USDA Natural Resources Conservation Service

Ecological site R055DY015SD
Thin 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 Thin Claypan ecological site typically is located on glaciated uplands – till plains, lake plains, and outwash plains; but it also occurs on side slopes of escarpments. Although these soils are moderately deep (over soft sedimentary shale bedrock) to very deep, a dense claypan layer severely limits the rooting depth of plants. The thickness of the surface layer is 6 inches or less. The texture of the claypan layer typically is clay, silty clay, or clay loam (forms a ribbon >1.5 inches long); but it is sandy loam or loam in a few soils (forms a ribbon <1.5 inches long). The texture of the surface layer is typically loam or silt loam, but silty clay loam and sandy loam also occur. Soil on this site is typically moderately well drained, but somewhat poorly drained is allowed. Salt accumulations occur within a depth of 16 inches. Slopes range from 0 to 15 percent. On the landscape, this site is below the Clayey, Loamy, and Loamy Overflow ecological sites; these sites do not have root-restrictive claypan layers. The Saline

Lowland site is in shallow depressions. The Claypan ecological site occurs in a mosaic across the landscape on micro-highs associated with the Thin Claypan site. The surface layer of Claypan is 6 to 14 inches thick and the depth to salts is >16 inches.

Associated 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.
R055DY013SD	**Claypan** This site typically occurs on micro-highs. It is 6 to 14 inches to the dense, root-restrictive claypan layer. The claypan forms a ribbon >1 inch long. It is >16 inches to accumulated salts.
R055DY010SD	**Loamy** This site occurs higher on the landscape. The subsoil forms a ribbon 1-2 inches long; it is not root-restrictive. Soil salinity is none to very slight (E.C. <4) to a depth >20 inches.
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.
R055DY007SD	**Saline Lowland** This site occurs in shallow depressions. It is poorly drained and has an accumulation of salts in the surface and subsoil layer (E.C. >8).

Similar sites

R055DY007SD	**Saline Lowland** This site occurs in shallow depressions. It is poorly drained and has an accumulation of salts in the surface and subsoil layer (E.C. >8).
R055DY013SD	**Claypan** This site typically occurs on micro-highs. It is 6 to 14 inches to the dense, root-restrictive claypan layer. The claypan forms a ribbon >1 inch long. It is >16 inches to accumulated salts.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Bouteloua gracilis*

Physiographic features

This site typically occurs on glaciated uplands – till plains, lake plains, and outwash plains. It most commonly occurs in micro-lows in swales and on foot slopes; but also occurs on side slopes of escarpments. Parent materials are till, glaciolacustrine sediments, glaciofluvial deposits, or colluvium from weathered shale residuum.

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Escarpment (3) Lake plain (4) Outwash plain
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	980–2,130 ft
Slope	0–3%

Ponding depth	0 in
Water table depth	36–80 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

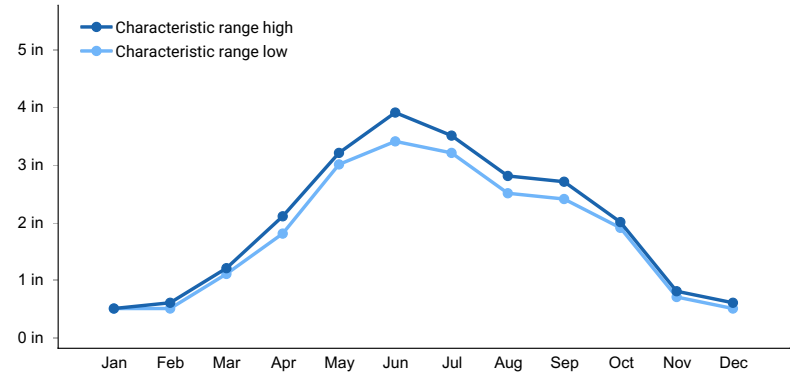


Figure 1. Monthly precipitation range

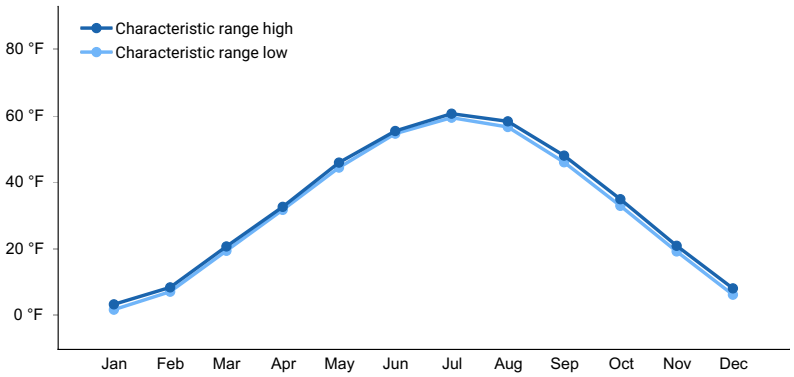


Figure 2. Monthly minimum temperature range

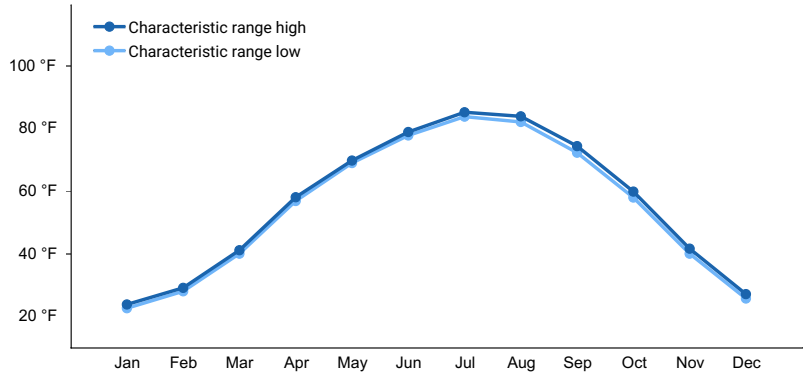


Figure 3. Monthly maximum temperature range

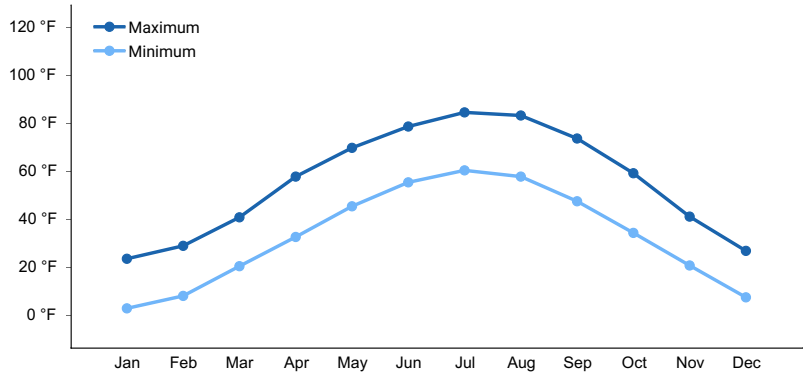


Figure 4. Monthly average minimum and maximum temperature

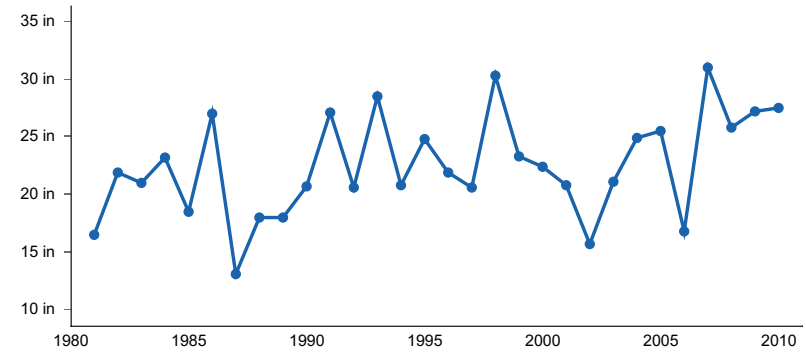


Figure 5. Annual precipitation pattern

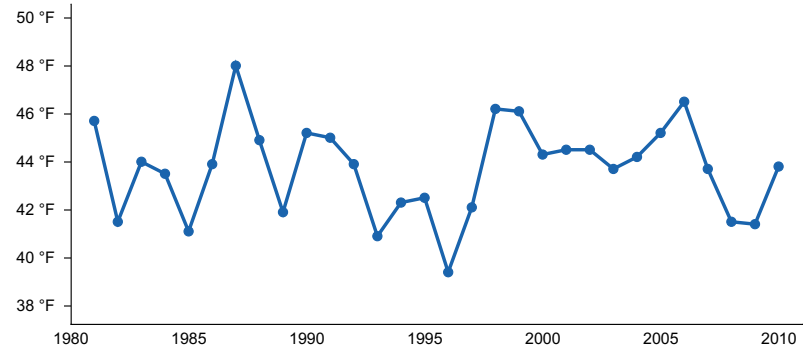


Figure 6. Annual average temperature pattern

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 a depth of 3 feet early in the growing season on low-relief areas, the root-restrictive claypan layer and soil salinity prohibit the plants from benefiting from subirrigation. Depth to the water table typically exceeds 3 feet in during April through June and is more than 6 feet during the remainder of the year. Surface infiltration is slow to very slow. Saturated hydraulic conductivity in the claypan layer is moderately low. Water loss is primarily through evapotranspiration.

Wetland description

Not Applicable.

Soil features

Soils associated with Thin Claypan ES are in the Mollisol order; they are classified further as Leptic Natrudolls. These soils were developed under prairie vegetation. They formed in till, glaciolacustrine sediments, glaciofluvial deposits, or colluvium over soft sedimentary shale bedrock. Typically, the soils are moderately well drained, but somewhat poorly drained soils are included in the site.

The common features of soils in this site are the shallow depth (typically less than 6 inches) to a dense, root-restrictive, claypan layer and salt accumulations within a depth of 16 inches (typically near the surface). Although these soils are very deep to moderately deep, the dense claypan severely limits the rooting depth of plants and the salts limit plant-available water. The texture of the surface is typically loam or silt loam, but silty clay loam and sandy loam also occur. The dense claypan typically is clay, silty clay, or clay loam (forms a ribbon >1.5 inches long); but it is sandy loam or loam in a few soils (forms a ribbon <1.5 inches long).

Wet surface compaction can occur with heavy traffic. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers; and there is a high risk of rills and eventually gullies if vegetative cover is not adequate. Crypto-biotic crusts are present and a moderate pedestaling of plants occur. These soils are mainly susceptible to water erosion. Loss of the soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to the Thin Claypan site are Exline and Ferney.

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) Glaciomarine deposits (3) Colluvium (4) Glaciofluvial deposits
Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam (4) Sandy loam
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very slow to slow
Depth to restrictive layer	4–7 in

Soil depth	80 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–1%
Available water capacity (0-60in)	4–7 in
Calcium carbonate equivalent (0-40in)	1–21%
Electrical conductivity (0-40in)	4–16 mmhos/cm
Soil reaction (1:1 water) (0-40in)	6.5–9
Subsurface fragment volume <=3" (0-40in)	1–4%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

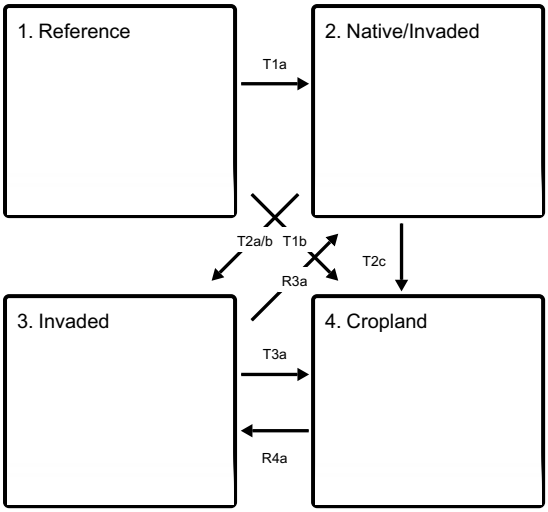
The site developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and frequent fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a slow decline in vegetative vigor 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 Western Wheatgrass/Blue Grama Plant Community Phase (1.1). Under favorable conditions the site has the potential to resemble the Western Wheatgrass/Blue Grama Plant Community Phase. This community phase and the Reference State has been determined by study of rangeland relict 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. Lightning fires occurred most frequently in July and August while fires started by Native Americans occurred in April, September and October. Large ungulate grazing was heavy and occurred often, but usually for short durations. Grazing may have been severe when occurring after a fire event. The grazing and fire interaction, especially when coupled with drought events, set up the dynamics discussed and displayed in the following state and transition diagram and descriptions.

This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence, causes this site to depart from the reference plant community. Blue grama and Kentucky bluegrass, if present, will begin to increase. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass will decrease in frequency and production. In time, heavy continuous grazing will likely cause upland sedges, blue grama, and/or Kentucky bluegrass, if present, to dominate and pioneer perennials and annuals to increase. The resulting plant community is relatively stable and competitive advantage prevents other species from establishing. 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. Shrubs such as western snowberry increase in this situation, especially in areas prone to snow accumulation and drift.

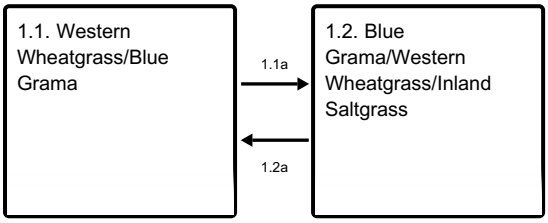
The following diagram illustrates the common states, community phases, community pathways, transitions and restoration pathways that can occur on the site.

State and transition model

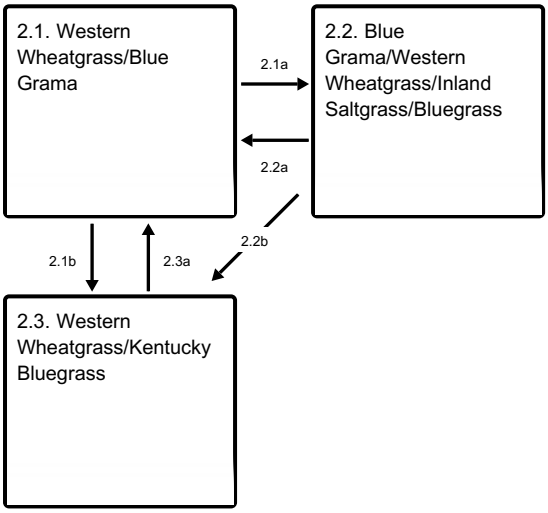
Ecosystem states



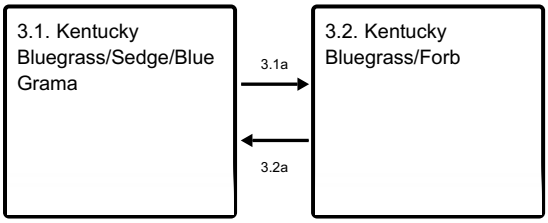
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

This state description represents the natural range of variability that dominated the dynamics of this ecological site. Historically, this state ranged from a mid statured, rhizomatous cool season grass dominated with lesser amounts of short statured, warm season grasses site to one dominated by a short statured, warm season grasses with lesser amounts of the mid statured cool season rhizomatous grass, depending upon disturbance regime. The primary disturbance mechanisms for this site in the reference condition included periodic 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. Dominance within this state shifted between warm-season and cool-season grasses. This change would have shifted the timing of energy capture and slightly altered the hydrologic function between plant community phases within the Reference State. Plant community phases within the Reference state were very resilient and able to recover ecological function following disturbances. Overall, the ecological processes were functioning at near optimum levels within this State. However, prolonged drought and heavy grazing pressure, like that associated with perennial water sources, may have resulted in a complete elimination of the mid statured cool season grass component from this state. Although not illustrated on the diagram, this would have resulted in the crossing of a threshold to a warm season short grass dominated steady state.

Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- prairie rose (*Rosa arkansana*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- saltgrass (*Distichlis spicata*), grass
- Nuttall's alkaligrass (*Puccinellia nuttalliana*), grass
- needleleaf sedge (*Carex duriuscula*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- curlycup gumweed (*Grindelia squarrosa*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous

Community 1.1
Western Wheatgrass/Blue Grama

The plant community upon which interpretations are primarily based is the Western Wheatgrass/Blue Grama Plant Community Phase. This site evolved with grazing by large herbivores and occasional prairie fires. The potential vegetation is about 85% grasses or grass-like plants, 10% forbs and 5% shrubs. Cool season grasses dominate the site, but warm season short grasses are also prevalent. The co-dominant grasses are western wheatgrass and blue grama. Other grasses and grass-like plants occurring on the site include buffalograss, inland saltgrass, Nuttall’s Alkaligrass, and needleleaf sedge. Significant forbs may include cudweed sagewort, curlycup gumweed, heath aster, scarlet globemallow, and western yarrow. Shrubs include fringed sagewort and prairie rose. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle and energy flow are functioning properly. Plant litter is properly distributed with some movement off-site and natural plant mortality is low. The diversity in plant species allows for some drought tolerance. This is a fragile, but sustainable plant community. Low to moderate available water capacity coupled with high accumulations of sodium and slow permeability strongly influences the soil-water-plant relationships.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	730	1164	1585
Forb	60	98	145
Shrub/Vine	10	39	70
Total	**800**	**1301**	**1800**

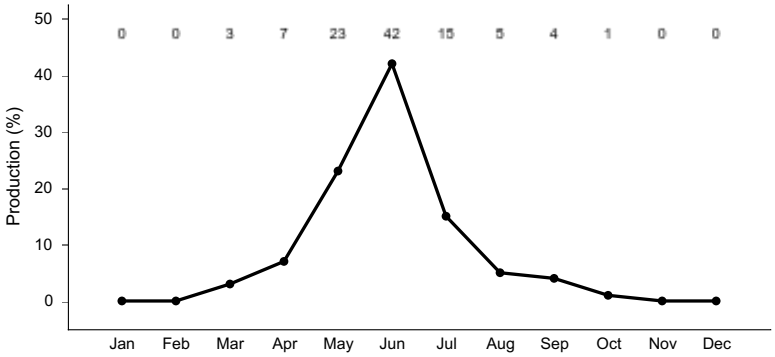


Figure 8. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 1.2
Blue Grama/Western Wheatgrass/Inland Saltgrass

This community phase resulted from a shift in dominance from mid statured, cool season rhizomatous grasses to a dominance of short statured, warm season grasses. Western wheatgrass declined as a result of grazing pressure and/or drought with a corresponding increase in blue grama, buffalograss, and inland saltgrass. Grasses and grass-likes still dominated the production but forbs such as western yarrow, curlycup gumweed, and rose pussytoes, and shrubs such as fringed sagewort increased. Overall production would have been slightly reduced, except after periods of prolonged drought when production would have been significantly reduced and time it would take to recover would have been extended. Energy capture would have shifted from spring and early summer to early to mid summer. Infiltration rates would have been slightly reduced due to the decline in western wheatgrass and resulting increase in blue grama.

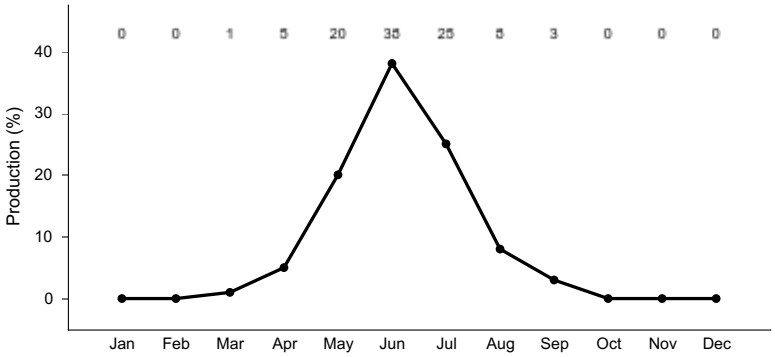


Figure 9. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Pathway 1.1a
Community 1.1 to 1.2

This pathway occurs when events favor the decrease of cool season, mid statured grasses and the increase of warm season, short statured grasses. Such events include early spring fires followed by severe grazing. This may have been a common occurrence in the natural range of variability. Spring and early summer drought, especially combined with early season burns or grazing could also initiate this pathway. Continuous early season burning or continuous early season grazing would also favor this pathway. Along this pathway, the dominate timing of energy capture shifts from spring and early summer to summer early fall as the plant functional groups begin to change.

Pathway 1.2a
Community 1.2 to 1.1

The climate of the northern Great Plains favors this pathway. Time and natural events that favor a decrease in warm season grasses and an increase in cool season grasses will initiate this pathway. Summer fires and/or short duration severe summer grazing will favor this pathway. These events were common within the natural range of

variability.

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 is still dominated by native cool and warm season grasses, but 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. Timing of grazing coupled with weather events dictate the dynamics that occur within this state. The 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

- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass
- Nuttall's alkaligrass (*Puccinellia nuttalliana*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- saltgrass (*Distichlis spicata*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- curlycup gumweed (*Grindelia squarrosa*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- scarlet globemallow (*Sphaeralcea coccinea*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous

Community 2.1
Western Wheatgrass/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, blue grama, and Nuttall’s Alkaligrass. Other grass or grass-like species include buffalograss, inland saltgrass, prairie junegrass and needleleaf sedge. Forbs would include cudweed sagewort, curlycup gumweed, heath aster, scarlet globemallow, and western yarrow. 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.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
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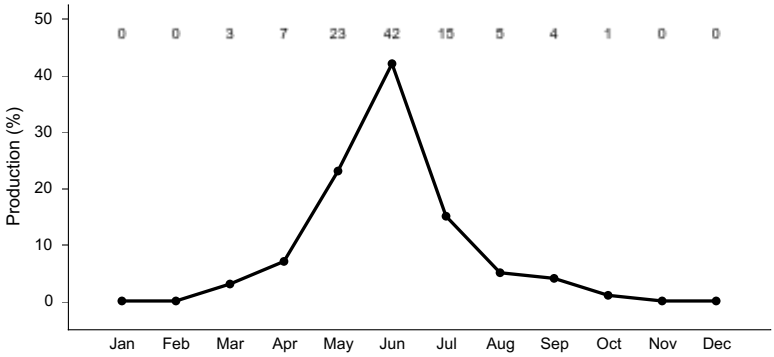

Figure 11. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 2.2
Blue Grama/Western Wheatgrass/Inland Saltgrass/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 70 percent grasses and grass-like species, 25 percent forbs, and 5 percent shrubs. Dominant grasses include western wheatgrass, blue grama, inland saltgrass with minor amounts of Kentucky bluegrass. Grasses of secondary importance include needleandthread, buffalograss, tumblegrass 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 and inland saltgrass have increased and Kentucky bluegrass has invaded. Needleandthread and prairie junegrass production has 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.

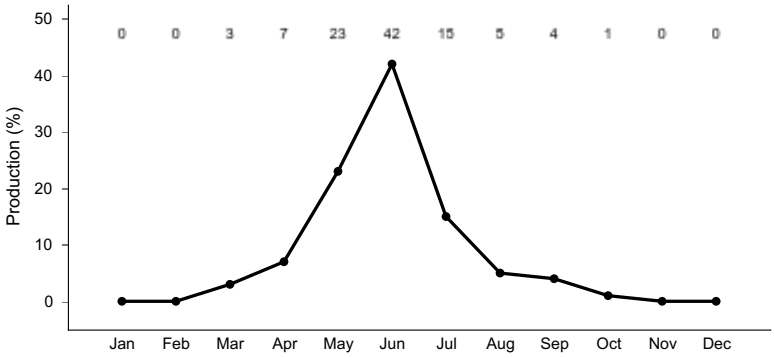

Figure 12. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 2.3
Western Wheatgrass/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.

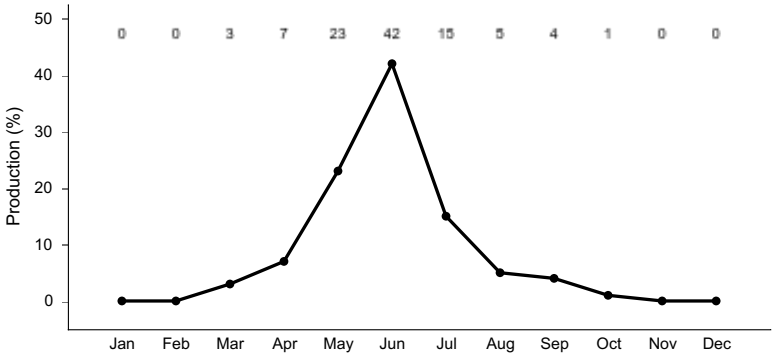

Figure 13. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Pathway 2.1a
Community 2.1 to 2.2

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 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. 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. These factors favor cool-season species, and lead back to the 2.1 Western Wheatgrass/Blue Grama Plant Community Phase.

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/Kentucky Bluegrass Plant Community Phase.

Pathway 2.3a
Community 2.3 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. The use of prescribed burning may also be necessary to properly initiate this pathway and shift the competitive advantage to the native cool-season grasses.

State 3

Invaded

This state is the result of invasion and dominance of introduced species with remnant amounts of native, short statured grasses and forbs. This state is characterized by the dominance of Kentucky bluegrass and possibly smooth bromegrass, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Due to soil chemistry and structure issues, remnant populations of inland saltgrass and blue grama may be present on those areas where the claypan occurs in close proximity to the soil surface. In appearance, this plant community phase may resemble a site with “spot grazing” issues even when no grazing has occurred. 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
- saltgrass (*Distichlis spicata*), grass
- blue grama (*Bouteloua gracilis*), grass
- sedge (*Carex*), grass
- smooth brome (*Bromus inermis*), 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 very grazing tolerant species such as Kentucky bluegrass, inland saltgrass, blue grama, sedges and forbs. The dominance is at times so complete that other species are difficult to find on the site. Nutrient cycling is greatly reduced, and mid-statured 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. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase.

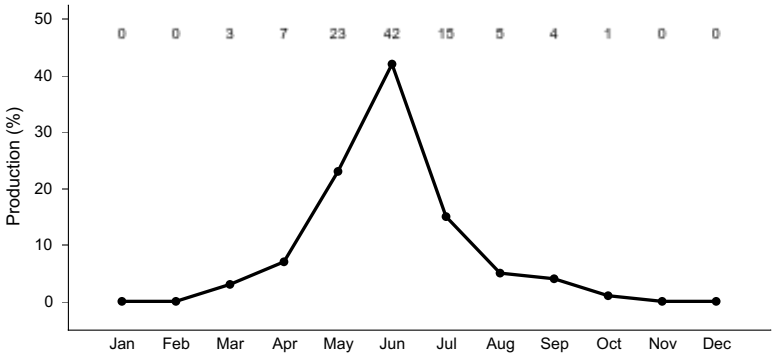

Figure 14. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 3.2
Kentucky Bluegrass/Forb

This plant community phase is a result of extended periods of non-use and no fire. It is characterized by a dominance of Kentucky bluegrass and forbs. Smooth bromegrass may also be present on the site. 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 Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less than the interpretive plant community. The period that forage palatability is high is relatively short. Energy capture is also reduced due to the shorter active growth period and lack of warm season plant diversity.

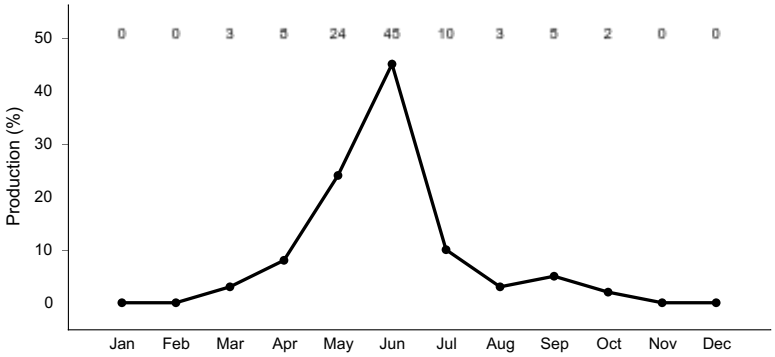

Figure 15. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

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 increase litter levels and decreased vigor of less shade tolerant short statured warm season grass species. These factors favor cool-season species, and lead to the 3.2 Kentucky Bluegrass/Forb 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 Inland Saltgrass/Kentucky Bluegrass/Blue Grama Plant Community Phase.

State 4
Cropland

This state is the result of annual cropping.

Transition T1a
State 1 to 2

This is the transition from the native cool season grass dominated reference state to a state that has been invaded by introduced cool season grass species. When propagules of Kentucky bluegrass are present, this transition occurs as natural and/or management actions favor a decline in the composition of cool and warm season native grasses and an increase in cool season introduced sodgrasses. Chronic season long or heavy late season grazing facilitate this transition. Complete rest from grazing and no fire events can also lead to this transition. The threshold between states is crossed when Kentucky bluegrass or other non-native grasses become established on the site.

Transition T1b
State 1 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Transition T2a/b

State 2 to 3

T2a - This represents the transition from the more native dominated Native/Invaded State to a plant community phase dominated by dense Kentucky bluegrass sod and grazing tolerant forbs. Heavy continuous season-long grazing is the major contributor 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. This transition typically leads to the 3.1 Saltgrass/Kentucky Bluegrass/Blue Grama Plant Community Phase. T2b - Complete rest from grazing and elimination of fire are the two major contributors to this transition. Preliminary studies 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; 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 dominant species. This transition typically leads to the 3.2 Kentucky Bluegrass/Forb Plant Community Phase.

Transition T2c
State 2 to 4

Removal of vegetative cover and tilling for agricultural crop production.

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 Native/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 the continued treatment of the introduced sodgrasses. This restoration pathway may also be initiated with high levels of prescribed grazing management over a long period of time, coupled with prescribed burning. The success of this restoration pathway depends upon the presence of a remnant population of native grass and grass-like species or the presence of these species in nearby similar sites. This remnant population may not be readily apparent without close inspection.

Transition T3a
State 3 to 4

Removal of vegetative cover and tilling for agricultural crop production.

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 (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			325–585	
	western wheatgrass	PASM	*Pascopyrum smithii*	325–585	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–65	–
2	**Short Warm-season Grasses**			195–325	
	blue grama	BOGR2	*Bouteloua gracilis*	130–260	–
	saltgrass	DISP	*Distichlis spicata*	13–65	–

	buffalograss	BODA2	*Bouteloua dactyloides*	13–65	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	0–26	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–26	–
3	**Cool-season Bunchgrasses**			13–65	
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	13–65	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–39	–
4	**Other Native Grasses**			13–65	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–65	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	13–39	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–13	–
5	**Grass-likes**			13–65	
	needleleaf sedge	CADU6	*Carex duriuscula*	13–65	–
	Pennsylvania sedge	CAPE6	*Carex pensylvanica*	0–26	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–26	–
Forb					
6	**Forbs**			65–130	
	Forb, native	2FN	*Forb, native*	13–52	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	13–26	–
	textile onion	ALTE	*Allium textile*	13–26	–
	white heath aster	SYER	*Symphyotrichum ericoides*	13–26	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	13–26	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	13–26	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	13–26	–
	bladderpod	LESQU	*Lesquerella*	0–13	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–13	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–13	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–13	–
	bushy knotweed	PORA3	*Polygonum ramosissimum*	0–13	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–13	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–13	–
	pussytoes	ANTEN	*Antennaria*	0–13	–
	field sagewort	ARCA12	*Artemisia campestris*	0–13	–
Shrub/Vine					
7	**Shrubs**			13–65	
	prairie sagewort	ARFR4	*Artemisia frigida*	13–39	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–26	–
	prairie rose	ROAR3	*Rosa arkansana*	0–26	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–26	–

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)

Grass/Grasslike					
1	**Wheatgrass**			325–585	
	western wheatgrass	PASM	*Pascopyrum smithii*	325–585	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–65	–
2	**Short Warm-season Grasses**			195–325	
	blue grama	BOGR2	*Bouteloua gracilis*	130–260	–
	saltgrass	DISP	*Distichlis spicata*	13–65	–
	buffalograss	BODA2	*Bouteloua dactyloides*	13–65	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	0–26	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–26	–
3	**Cool-season Bunchgrasses**			13–65	
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	13–65	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–39	–
4	**Other Native Grasses**			13–65	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–65	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	13–39	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–13	–
5	**Grass-likes**			13–65	
	needleleaf sedge	CADU6	*Carex duriuscula*	13–65	–
	Pennsylvania sedge	CAPE6	*Carex pensylvanica*	0–26	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–26	–
6	**Non-Native Grasses**			13–26	
	Kentucky bluegrass	POPR	*Poa pratensis*	13–26	–
	Grass, perennial	2GP	*Grass, perennial*	0–13	–
	smooth brome	BRIN2	*Bromus inermis*	0–13	–
Forb					
7	**Forbs**			65–130	
	Forb, native	2FN	*Forb, native*	13–52	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	13–26	–
	textile onion	ALTE	*Allium textile*	13–26	–
	white heath aster	SYER	*Symphyotrichum ericoides*	13–26	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	13–26	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	13–26	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	13–26	–
	bladderpod	LESQU	*Lesquerella*	0–13	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–13	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–13	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–13	–
	bushy knotweed	PORA3	*Polygonum ramosissimum*	0–13	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–13	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–13	–
	pussytoes	ANTEN	*Antennaria*	0–13	–

	field sagewort	ARCA12	*Artemisia campestris*	0–13	–
Shrub/Vine					
8	**Shrubs**			13–65	
	prairie sagewort	ARFR4	*Artemisia frigida*	13–39	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–26	–
	prairie rose	ROAR3	*Rosa arkansana*	0–26	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–26	–

Inventory data references

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

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

Other references

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Approval

Suzanne Mayne-Kinney, 11/14/2024

Rangeland health reference sheet

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

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

Indicators

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

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

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

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

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

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

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

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

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

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

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:**