USDA Natural Resources Conservation Service

Ecological site R055DY042SD
Sandy Claypan

Last updated: 11/14/2024
Accessed: 11/21/2024

General information

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

MLRA notes

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

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

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

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

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

Classification relationships

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

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

Ecological site concept

The Sandy Claypan ecological site typically is located on flats and on foot slopes of rises on outwash plains, delta plains, and lake plains; it also can occur on terraces. Although the soil parent materials are very deep; a moderately root-restrictive, dense claypan layer occurs in the upper part of the subsoil (at a depth of 6 to 16 inches). The claypan subsoil layer is fine sandy loam, sandy loam, or loam (with <18% clay); it forms a ribbon <1 inch long. The texture of the surface layer is typically fine sandy loam or sandy loam, but loam and loamy fine sand are included. Generally, soil on this site is moderately well drained. Salt accumulations are allowable below a depth 16 inches. Slopes range from 0 to 6 percent. On the landscape, this site is below the Sandy and Sands ecological sites and above the Limy Subirrigated and Saline Lowland sites. The Thin Claypan ecological site is in adjacent micro-lows; it has a dense claypan layer within a depth of 6 inches. The Subirrigated Sands site occurs on similar landscape

positions; it does not have the dense claypan layer of this site.

Associated sites

R055DY006SD	**Limy Subirrigated** This site is slightly lower on the landscape. The soils do not have a dense claypan layer. They are highly calcareous within a depth of 16 inches and have redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.
R055DY007SD	**Saline Lowland** This site is typically lower on the landscape. It has an accumulation of salts in the surface and subsoil layers (E.C. >8). Typically, this site does not have a claypan layer, but one is allowed if the soil is poorly drained. All textures are included in this site.
R055DY008SD	**Sands** This site is higher on the landscape. The soil is sand or loamy sand (fine to coarse sands) within a depth of 10 inches. The subsoil does not form a ribbon. It does not have a dense claypan layer.
R055DY009SD	**Sandy** This site is higher on the landscape. The soil has sandy loam or fine sandy loam textures (forms a ribbon <1 inch long) to a depth >10 inches. It does not have a dense claypan layer.
R055DY044SD	**Subirrigated Sands** This site is on similar landscape positions. It has redoximorphic features at a depth of 30 to 40 inches. The subsoil does not form a ribbon. It does not have a dense claypan layer.
R055DY015SD	**Thin Claypan** This site is in micro-lows. The soil has a root-restrictive claypan layer within a depth of 6 inches and accumulated salts within 16 inches.

Similar sites

R055DY015SD	**Thin Claypan** This site is in micro-lows. The soil has a root-restrictive claypan layer within a depth of 6 inches and accumulated salts within 16 inches.
R055DY013SD	**Claypan** This site is on similar landscape positions on till plains and lake plains. The soil has a root-restrictive claypan layer that forms a ribbon >1 inch thick. Commonly, visible salts occur below a depth of 16 inches.
R055DY009SD	**Sandy** This site is higher on the landscape. The soil has sandy loam or fine sandy loam textures (forms a ribbon <1 inch long) to a depth >10 inches. It does not have a dense claypan layer.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Andropogon gerardii*

Physiographic features

This site typically occurs on sandy uplands – outwash plains, delta plains, and lake plains. It occurs on flats and on foot slopes of rises. A few areas are on terraces. The parent materials are glaciofluvial or sandy glaciolacustrine deposits. Slopes range from 0 to 2 percent.

Table 2. Representative physiographic features

Landforms	(1) Outwash plain (2) Lake plain (3) Delta plain (4) Terrace

Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	299–649 m
Slope	0–2%
Ponding depth	0 cm
Water table depth	91–152 cm
Aspect	Aspect is not a significant factor

Climatic features

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

Table 3. Representative climatic features

Frost-free period (characteristic range)	114-117 days
Freeze-free period (characteristic range)	129-134 days
Precipitation total (characteristic range)	559-584 mm
Frost-free period (actual range)	114-119 days
Freeze-free period (actual range)	127-134 days
Precipitation total (actual range)	559-584 mm
Frost-free period (average)	116 days
Freeze-free period (average)	131 days
Precipitation total (average)	584 mm

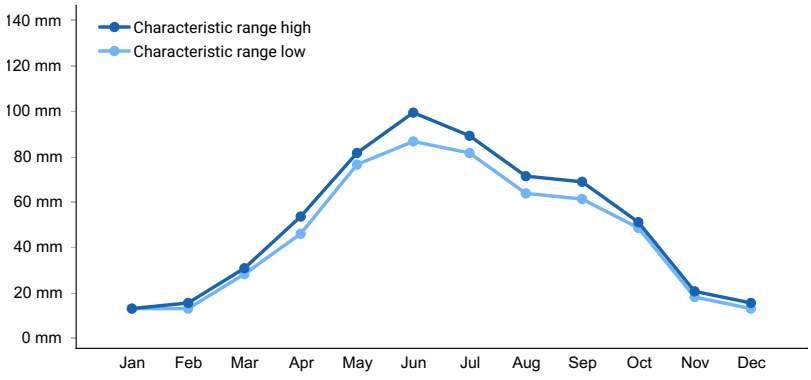


Figure 1. Monthly precipitation range

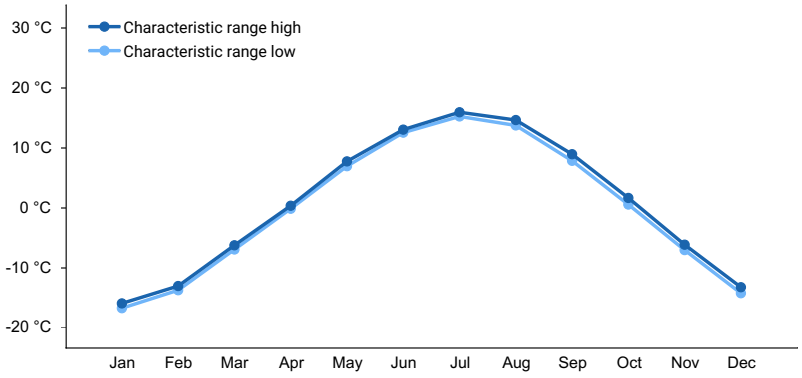


Figure 2. Monthly minimum temperature range

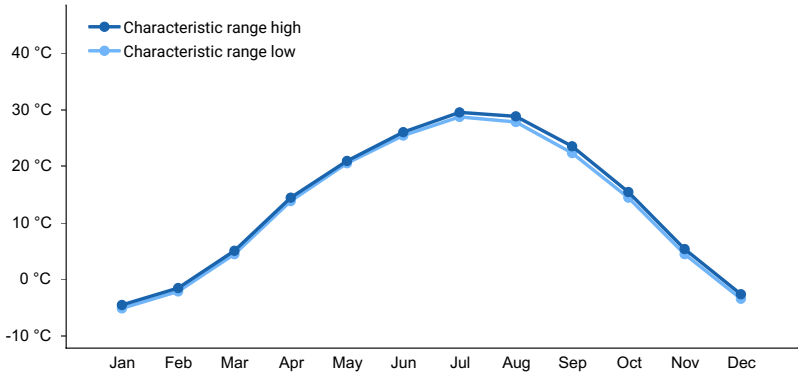


Figure 3. Monthly maximum temperature range

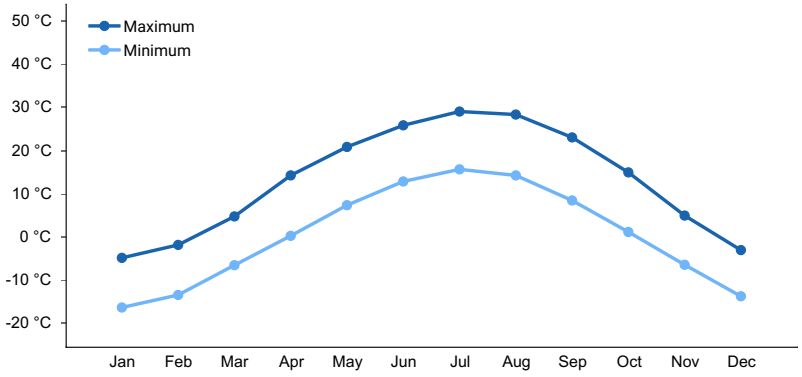


Figure 4. Monthly average minimum and maximum temperature

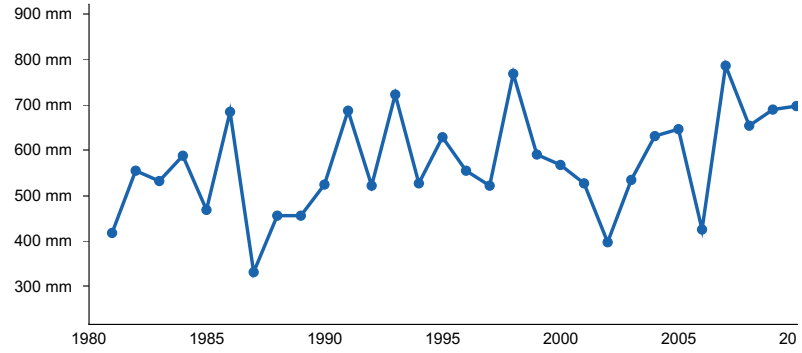


Figure 5. Annual precipitation pattern

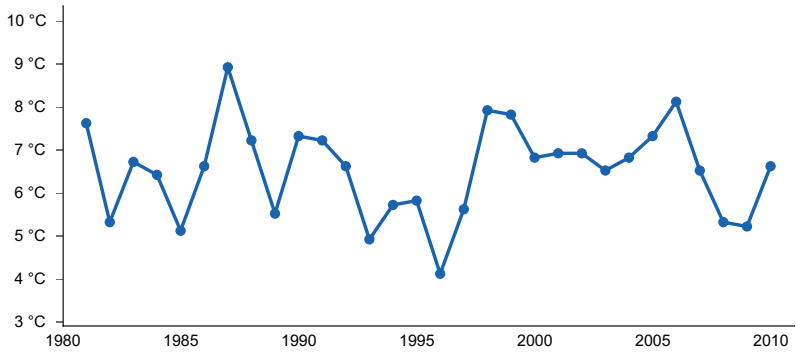


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BRITTON [USC00391049], Britton, SD
- (2) ANDOVER #2 [USC00390120], Andover, SD
- (3) TURTON [USC00398420], Turton, SD
- (4) CONDE [USC00391917], Conde, SD
- (5) REDFIELD [USC00397052], Redfield, SD
- (6) MELLETTE 4 W [USC00395456], Northville, SD
- (7) ABERDEEN [USW00014929], Aberdeen, SD
- (8) COLUMBIA 8 N [USC00391873], Columbia, SD

Influencing water features

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 as shallow as 3 feet early in the growing season on low-relief areas, the root-restrictive claypan layer prohibits the plants from benefiting significantly from subirrigation. Depth to the water table typically is greater than 5 feet through most of the growing season. Surface infiltration is moderately rapid or moderate. Saturated hydraulic conductivity is moderately high or high in the surface soil, but moderately low in the subsoil. Water loss is through percolation below the root zone and through evapotranspiration.

Wetland description

Not Applicable.

Soil features

Soils are in the Mollisol order, which are classified further as Calcic Natrudolls. These soils were developed under prairie vegetation. Salt accumulations, where present, are below a depth of 16 inches. They formed in glaciofluvial or glaciolacustrine deposits; in some soils, glacial till occurs below a depth of 4 feet.

The common feature of soils in this site is a sodic, claypan subsoil layer that is fine sandy loam, sandy loam, or loam (with <18% clay); it forms a ribbon <1 inch long. Although the soil parent materials are very deep; the moderately root-restrictive claypan layer occurs in the upper part of the subsoil (at a depth of 6 to 16 inches). The texture of the surface layer is typically fine sandy loam or sandy loam, but loam and loamy fine sand are included. These soils commonly have a gray subsurface layer of loamy find sand just above the claypan layer. Salt accumulations, where present, are below a depth of 16 inches. The soils in this site typically are moderately well drained – redoximorphic features, where present, are deeper than 3.5 feet.

This site should show slight to no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Sub-surface soil layers are restrictive to water movement and root penetration. These soils are mainly susceptible to wind erosion. Loss of the soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to Sandy Claypan site are: Letcher.

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) Glaciofluvial deposits (2) Glaciolacustrine deposits
Surface texture	(1) Fine sandy loam (2) Sandy loam (3) Loam (4) Loamy fine sand
Drainage class	Moderately well drained
Permeability class	Slow to moderate
Depth to restrictive layer	13–43 cm
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	9.65–16.51 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Soil reaction (1:1 water) (0-101.6cm)	5.1–9
Subsurface fragment volume <=3" (0-101.6cm)	0%
Subsurface fragment volume >3" (0-101.6cm)	0%

Ecological dynamics

The site developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and 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 Prairie Sandreed/Bluestem/Needlegrass/Wheatgrass Plant Community Phase (1.1). The Reference State and the interpretive plant community have 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 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.

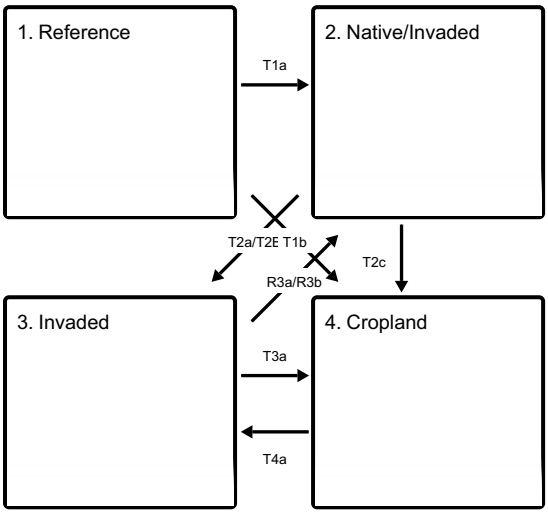
This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) 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. Tall and mid warm-season grasses 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.

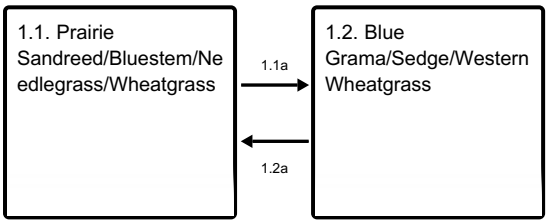
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best 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; 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

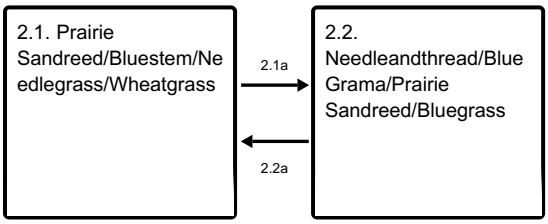
Ecosystem states



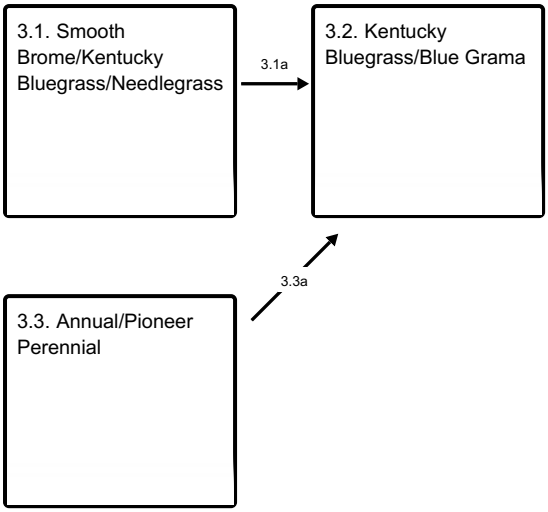
State 1 submodel, plant communities



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 co-dominated by cool-season and warm-season grasses. 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

- leadplant (*Amorpha canescens*), shrub
- western snowberry (*Symphoricarpos occidentalis*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- big bluestem (*Andropogon gerardii*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- needle and thread (*Hesperostipa comata*), grass
- stiff sunflower (*Helianthus pauciflorus*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- upright prairie coneflower (*Ratibida columnifera*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous
- longbract spiderwort (*Tradescantia bracteata*), other herbaceous

Community 1.1
Prairie Sandreed/Bluestem/Needlegrass/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 a mix of cool- and warm-season grasses. This is the interpretive plant community and is considered to be climax. This community evolved with grazing by large herbivores and occasional prairie fire. The potential vegetation was about 85 percent grass and grass-like species, 10 percent forbs, and 5 percent shrubs. Cool-season and tall warm-season grasses dominated the plant community. The co-dominant grasses included prairie sandreed, western wheatgrass, big bluestem, porcupine grass and needle and thread. Other grasses and grass-like plants occurring on the site included blue grama, green needlegrass, little bluestem, prairie junegrass and sedges. Significant forbs included stiff sunflower, bracted spiderwort, hairy goldaster, false gromwell, dotted gayfeather, and purple coneflower. The dominant shrubs were leadplant, western snowberry, and fringed sagewort.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1877	2408	2909
Forb	118	202	308
Shrub/Vine	22	81	146
Total	**2017**	**2691**	**3363**

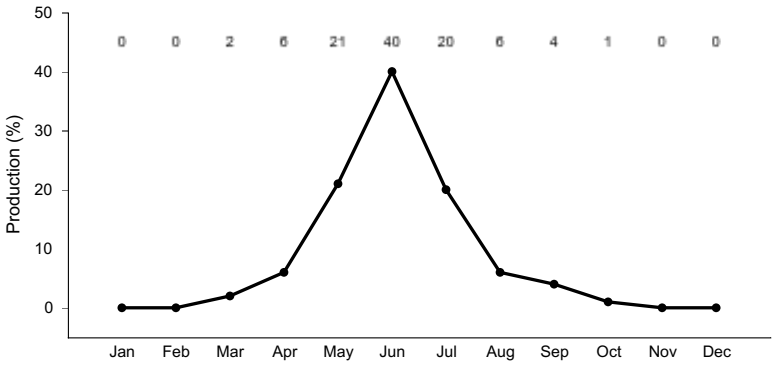


Figure 8. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 1.2
Blue Grama/Sedge/Western Wheatgrass

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, and needle and thread. Grasses of secondary importance included prairie sandreed, porcupine grass, big bluestem, sand dropseed, and threeawn. Forbs commonly found in this plant community included cudweed sagewort, heath aster, and western yarrow. Short grasses, grass-likes, and forbs increased to dominate the site and annual production decreased dramatically. Lack of litter and reduced plant vigor resulted in higher soil temperatures, poor water infiltration rates, and high evapotranspiration which gave blue grama and sedges a competitive advantage over cool season mid-grasses. When compared to the Prairie Sandreed/Bluestem/Needlegrass/Wheatgrass Plant Community Phase (1.1), blue grama and sedge increased. Porcupine grass, prairie dropseed, and big bluestem decreased; 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.

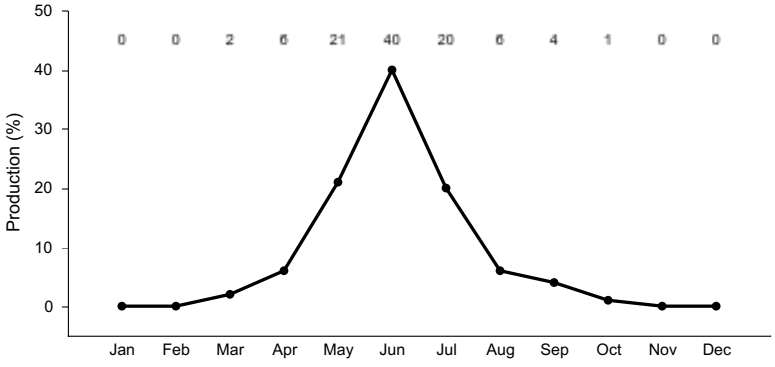


Figure 9. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

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- and warm-season grasses such as prairie sandreed, big bluestem, and porcupine grass will decrease, and shorter statured species such as blue grama and sedge will increase. This pathway would have led to the 1.2 Blue Grama/Sedge/Western Wheatgrass 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 Prairie Sandreed/Bluestem/Needlegrass/Wheatgrass Plant Community Phase.

State 2
Native/Invaded

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 co-dominated by cool- and warm-season grasses. 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- and warm-season species can decline and a corresponding increase in short statured grass will occur.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- western snowberry (*Symphoricarpos occidentalis*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- big bluestem (*Andropogon gerardii*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- dotted blazing star (*Liatris punctata*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous
- longbract spiderwort (*Tradescantia bracteata*), other herbaceous
- stiff sunflower (*Helianthus pauciflorus*), other herbaceous
- upright prairie coneflower (*Ratibida columnifera*), other herbaceous

Community 2.1
Prairie Sandreed/Bluestem/Needlegrass/Wheatgrass

This plant community phase is similar to the 1.1 Prairie Sandreed/Bluestem/Needlegrass/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 grass and grass-like species, 10 percent forbs, and 5 percent shrubs. Cool-season and tall warm-season grasses dominate the plant community. The co-dominant grasses include prairie sandreed, western wheatgrass, big bluestem, porcupine grass, and needle and thread. Other grasses and grass-like plants occurring on the site include blue grama, green needlegrass, little bluestem, prairie junegrass, and sedges. Significant forbs include stiff sunflower, bracted spiderwort, hairy goldaster, false gromwell, dotted gayfeather, and purple coneflower. The dominant shrubs are leadplant, western snowberry, and fringed sagewort. 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.

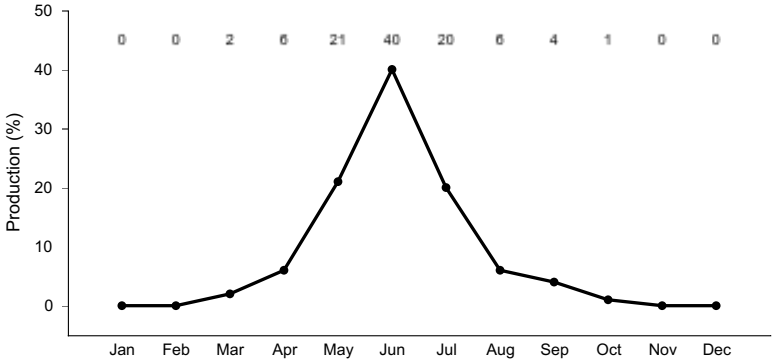


Figure 10. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 2.2
Needleandthread/Blue Grama/Prairie Sandreed/Bluegrass

This plant community is a result of heavy continuous grazing, continuous season-long grazing, or from over utilization during extended drought periods. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grass and grass-like species include needle and thread, blue grama, prairie sandreed, and Kentucky bluegrass. Grasses of secondary importance include porcupine grass, big bluestem, western wheatgrass, slender wheatgrass, green needlegrass, sand dropseed, 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 Prairie Sandreed/Bluestem/Needlegrass/Wheatgrass Plant Community Phase (1.1), blue grama and needle and thread have increased; Kentucky bluegrass has invaded. Porcupine grass and production of mid and tall grasses has also been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. The increase of shorter-statured, more compact rooted species will result in somewhat higher runoff and decreased infiltration. This will cause the site to become drier. These species will also more competitive.

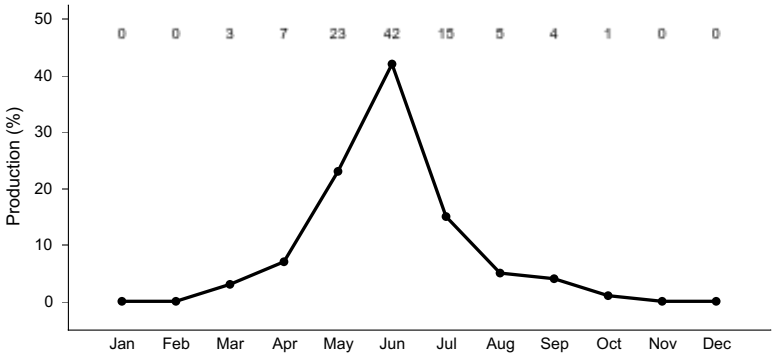


Figure 11. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

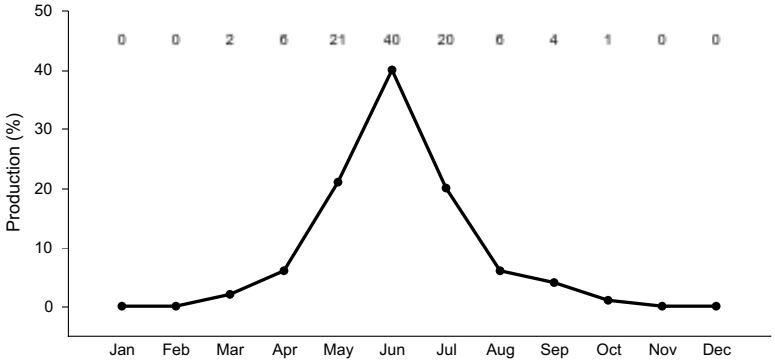


Figure 12. Plant community growth curve (percent production by month).

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), 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 Needle and thread/Blue Grama/Prairie Sandreed/Bluegrass Plant Community Phase.

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.

State 3
Invaded

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass and smooth bromegrass, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant introduced grass species. The nutrient cycle is also impaired, and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Once the state is well established, even drastic events such as high intensity fires driven by high fuel loads of litter and thatch will not result in more than a very short term reduction of Kentucky bluegrass. These events may reduce the dominance of Kentucky bluegrass, but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish and dominate before Kentucky bluegrass rebounds and again dominates the system.

Dominant plant species

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

Community 3.1
Smooth Brome/Kentucky Bluegrass/Needlegrass

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.

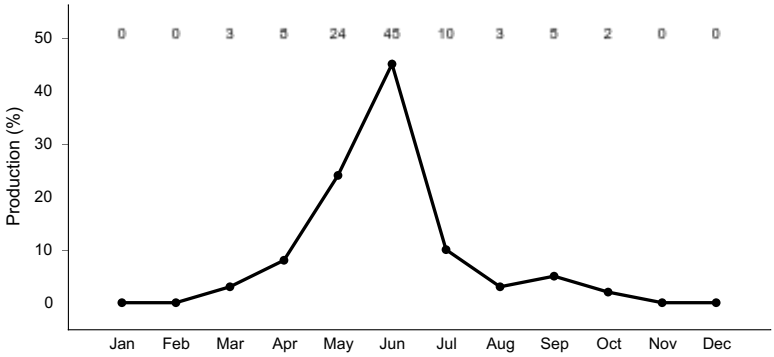


Figure 13. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Kentucky Bluegrass/Blue Grama

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass, 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.

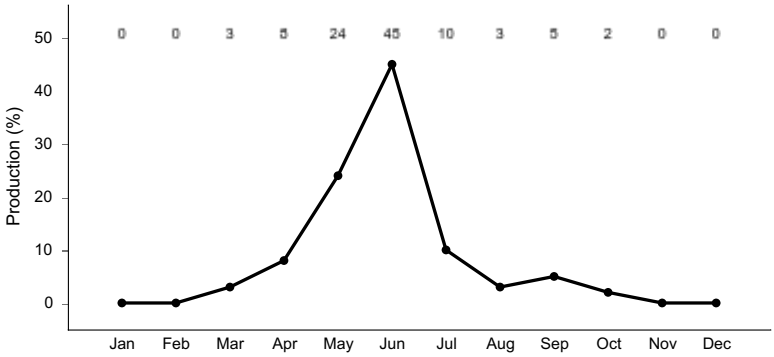


Figure 14. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.3
Annual/Pioneer Perennial

It is most commonly associated with the cessation of cropping without the benefit of range planting, resulting in a “go-back” situation. Soil conditions can be quite variable on the site, in part due to variations in the management/cropping history (e.g. development of tillage induced compaction, erosion, fertility, herbicide/pesticide carryover). Thus, soil conditions should be assessed when considering restoration techniques. The species present in this phase are highly variable, but often include non-native invasive and/or early seral species. Plant diversity is low (plant richness may be high, but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites.

Pathway 3.1a
Community 3.1 to 3.2

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 3.2 Kentucky Bluegrass/Blue Grama Plant Community Phase.

Pathway 3.3a
Community 3.3 to 3.2

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 2.1 Foxtail Barley/Inland Saltgrass, *Bare Ground* Plant Community Phase.

State 4
Cropland

This State is results from annual cropping.

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 T1b
State 1 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Transition T2a/T2B
State 2 to 3

Transition T2a from Native/Invaded State (State 2) to the Invaded State (State 3) Complete rest from grazing and elimination of fire are the two major contributors to this transition. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early green-up and increased moisture and humidity at the soil surface and grazing pressure cannot cause a reduction in sodgrass dominance. Production is limited to the sod forming species. Infiltration continues to decrease and runoff increases; energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by root depth of the dominant species. This transition typically leads to the 3.1 Smooth Brome/Kentucky Bluegrass/Needlegrass Plant Community Phase. Transition T2b from Native/Invaded State (State 2) to the Invaded State (State 3) This represents the transition from the more native dominated Native/Invaded State to a plant community phase dominated by a 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 3.2 Kentucky Bluegrass/Blue Grama Plant Community Phase.

Transition T2c

State 2 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Restoration pathway R3a/R3b
State 3 to 2

R3a - Restoration along this pathway may be possible with the combination of prescribed burning and long-term prescribed grazing if sufficient native species remnants are present on the site. R3b - Restoration may also be possible using selected plant materials and agronomic practices to approach something very near the functioning of the Invaded State (State 2). Application of chemical herbicides and the use of mechanical seeding methods using adapted varieties of the dominant native grasses are possible and can be successful. After establishment of the native grasses, management objectives must include the maintenance of those species, the associated reference function and continued treatment of the introduced grasses.

Transition T3a
State 3 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Restoration pathway T4a
State 4 to 3

This is the Transition from any plant community to State 3 Invaded State. It is most commonly associated with the cessation of cropping without the benefit of range planting, resulting in a “go-back” situation. Soil conditions can be quite variable on the site, in part due to variations in the management/cropping history (e.g. development of tillage induced compaction, erosion, fertility, herbicide/pesticide carryover). Thus, soil conditions should be assessed when considering restoration techniques.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			269–538	
	western wheatgrass	PASM	*Pascopyrum smithii*	269–538	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	54–269	–
2	**Tall Warm-season Grasses**			269–538	
	big bluestem	ANGE	*Andropogon gerardii*	135–538	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	135–538	–
3	**Needlegrass**			269–538	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	135–404	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	135–404	–
	green needlegrass	NAVI4	*Nassella viridula*	0–135	–
4	**Short Warm-season Grasses**			54–269	
	blue grama	BOGR2	*Bouteloua gracilis*	54–269	–
	threeawn	ARIST	*Aristida*	0–81	–
	saltgrass	DISP	*Distichlis spicata*	0–27	–
5	**Other Native Grasses**			135–269	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	27–135	–
	little bluestem	SCSC	*Schizachyrium scoparium*	27–135	

	little bluestem	SCSC	*Schizachyrium scoparium*	27–135	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	27–81	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	27–54	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–27	–
6	**Grass-likes**			27–135	
	threadleaf sedge	CAFI	*Carex filifolia*	27–135	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–81	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–54	–
Forb					
7	**Forbs**			135–269	
	Forb, native	2FN	*Forb, native*	27–81	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	27–54	–
	field sagewort	ARCA12	*Artemisia campestris*	0–54	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	27–54	–
	prairie clover	DALEA	*Dalea*	27–54	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	27–54	–
	dotted blazing star	LIPU	*Liatris punctata*	27–54	–
	soft-hair marbleseed	ONBEB	*Onosmodium bejariense var. bejariense*	0–54	–
	scurfpea	PSORA2	*Psoralidium*	27–54	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	27–54	–
	goldenrod	SOLID	*Solidago*	27–54	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	27–54	–
	white heath aster	SYER	*Symphyotrichum ericoides*	27–54	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	27–54	–
	beardtongue	PENST	*Penstemon*	27–54	–
	spiny phlox	PHHO	*Phlox hoodii*	0–27	–
	American vetch	VIAM	*Vicia americana*	0–27	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–27	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–27	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–27	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–27	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–27	–
	milkvetch	ASTRA	*Astragalus*	0–27	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–27	–
Shrub/Vine					
8	**Shrubs**			27–135	
	leadplant	AMCA6	*Amorpha canescens*	27–81	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	27–81	–
	prairie sagewort	ARFR4	*Artemisia frigida*	27–54	–
	prairie rose	ROAR3	*Rosa arkansana*	27–54	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–54	–

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.

MMLRA 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:**