USDA Natural Resources Conservation Service

# Ecological site R055DY011SD
# Clayey

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## 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 Clayey ecological site occurs on upland areas. Soils are well drained and have greater than 40 percent clay in the surface or subsoil. The surface and subsoil textures typically are silty clay or clay. Some soils have a loamy surface and a clayey subsoil. In some areas the surface layer may consist of stony to extremely stony. Slopes can range from 0 to 3 percent. Vegetation in the Reference State is dominated by cool-season grasses such as western wheatgrass and needlegrasses. Forbs include cudweed sagewort, prairie coneflower, and western yarrow. Non-native grasses such as smooth bromegrass and Kentucky bluegrass or native conifers such as eastern redcedar may invade due to shifts in disturbance regime.

## Associated sites

| | |
|---|---|
| R055DY010SD | **Loamy**<br>These sites occur on uplands. Soils are well drained and have less than 40 percent clay in the subsoil. |
| R055DY013SD | **Claypan**<br>These sites occur on uplands. Soils are moderately well drained and have a claypan (columnar structure) greater than 4 inches from the soil surface. |

## Similar sites

| | |
|---|---|
| R055DY010SD | **Loamy**<br>The Loamy site is in a similar landscape position, but the soils have less than 40 percent clay in the surface or subsoil. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Nassella viridula*<br>(2) *Pascopyrum smithii* |

## Physiographic features

This site typically occurs on glaciated uplands – ground moraines and lake plains and colluvium from weathered shale and shale till. This site is typically on linear back slopes, concave foot slopes, or on flats on till plains and lake plains and on side slopes of escarpments. On ground moraines the parent material is either fine-loamy or clayey. On lake plains the parent material is either fine-silty or clayey. On escarpments the parent material is clayey.

The following data (tables) were obtained from the National Soil Information System.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Lake plain<br>(2) Till plain<br>(3) Flood plain |
| Runoff class | Low to medium |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 980–2,100 ft |
| Slope | 0–3% |
| Ponding depth | 0 in |
| Water table depth | 38–62 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 |

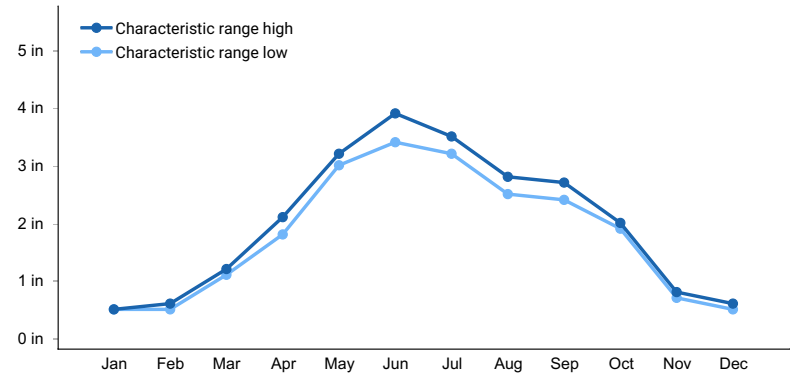



**Figure 1. Monthly precipitation range**

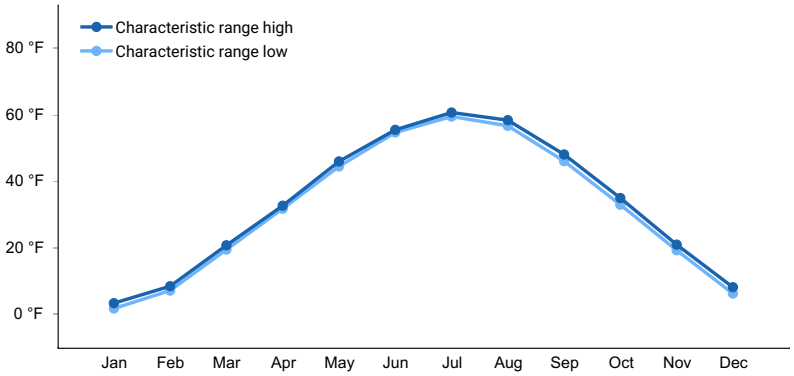



**Figure 2. Monthly minimum temperature range**

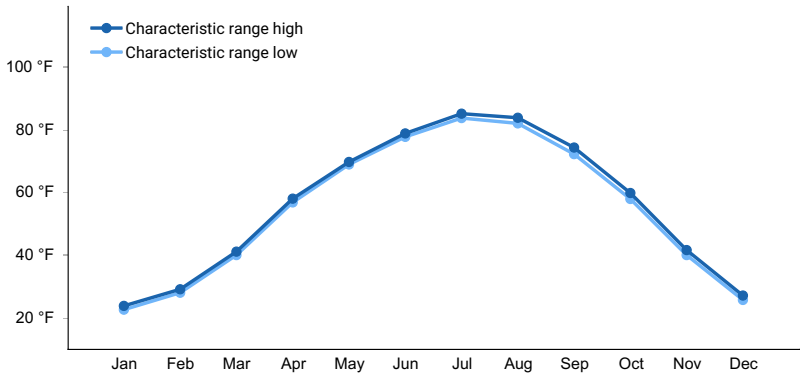



**Figure 3. Monthly maximum temperature range**

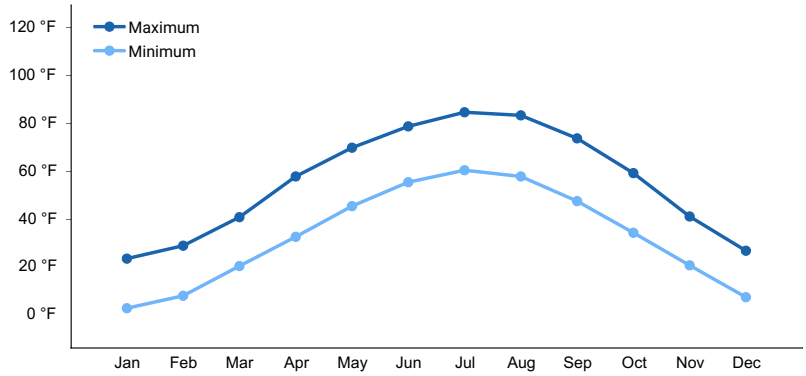



**Figure 4. Monthly average minimum and maximum temperature**

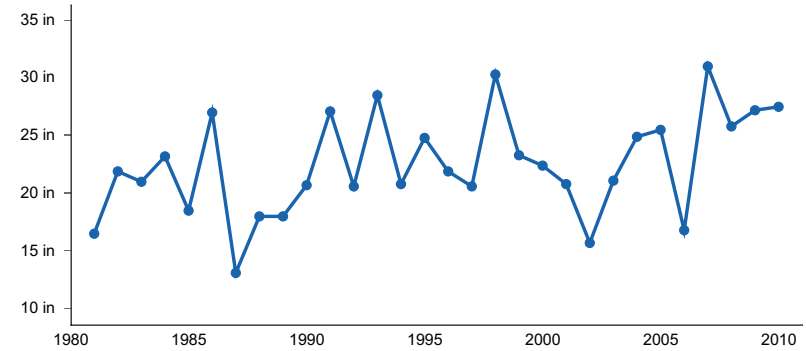



**Figure 5. Annual precipitation pattern**

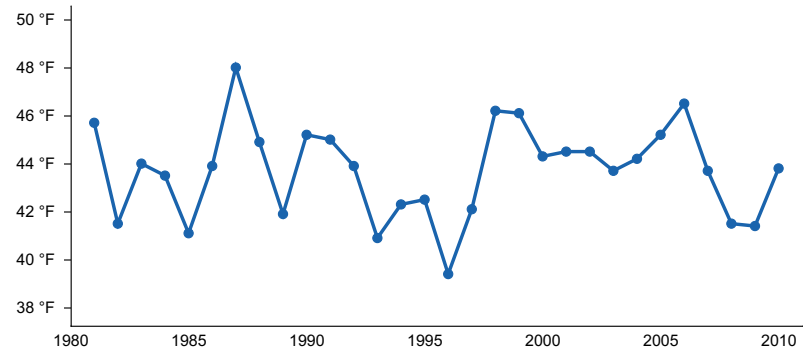



**Figure 6. Annual average temperature pattern**

## 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 3-5 feet early in the growing season on some low-relief, concave areas.

## Wetland description

Not Applicable.

## Soil features

The common features of soils in this site are the silty clay loam to clay textured subsoils and slopes of 0 to 3 percent. The loam to silty clay surface layer is 5 to 18 inches thick. The soils have a moderately slow to very slow infiltration rate. The soils in this site are well to moderately well drained and formed in glaciolacustrine sediments and clayey till. When dry these soils crack. When the soils are wet, surface compaction can occur with heavy traffic. This site typically should show slight to no evidence of rills, wind scoured areas or pedestalled plants. Water flow paths should not be present, and the soil surface is stable and intact. Sub-surface soil layers are non-restrictive to water movement and root penetration. These soils are susceptible to water and wind erosion. Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/) for specific local soils information. Soils representative of this site include the Cresbard, Aberdeen, and Harmony Soil Series.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Glaciolacustrine deposits<br>(2) Till |
| Surface texture | (1) Silty clay loam<br>(2) Silt loam<br>(3) Loam |
| Family particle size | (1) Clayey |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Very slow to moderately slow |
| Depth to restrictive layer | 80 in |
| Soil depth | 80 in |
| Surface fragment cover <=3" | 0–3% |
| Surface fragment cover >3" | 0–1% |
| Available water capacity (0-60in) | 5–8 in |
| Calcium carbonate equivalent (0-40in) | 0–18% |
| Soil reaction (1:1 water) (0-40in) | 6–9 |
| Subsurface fragment volume <=3" (0-40in) | 0–7% |
| Subsurface fragment volume >3" (0-40in) | 0–5% |

## Ecological dynamics

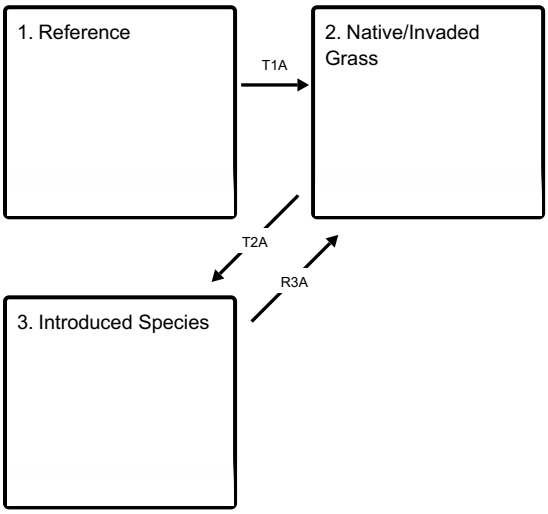
The site developed under Northern Great Plains climatic conditions, and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a slow decline in vegetative vigor 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 Green Needlegrass/Western Wheatgrass Plant Community Phase (1.1). The Reference State and the interpretive plant community have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered. Community phases, community pathways, states, transitions, thresholds and restoration pathways have been determined through similar studies and experience. The 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 and 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.

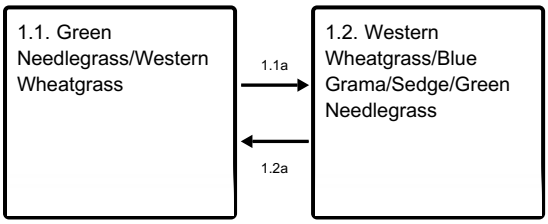
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and/or states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

## State and transition model

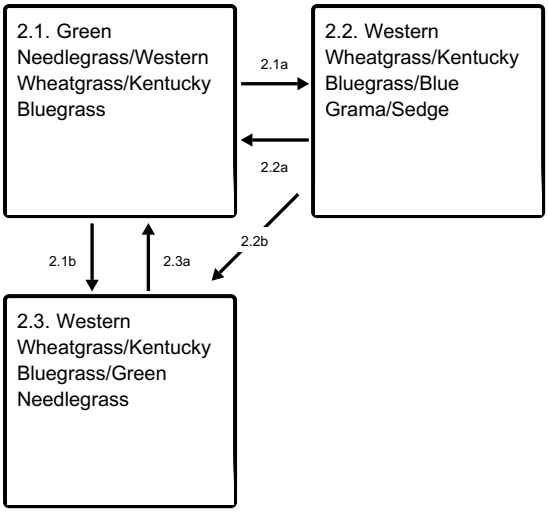
**Ecosystem states**



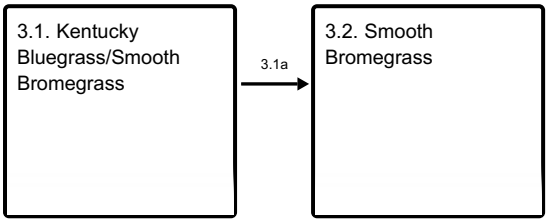

**State 1 submodel, plant communities**



**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 2) 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

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

## Community 1.1
## Green Needlegrass/Western Wheatgrass

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 cool-season grasses such as green needlegrass and western wheatgrass. There are also other needlegrasses and wheatgrasses present as well as various amounts of warm-season grasses such as big bluestem, blue grama and sideoats grama. A variety of leguminous and non-leguminous perennial forbs are present but only in slight amounts. This is the reference plant community phase and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. This is a naturally nitrogen deficient plant community.

**Table 5. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 1650 | 2327 | 2990 |
| Forb | 125 | 195 | 275 |
| Shrub/Vine | 25 | 78 | 135 |
| **Total** | **1800** | **2600** | **3400** |

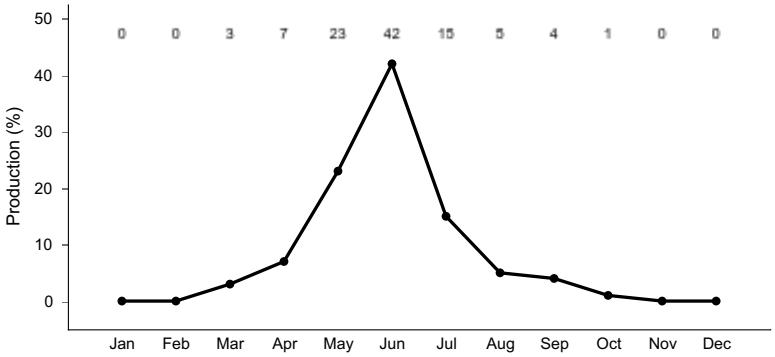



**Figure 8. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..**

## Community 1.2
## Western Wheatgrass/Blue Grama/Sedge/Green Needlegrass

This plant community was a result of concentrated grazing following a spring fire, from 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 grass and grass-like species included western wheatgrass, blue grama, sedge, buffalograss, and green needlegrass. Grasses of secondary importance included sideoats grama, needleandthread, and porcupine grass. Forbs commonly found in this plant community included cudweed sagewort, heath aster, and western yarrow. This plant community had similar plant composition to the 2.2 Western Wheatgrass/Kentucky Bluegrass/Blue Grama/Sedge 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 Green Needlegrass/Western Wheatgrass Plant Community Phase (1.1), blue grama and sedge increased. Green needlegrass 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.

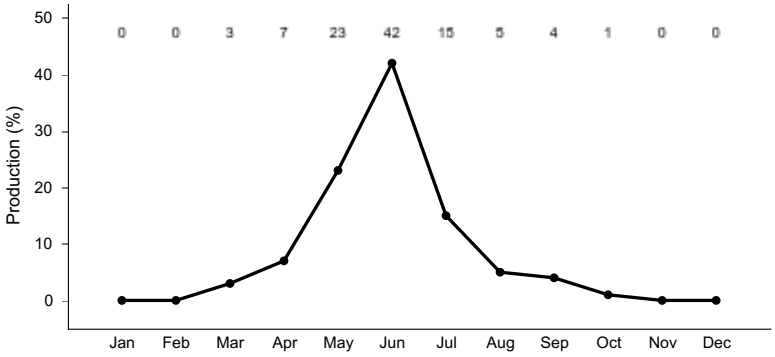



**Figure 9. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..**

### Pathway 1.1a
### Community 1.1 to 1.2

This pathway occurs as a result of spring fire followed by heavy grazing, or a combination of moderate to heavy grazing coupled with prolonged periods of below-average precipitation. The dominant cool-season grasses such as green needlegrass and western wheatgrass will decrease, and shorter statured species such as blue grama and sedge will increase. This pathway would have led to the 1.2 Western Wheatgrass/Blue Grama/Sedge/Green Needlegrass 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 Green Needlegrass/Western Wheatgrass 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**

- green needlegrass (*Nassella viridula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- blue grama (*Bouteloua gracilis*), grass
- sedge (*Carex*), grass

### Community 2.1
### Green Needlegrass/Western Wheatgrass/Kentucky Bluegrass

This plant community phase is similar to the 1.1 Green Needlegrass/Western Wheatgrass 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, slender wheatgrass, big bluestem, and sideoats grama. Other grass or grass-like species include needleandthread, porcupine grass, blue grama, Kentucky bluegrass, buffalograss, prairie dropseed, and sedge. 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.

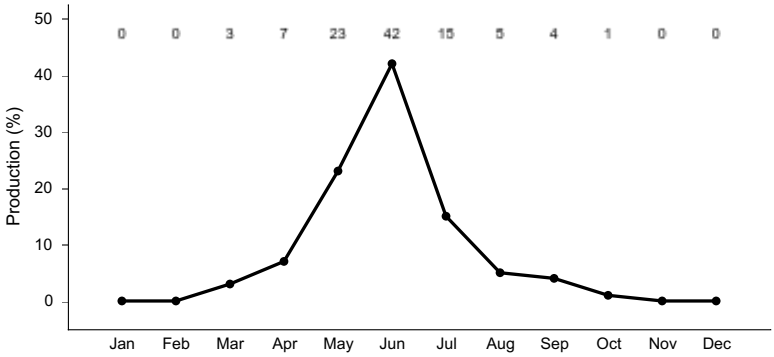



**Figure 10. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..**

## Community 2.2
## Western Wheatgrass/Kentucky Bluegrass/Blue Grama/Sedge

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 grass and grass-like species include western wheatgrass, blue grama, sedge, 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, heath aster, prairie coneflower, and western yarrow. When compared to the Green Needlegrass/Western Wheatgrass Plant Community Phase (1.1), blue grama and sedge have 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 species with a dense, shallower rooted species will result in somewhat higher runoff and decreased infiltration. This will cause the site to become drier. These species will also become more competitive.

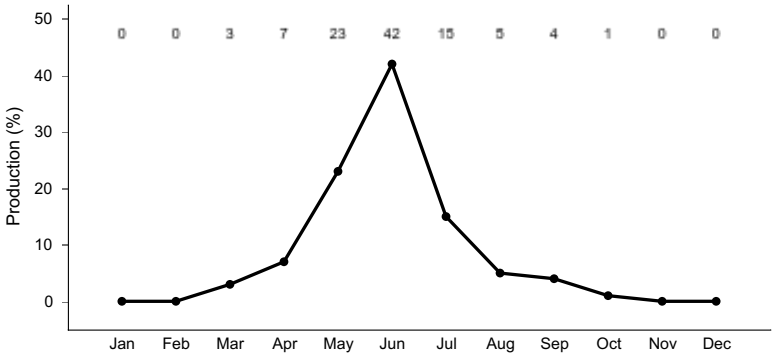



**Figure 11. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..**

## Community 2.3
## Western Wheatgrass/Kentucky Bluegrass/Green Needlegrass

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 T2 will be initiated.

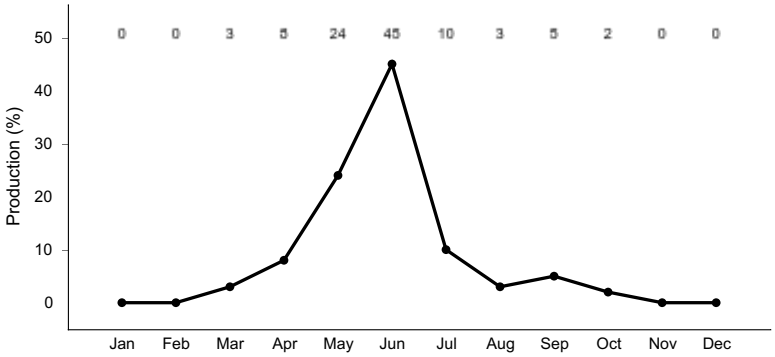



**Figure 12. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..**

### 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 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/Kentucky Bluegrass/Blue Grama/Sedge 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/Kentucky Bluegrass/Green Needlegrass 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 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/Kentucky Bluegrass/Green Needlegrass Plant Community Phase.

### Pathway 2.3a
### Community 2.3 to 2.1

The implementation of prescribed burning coupled with 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 native grasses.

## 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**

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

## Community 3.1
## Kentucky Bluegrass/Smooth Bromegrass

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, smooth bromegrass, 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.

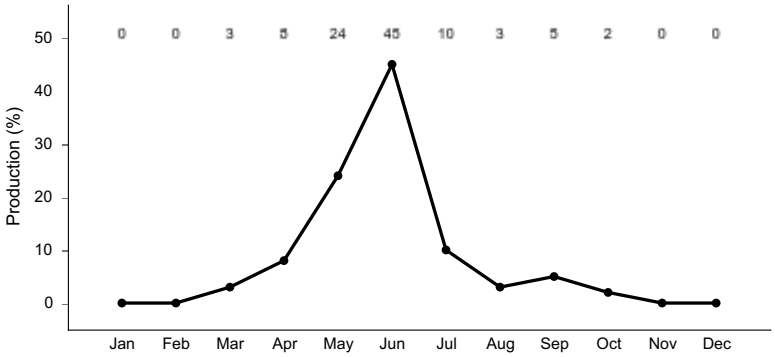



**Figure 13. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..**

## Community 3.2
## Smooth Bromegrass

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.

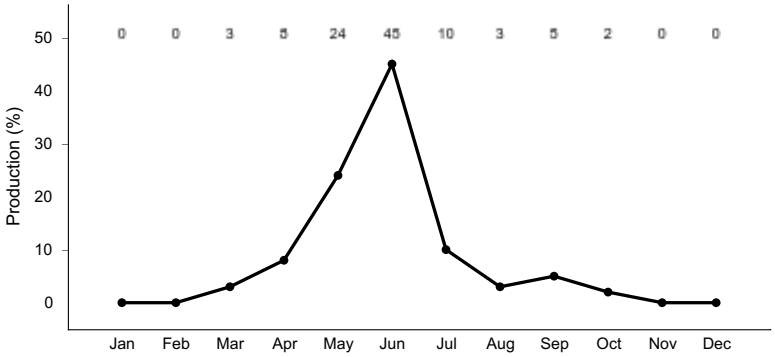



**Figure 14. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..**

## 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 species. These factors favor cool-season species, and lead to the 3.2 Smooth Bromegrass 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 T2A
## State 2 to 3

This represents the transition from the more native dominated Native/Invaded State to a state dominated by non-native cool-season grasses. 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
## 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 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 on 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.

## Additional community tables

**Table 6. Community 1.1 plant community composition**

| | | | | Annual Production | Foliar Cover |
|---|---|---|---|---|---|

| Group | Common Name | Symbol | Scientific Name | (Lb/Acre) | (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Needlegrass** | | | 650–1040 | |
| | green needlegrass | NAVI4 | *Nassella viridula* | 520–1040 | – |
| | porcupinegrass | HESP11 | *Hesperostipa spartea* | 26–130 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–78 | – |
| 2 | **Wheatgrass** | | | 260–520 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 260–520 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 52–260 | – |
| | slender wheatgrass | ELTRS | *Elymus trachycaulus ssp. subsecundus* | 52–260 | – |
| 3 | **Tall/Mid Warm-Season Grasses** | | | 52–260 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 0–260 | – |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–260 | – |
| | prairie dropseed | SPHE | *Sporobolus heterolepis* | 0–130 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–78 | – |
| 4 | **Short Warm-season Grasses** | | | 52–130 | |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 26–130 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 26–130 | – |
| 5 | **Other Native Grasses** | | | 52–130 | |
| | Graminoid (grass or grass-like) | 2GRAM | *Graminoid (grass or grass-like)* | 0–78 | – |
| | plains reedgrass | CAMO | *Calamagrostis montanensis* | 26–78 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 26–78 | – |
| 6 | **Grass-likes** | | | 26–130 | |
| | Grass-like (not a true grass) | 2GL | *Grass-like (not a true grass)* | 0–130 | – |
| | sedge | CAREX | *Carex* | 26–130 | – |
| **Forb** | | | | | |
| 7 | **Forbs** | | | 130–260 | |
| | Forb, native | 2FN | *Forb, native* | 0–130 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 26–52 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 26–52 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 26–52 | – |
| | false boneset | BREU | *Brickellia eupatorioides* | 26–52 | – |
| | wavyleaf thistle | CIUN | *Cirsium undulatum* | 26–52 | – |
| | purple prairie clover | DAPU5 | *Dalea purpurea* | 26–52 | – |
| | white heath aster | SYER | *Symphyotrichum ericoides* | 26–52 | – |
| | American vetch | VIAM | *Vicia americana* | 26–52 | – |
| | silverleaf Indian breadroot | PEAR6 | *Pediomelum argophyllum* | 26–52 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 26–52 | – |
| | goldenrod | SOLID | *Solidago* | 0–52 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 0–26 | – |
| | sanddune wallflower | ERCAC | *Erysimum capitatum var. capitatum* | 0–26 | – |
| | scarlet beeblossom | GACO5 | *Gaura coccinea* | 0–26 | – |

| | | | | | |
|---|---|---|---|---|---|
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–26 | – |
| **Shrub/Vine** | | | | | |
| 8 | **Shrubs** | | | 26–130 | |
| | western snowberry | SYOC | *Symphoricarpos occidentalis* | 0–78 | – |
| | leadplant | AMCA6 | *Amorpha canescens* | 26–78 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 26–52 | – |
| | prairie rose | ROAR3 | *Rosa arkansana* | 0–52 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–52 | – |

## 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):**

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

---

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

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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):**

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

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17. **Perennial plant reproductive capability:**

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