure 3. Monthly maximum temperature range

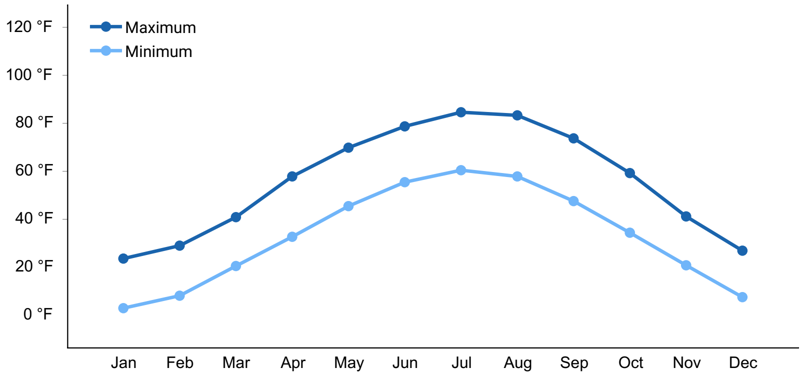


Figure 4. Monthly average minimum and maximum temperature

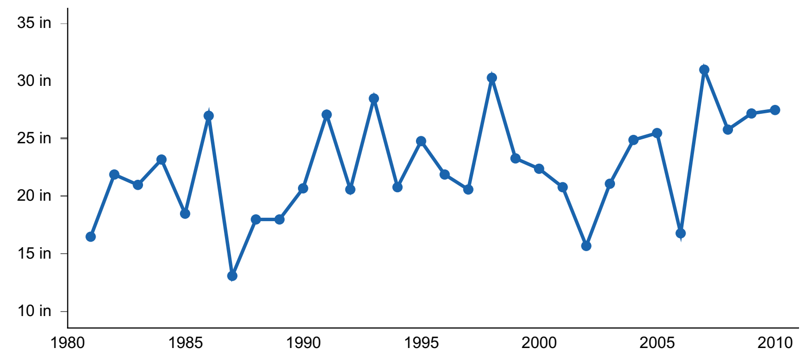


Figure 5. Annual precipitation pattern

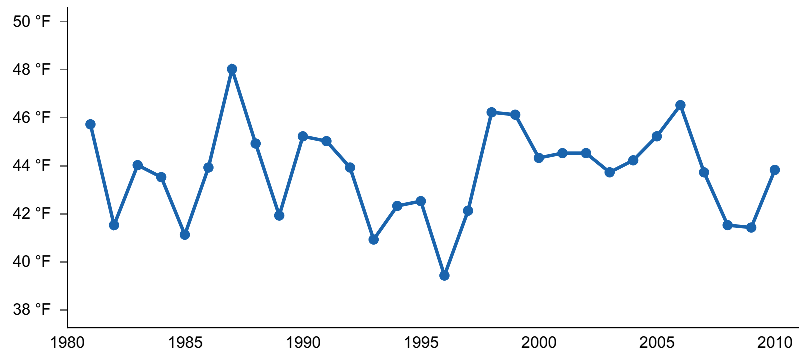


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BRITTON [USC00391049], Britton, SD
- (2) ANDOVER #2 [USC00390120], Andover, SD
- (3) TURTON [USC00398420], Turton, SD

- (4) CONDE [USC00391917], Conde, SD
- (5) REDFIELD [USC00397052], Redfield, SD
- (6) MELLETTE 4 W [USC00395456], Northville, SD
- (7) ABERDEEN [USW00014929], Aberdeen, SD
- (8) COLUMBIA 8 N [USC00391873], Columbia, SD

Influencing water features

This site does not receive significant additional water, either as runoff from adjacent slopes or from a seasonal high water table. Although the seasonal water table can be within 2.5 feet early in the growing season on some low-relief, concave areas, the root-restrictive claypan layer prohibits the plants from benefiting significantly from subirrigation. Depth to the water table is typically more than 4 feet through most of the growing season. Surface infiltration is moderate to very slow. Saturated hydraulic conductivity in the claypan layer is moderately low. Water loss on this site occurs primarily through evapotranspiration.

Wetland description

Not Applicable.

Soil features

Soils associated with Claypan ES are in the Mollisol order; they are classified further as Calcic Natrudolls. These soils were developed under prairie vegetation. They formed in glaciolacustrine deposits or till. They typically are moderately well drained, but somewhat poorly drained soils are included. The common feature of soils in this site is a dense, claypan layer in the upper part of the subsoil; although these are very deep soils, the claypan is moderately root-restrictive. The depth to the claypan ranges from 6 to 14 inches. Salt accumulations, where present, are deeper than 16 inches and commonly occur within a depth of 24 inches. The texture of the claypan typically is clay loam, clay, or silty clay, but is loam or silty clay loam in some soils. The claypan layer forms a ribbon 1 to >2 inches long. The texture of the surface layer is loam, silt loam, silty clay loam, or fine sandy loam.

Soil salinity is none to slight (E.C. <8) in the upper 16 inches; below this, it typically increases to moderate (E.C. 8 - <16) within a depth of 24 inches. Sodicity is low above the claypan layer; but increases significantly in that layer and below. It commonly exceeds an SAR value of 13 in the lower subsoil.

Soil reaction is slightly acid to slightly alkaline (pH 6.1 to 7.8) above the claypan and slightly alkaline to strongly alkaline (pH 7.4 to 9.0) in the subsoil and substratum. Calcium carbonate content is none to moderately low to a depth of 16 inches or more; however, the soil has a layer with 15 to 25 percent $CaCO_3$ within a depth of 40 inches (commonly within a depth 30 inches).

When dry these soils may crack. When the soils are wet, surface compaction can occur with heavy traffic. This site should show slight to no evidence of rills, wind-scoured areas or pedestaled plants. Water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact. Sub-surface soil layers are restrictive to water movement and root penetration.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 5 percent. Loss of the soil surface layer can result in a shift in species composition and/or production. Soils representative of this site include the Cavour and Nahon soil series.

Table 4. Representative soil features

Parent material	(1) Glaciolacustrine deposits (2) Till
Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained

Permeability class	Very slow to moderately slow
Depth to restrictive layer	6–13 in
Soil depth	80 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–1%
Available water capacity (0-60in)	3.8–6.1 in
Calcium carbonate equivalent (0-40in)	1–25%
Electrical conductivity (0-40in)	2–14 mmhos/cm
Sodium adsorption ratio (0-40in)	5–25
Soil reaction (1:1 water) (0-40in)	6.6–9
Subsurface fragment volume <=3" (0-40in)	1–5%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.

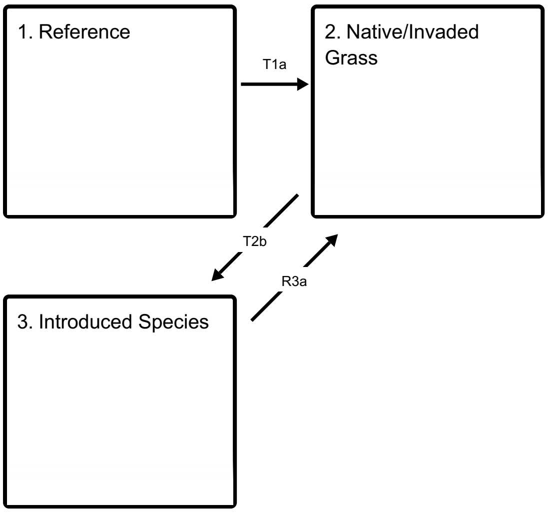
Continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following grazing events causes departure from the 3.1 Western Wheatgrass/Needlegrass/Blue Grama Plant Community Phase. Blue grama will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, needleandthread, porcupine grass, sideoats grama, big bluestem and little bluestem will decrease in frequency and production. Extended periods of non-use and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as Kentucky bluegrass, smooth bromegrass, green needlegrass, and cheatgrass.

Interpretations are primarily based on the 1.1 Western Wheatgrass/Needlegrass/Blue Grama Plant Community Phase. It 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 used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

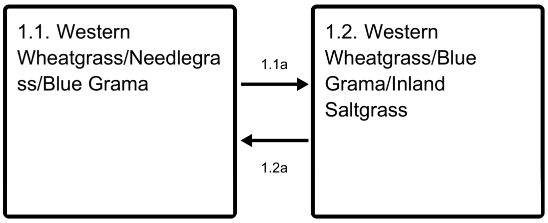
The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes may be made as more data is collected. Narratives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

State and transition model

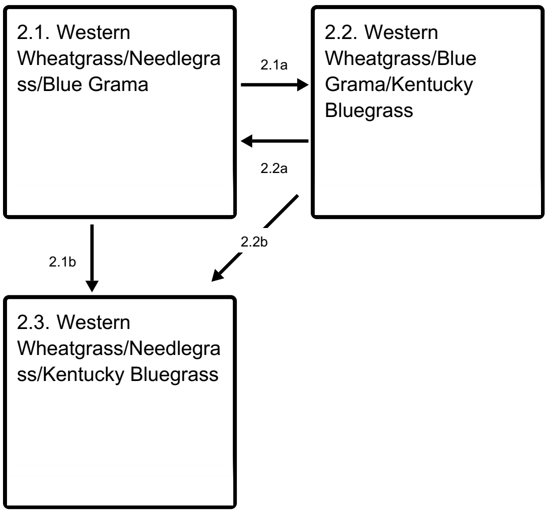
Ecosystem states



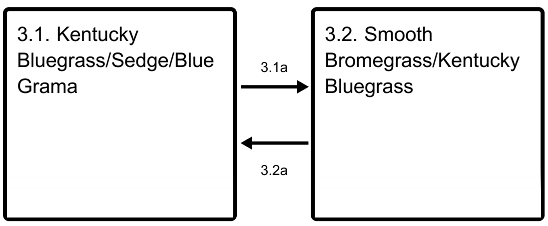
State 1 submodel, plant communities



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 dominated by cool-season grasses, with warm-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and/or above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. Cool-season and taller warm-season grasses would have declined and a corresponding increase in short, warm-season grasses would have occurred. Today, a similar state (State 3) can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest.

Dominant plant species

- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 1.1
Western Wheatgrass/Needlegrass/Blue Grama

Interpretations are based primarily on the Western Wheatgrass/Needlegrass/Blue Grama Plant Community Phase (this is also considered to be climax). The potential vegetation was about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community was dominated by cool-season grasses. The major grasses included western wheatgrass, green needlegrass, and blue grama. Other grass or grass-like species included needleandthread, slender wheatgrass, and porcupine grass. This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high drought tolerance. This was a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1290	1790	2265
Forb	95	150	225
Shrub/Vine	15	60	110
Total	**1400**	**2000**	**2600**

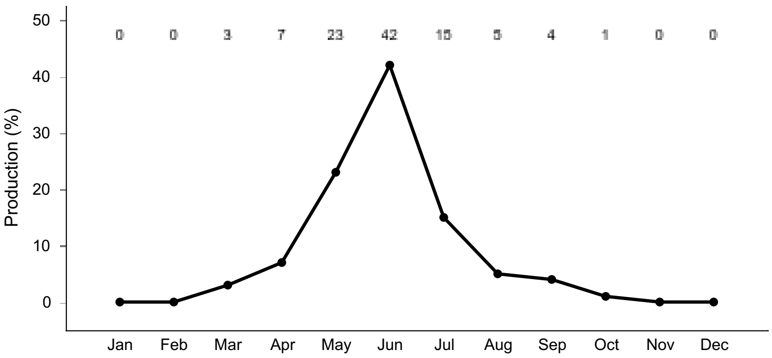


Figure 8. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 1.2
Western Wheatgrass/Blue Grama/Inland Saltgrass

This plant community evolved under heavy continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses included western wheatgrass, blue grama, inland saltgrass, buffalograss, green needlegrass, sideoats grama, and needleandthread. Grasses of secondary importance included porcupine grass and sedge. Forbs commonly found in this plant community included cudweed sagewort, prairie coneflower, and western yarrow. This plant community had similar plant composition to the 2.2 Western Wheatgrass/Blue Grama/Kentucky Bluegrass Plant Community Phase. The main difference is that this plant community phase did not have the presence of non-native invasive species such as Kentucky bluegrass and smooth bromegrass. When compared to the Western Wheatgrass/Needlegrass/Blue Grama Plant Community Phase (1.1), blue grama and inland saltgrass increased. Green needlegrass and porcupine grass decreased, and production was also reduced. This plant community was moderately resistant to change. The herbaceous species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term. The increase of shorter-statured, more compact rooted species would have resulted in somewhat higher runoff and decreased infiltration. This would have caused the site to become drier. These species also would have been more competitive.

Pathway 1.1a
Community 1.1 to 1.2

This pathway occurred as a result of relatively heavy, continuous grazing typically at the same time of year each year without adequate recovery periods, or a combination of disturbances such as extended periods of below average precipitation coupled with periodic or chronic heavy grazing. This pathway would have led to the 1.2 Western Wheatgrass/Blue Grama/Inland Saltgrass Plant Community Phase.

Pathway 1.2a
Community 1.2 to 1.1

This pathway occurred when grazing, precipitation, and/or fire returned to normal disturbance regime levels and frequencies or periodic light to moderate grazing possibly including periodic rest occurred. This would have led to the 1.1 Western Wheatgrass/Needlegrass/Blue Grama Plant Community Phase.

State 2
Native/Invaded Grass

This state represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire due to fire suppression. This state is dominated by cool-season grasses with warm-season grasses being subdominant. It can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. Taller cool-season species can decline and a corresponding increase in short statured grass will occur.

Dominant plant species

- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass
- blue grama (*Bouteloua gracilis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 2.1
Western Wheatgrass/Needlegrass/Blue Grama

This plant community phase is similar to the 1.1 Western Wheatgrass/Needlegrass/Blue Grama Plant Community Phase, but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 10 percent by air-dry weight). The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community is dominated by cool-season grasses, with warm-season grasses being subdominant. The major grasses include western wheatgrass, green needlegrass, and blue grama. Other grass or grass-like species include needleandthread, slender wheatgrass, and porcupine grass. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

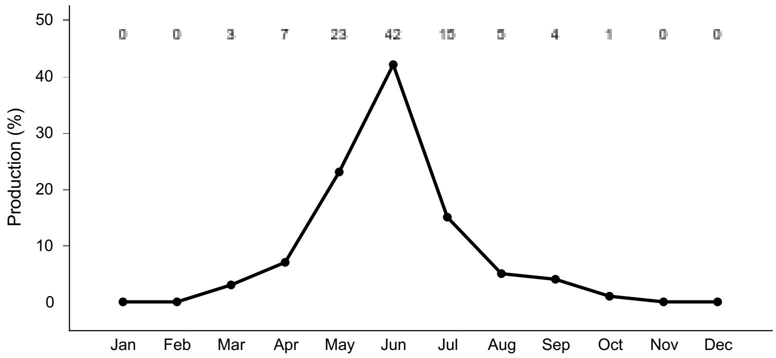


Figure 9. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 2.2
Western Wheatgrass/Blue Grama/Kentucky Bluegrass

This plant community is a result of heavy continuous grazing, continuous season-long grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grasses include western wheatgrass, blue grama, and Kentucky bluegrass. Grasses of secondary importance include green needlegrass, needleandthread, porcupine grass, buffalograss, smooth bromegrass, and sedge. Forbs commonly found in this plant community include cudweed sagewort, prairie coneflower, and western yarrow. When compared to the Western Wheatgrass/Needlegrass/Blue Grama Plant Community Phase (1.1), blue grama has increased and Kentucky bluegrass has invaded. Green needlegrass and production of mid and tall grasses has also been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. The increase of shorter-statured, more compact rooted species will result in somewhat higher runoff and decreased infiltration. This will cause the site to become drier. These species will also more competitive.

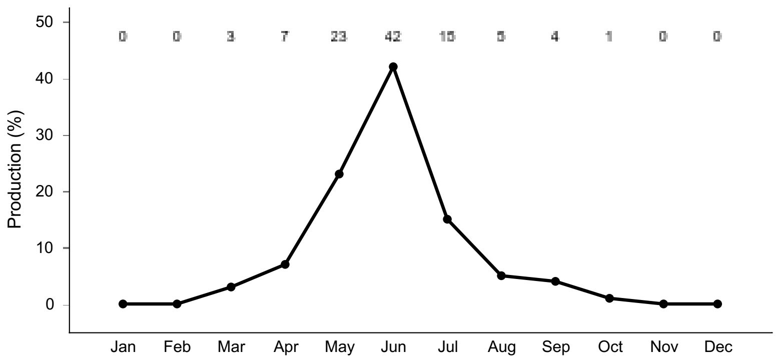


Figure 10. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 2.3
Western Wheatgrass/Needlegrass/Kentucky Bluegrass

This plant community is a result of continuous season-long grazing, typically at light levels, or prolonged periods (multiple years) of complete rest from grazing and elimination of fire. This community phase is characterized by an increase in the introduced cool-season sodgrass, Kentucky bluegrass. This community phase is the most dominant both temporally and spatially. Kentucky bluegrass has become nearly co-dominant with western wheatgrass and green needlegrass. Warm season grasses are present but minor and tap rooted perennial forbs have decreased. Production and infiltration both decrease and this community phase is at risk of transitioning across a state threshold. With natural or management actions that decrease the composition of the cool-season bunchgrasses and increase the composition of Kentucky bluegrass, transition T2b will be initiated.

Pathway 2.1a
Community 2.1 to 2.2

This pathway occurs as a result of heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year), or continuous season-long grazing, or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing. This pathway will lead to the 2.2 Western Wheatgrass/Blue Grama/Kentucky Bluegrass Plant Community Phase.

Pathway 2.1b
Community 2.1 to 2.3

Prolonged periods (multiple years) of continuous season-long grazing, or complete rest from grazing or grazing at very light levels coupled with elimination of fire results in increased litter levels and decreased vigor of less shade tolerant species. These factors favor cool-season species, and lead to the 2.3 Western Wheatgrass/Needlegrass/Kentucky Bluegrass Plant Community Phase. When continuous or light grazing is involved, this community will often occur in a patchy mosaic pattern, often referred to as patch grazing.

Pathway 2.2a
Community 2.2 to 2.1

The implementation of prescribed grazing including adequate recovery periods between grazing events and season of use change will initiate this pathway by shifting the competitive advantage away from the short statured grasses to the taller cool-season grasses.

Pathway 2.2b
Community 2.2 to 2.3

Prolonged periods (multiple years) of complete rest from grazing or grazing at very light levels coupled with elimination of fire results in increase litter levels and decreased vigor of less shade tolerant species. These factors favor cool-season species, and lead to the 2.3 Western Wheatgrass/Needlegrass/Kentucky Bluegrass Plant Community Phase.

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 smooth bromegrass, and an increasing thatch layer that effectively blocks introduction of other plants into the system. 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 the invasive grass dominance. 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.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- sedge (*Carex*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 3.1

Kentucky Bluegrass/Sedge/Blue Grama

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass, sedge, and blue grama. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. The period that palatability is high is relatively short, as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase.

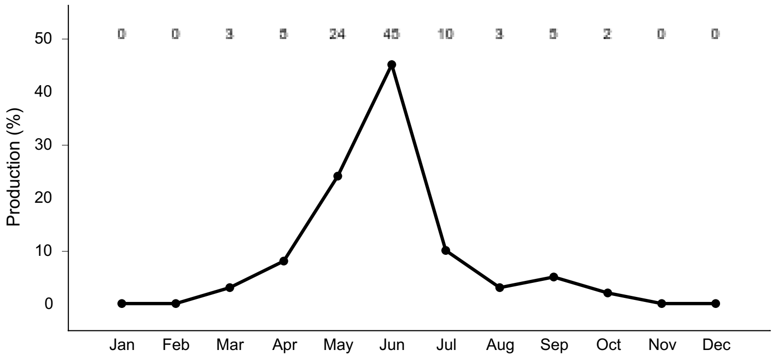


Figure 11. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Smooth Bromegrass/Kentucky Bluegrass

This plant community phase is a result of extended periods of non-use and no fire. It is characterized by a dominance of smooth bromegrass and Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. When dominated by smooth bromegrass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced.

Pathway 3.1a
Community 3.1 to 3.2

Prolonged periods (multiple years) of complete rest from grazing or grazing at very light levels coupled with elimination of fire results in increased litter levels and decreased vigor of less shade tolerant species. These factors favor cool-season species, and lead to the 3.2 Smooth Bromegrass/Kentucky Bluegrass Plant Community Phase.

Pathway 3.2a
Community 3.2 to 3.1

This pathway occurs as a result of heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year), or continuous season-long grazing, or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing. This pathway will lead to the 3.1 Kentucky Bluegrass/Sedge/Blue Grama Plant Community Phase.

Transition T1a
State 1 to 2

This is the transition from the native herbaceous dominated reference state to the herbaceous dominated native/invaded state. This transition occurs when propagules of non-native species such as Kentucky bluegrass and/or smooth bromegrass are present and become established on the site. This occurs as natural and/or management actions (altered grazing and/or fire regime) favor an increase in cool-season sodgrasses. Chronic season-long or heavy late season grazing facilitates this transition. Complete rest from grazing and no fire events can also lead to this transition. The threshold between states is crossed when the non-natives become established on the site.

Transition T2b
State 2 to 3

Complete rest from grazing and elimination of fire are the two major contributors to this transition. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early green up and increased moisture and humidity at the soil surface and grazing pressure cannot cause a reduction in sodgrass dominance. Production is limited to the sod forming species. Infiltration continues to decrease and runoff increases, energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by root depth of the dominate species. This transition typically leads to the 3.2 Smooth Bromegrass/Kentucky Bluegrass Plant Community Phase.

Restoration pathway R3a
State 3 to 2

It may be possible using selected plant materials and agronomic practices to approach something very near the functioning of the Invaded State (State 2). Application of chemical herbicides and the use of mechanical seeding methods using adapted varieties of the dominant native bunchgrasses are possible and can be successful. After establishment of the native bunchgrasses, management objectives must include the maintenance of those species, the associated reference function and continued treatment of the introduced sodgrasses.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			400–600	
	western wheatgrass	PASM	*Pascopyrum smithii*	400–600	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–100	–
2	**Needlegrass**			300–600	
	green needlegrass	NAVI4	*Nassella viridula*	200–400	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	40–200	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–100	–
3	**Short Warm-season Grasses**			100–300	
	blue grama	BOGR2	*Bouteloua gracilis*	100–300	–
	saltgrass	DISP	*Distichlis spicata*	20–100	–
	buffalograss	BODA2	*Bouteloua dactyloides*	20–100	–
4	**Other Native Grasses**			20–100	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–100	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	20–100	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–40	–
5	**Grass-likes**			20–100	
	needleleaf sedge	CADU6	*Carex duriuscula*	20–100	–

	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–60	–
Forb					
6	**Forbs**			100–200	
	Forb, native	2FN	*Forb, native*	20–60	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	20–40	–
	field sagewort	ARCA12	*Artemisia campestris*	0–40	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–40	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	20–40	–
	white heath aster	SYER	*Symphyotrichum ericoides*	20–40	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–40	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	20–40	–
	goldenrod	SOLID	*Solidago*	0–20	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–20	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–20	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–20	–
	Nuttall's violet	VINU2	*Viola nuttallii*	0–20	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–20	–
	mouse-ear chickweed	CERAS	*Cerastium*	0–20	–
	textile onion	ALTE	*Allium textile*	0–20	–
	pussytoes	ANTEN	*Antennaria*	0–20	–
Shrub/Vine					
7	**Shrubs**			20–100	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	–
	prairie sagewort	ARFR4	*Artemisia frigida*	20–40	–
	prairie rose	ROAR3	*Rosa arkansana*	20–40	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	20–40	–

Inventory data references

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

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

Other references

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

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

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:**