USDA Natural Resources Conservation Service

Ecological site R055DY041SD
Choppy Sands

Last updated: 2/23/2024
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 Choppy Sands ecological site is located on sandy uplands – delta plains, lake plains, outwash plains, and sand-mantled moraines – which have been reworked by wind into dunes. The soils are very deep. The thickness of the topsoil is generally <5 inches; but it may be as thick as 9 inches. The surface layer is loamy fine sand or fine sand. The rest of the soil profile to depth >40 inches is typically fine sand. Soil on this site is excessively drained. The slopes of the dunes are highly variable; the slope range of the Choppy Sands site is typically 15 to 35 percent but slopes >35% may be included in some areas. On the landscape, this site is above the Subirrigated, Subirrigated Sands, and Wet Meadow ecological sites (all three sites occur in blow-out areas). The Sands site occurs on adjacent, less sloping (<15 percent), wind-worked areas and on more stable sandy landscapes.

Associated sites

R055DY008SD	**Sands** This site occurs on more stable sand plains and on less sloping areas (<15% slope) of wind-worked sand plains. It is sand or loamy sand (fine to coarse sands) within a depth of 10 inches. The subsoil does not form a ribbon.
R055DY003SD	**Subirrigated** This site occurs in swales and blow-outs. It has redoximorphic features at a depth of 18 to 30 inches.
R055DY004SD	**Wet Meadow** This site is in the bottom of some blowouts. It is poorly drained - a seasonal high water table is typically within a depth of 1.5 feet during the months of April through June; it may pond due to frozen ground in early spring. It has redoximorphic features within a depth of 18 inches. On this landscape, the site is non-saline.
R055DY044SD	**Subirrigated Sands** This site occurs on concave areas of flats and in shallow depressions with occasional, brief ponding. It has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.

Similar sites

R055DY008SD	**Sands** This site occurs on more stable sand plains and on less sloping areas (<15% slope) of wind-worked sand plains. It is sand or loamy sand (fine to coarse sands) within a depth of 10 inches. The subsoil does not form a ribbon.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon hallii* (2) *Calamovilfa longifolia*

Physiographic features

This site occurs on sandy uplands – delta plains, lake plains, outwash plains, and sand-mantled moraines – which have been reworked by wind into dunes. Slope ranges from 6 to 35 percent.

Table 2. Representative physiographic features

Landforms	(1) Ridge
Runoff class	Very low to low
Flooding frequency	None
Ponding frequency	None
Elevation	299–649 m
Slope	6–35%
Ponding depth	0 cm
Water table depth	203 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

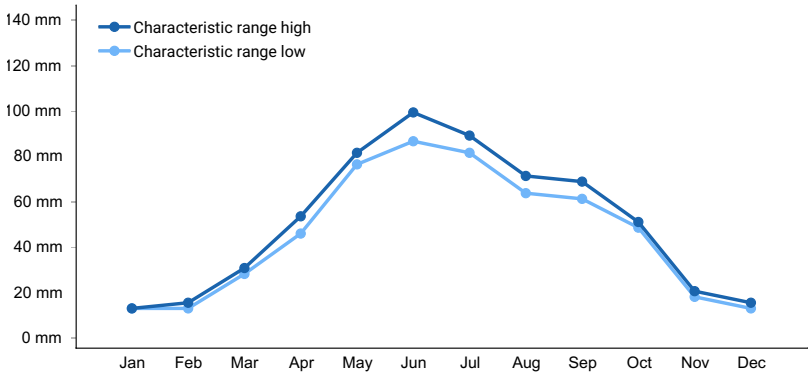


Figure 1. Monthly precipitation range

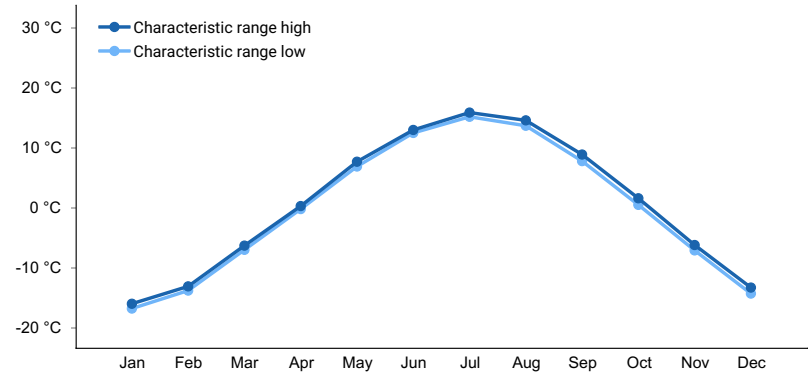


Figure 2. Monthly minimum temperature range

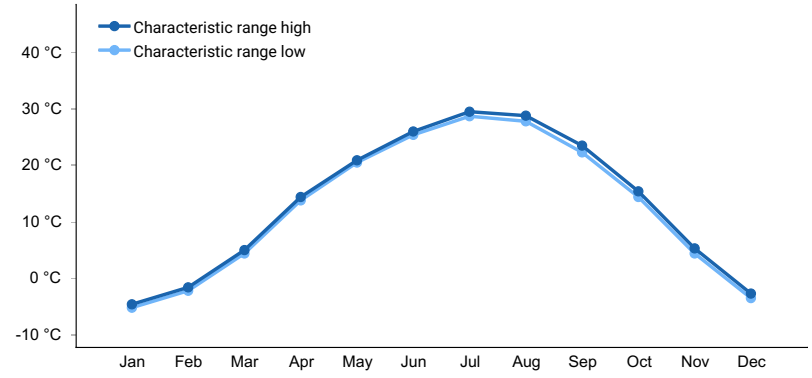


Figure 3. Monthly maximum temperature range

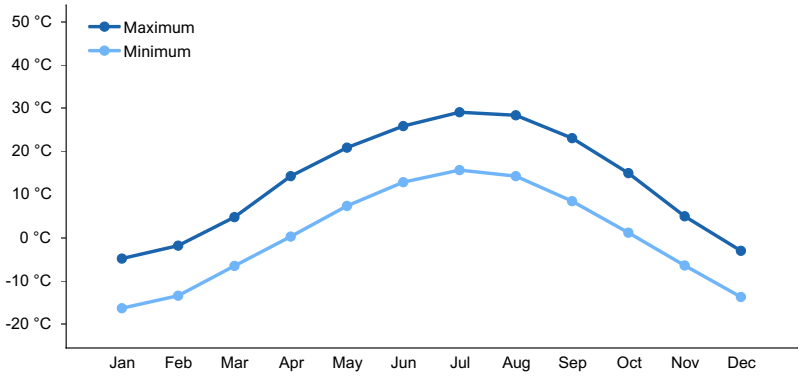


Figure 4. Monthly average minimum and maximum temperature

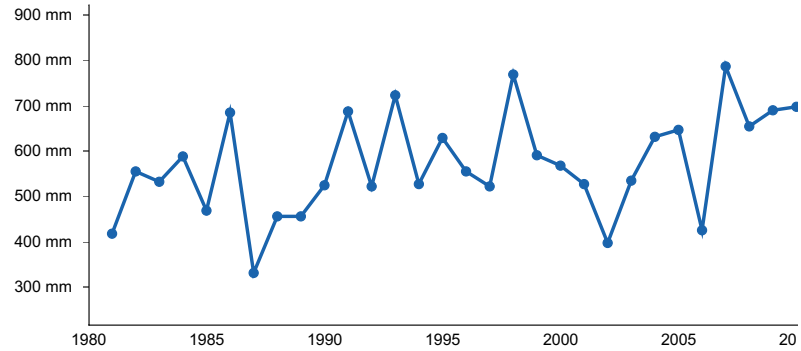


Figure 5. Annual precipitation pattern

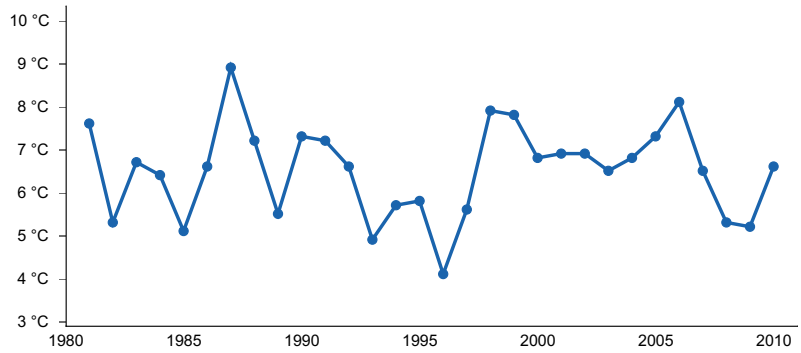


Figure 6. Annual average temperature pattern

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 additional water, either as runoff from adjacent slopes or from a seasonal high water table. Depth to the water table is deeper than 6 feet throughout the growing season. Surface infiltration is rapid. Saturated hydraulic conductivity through the profile is high. Water loss on this site occurs through percolation below the root zone and through evapotranspiration.

Wetland description

Not Applicable.

Soil features

Soils associated are in the Entisol order; they are classified further as Typic Udipsamments. These soils were developed under prairie vegetation. They formed in eolian sands. These soils are very deep and excessively drained. The common features of soils in this site are the coarse textures throughout and the wind-blown landform with dominant slopes exceeding 15 percent. The surface layer is loamy fine sand or fine sand; it generally is <5 inches thick; but it may be as thick as 9 inches. The rest of the soil profile is typically fine sand.

Salinity and sodicity are typically none throughout the soil profile. Soil reaction ranges from slightly acid to slightly alkaline. Calcium carbonate content is none or very low.

It is not uncommon to have pedestaling of plants due to the inherent instability of the soils. Water flow paths are broken, irregular in appearance or discontinuous. There is a risk of rills and eventually gullies if vegetative cover is not adequate. Wind erosion is the greatest risk. Loss of the thin soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to the Choppy Sands site are Serden.

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) Eolian sands
Surface texture	(1) Fine sand (2) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid
Depth to restrictive layer	203 cm
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	5.59–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0–3%
Soil reaction (1:1 water) (0-101.6cm)	6.6–7.8
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 influences 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 Reference State. 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 frequent 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.

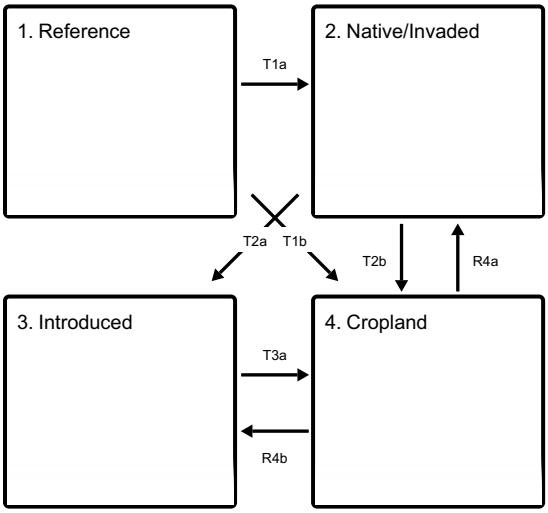
This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence, causes this site to depart from the reference plant community. Species such as needle and thread, blue grama and threadleaf sedge will initially increase. Species such as sand bluestem and prairie sandreed decrease in frequency and production. In time, heavy continuous grazing will likely cause blue grama, sand dropseed, and threadleaf sedge to dominate and other pioneer perennials and annuals to increase. The decrease in surface cover will elevate soil surface temperatures and evapotranspiration rates will increase.

Heavy disturbance through improper grazing, wildfire, excessive defoliation, or any type of physical disturbance (i.e. off-road vehicle) can lead to serious erosion problems (blowout) on these fragile soils. Extended periods of non-use and/or lack of fire will result in a plant community having litter levels higher than expected for the site. This will favor an increase in Kentucky bluegrass and/or smooth bromegrass as well as shrubs species such as western snowberry. Remnant native plants may be present but are reduced in vigor.

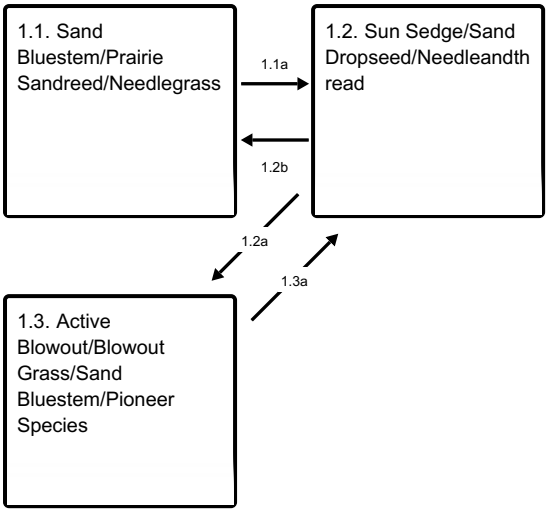
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best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

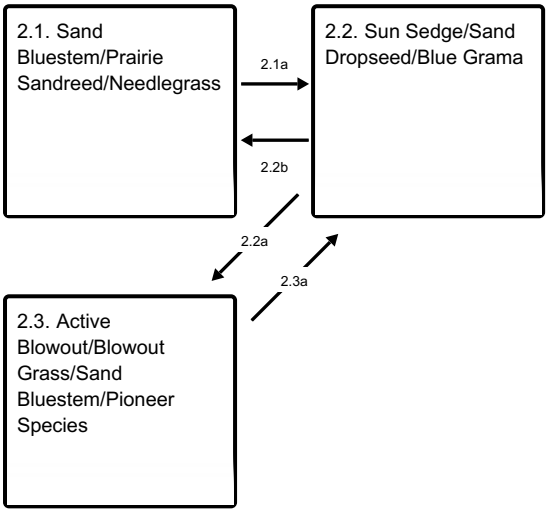
Ecosystem states



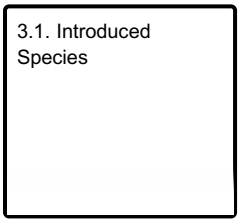
State 1 submodel, plant communities



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 dominated by warm- and cool-season grasses. The primary disturbance mechanisms for this site in the reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Mid and tall stature grass species can decline and a corresponding increase in short stature warm-season grasses and cool-season grass-like species will occur. Slight shifts would have occurred in the timing of energy capture, hydrologic function and nutrient cycling between plant community phases 1.1 and 1.2 within State 1. Hydrologic function, energy capture and nutrient cycling would have been reduced in community phase 1.3 but would not have departed beyond the point of recovery.

Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub

- sand bluestem (*Andropogon hallii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- needle and thread (*Hesperostipa comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- blue grama (*Bouteloua gracilis*), grass
- longbract spiderwort (*Tradescantia bracteata*), other herbaceous
- field sagewort (*Artemisia campestris*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- blazing star (*Liatris*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous

Community 1.1
Sand Bluestem/Prairie Sandreed/Needlegrass

This community phase was the most dominant both temporally and spatially. The prevailing climate and weather patterns favored the development of this community phase. Tall statured warm-season grasses such as sand bluestem and prairie sandreed would have been co-dominant with mid statured cool-season bunchgrass such as needleandthread and porcupine grass. Other grasses and grass-likes species would have included little bluestem, Canada wildrye, sand dropseed, prairie Junegrass, blue grama, and sedge. A variety of leguminous and non-leguminous perennial forbs including bracted spiderwort, dotted gayfeather, goldenrod, green sagewort, hairy goldaster, silky purple prairie clover and sunflower were present. Shrubs included fringed sagewort, leadplant and rose. In this community phase, grasses and grass-likes would have constituted about 85 to 95 percent, forbs 5 to 10 percent and shrub 1 to 5 percent of the annual production. This represents the plant community phase upon which interpretations are primarily based and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. Community dynamics, nutrient cycling, water cycle and energy flow were functioning at near optimum levels. A good component of bunchgrasses, minimal bare ground, litter in contact with the soil surface, soil texture and deep rooted plants would have resulted in high infiltration rates and minimal runoff. Due to the balance between warm and cool season grasses, energy capture would have been spread across the entire growing season. Natural plan mortality was low. The diversity in plant species allowed for high drought tolerance.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1457	2001	2544
Shrub/Vine	112	177	241
Forb	112	177	241
Total	**1681**	**2355**	**3026**

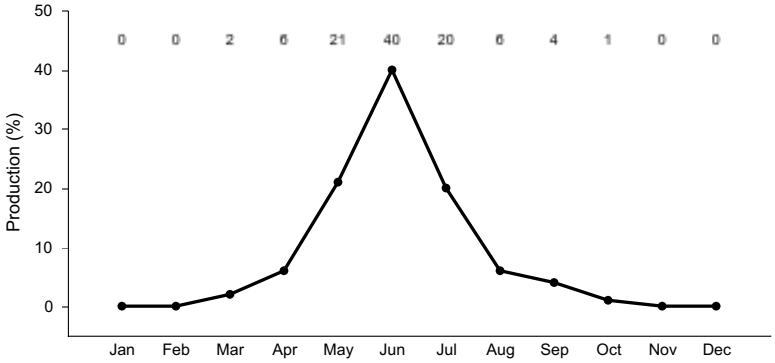


Figure 8. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 1.2
Sun Sedge/Sand Dropseed/Needleandthread

This plant community shift results from heavy, frequent grazing over a period of several years and/or several consecutive years of below normal precipitation. This increase in grazing pressure may have resulted from proximity to a water source, changes in fire frequency and/or prolonged drought. Grasses and grass-like species would have still dominated this phase but the overall productivity of these species would have been reduced and the number and amount of forbs would have increased. Needleandthread would have displaced porcupine grass to become the dominate needlegrass while blue grama, sand dropseed and sedges would have also increased. Prairie sandreed and the bluestems would have decreased but still have been present. Forb species such as green sagewort, goldenrod, western ragweed, western yarrow and prairie coneflower would have increased. The shift to the shallower rooted, short statured blue grama and sedges coupled with an increase in bare ground results in higher soil surface temperatures as compared to plant community phase 1.1. Due to soil texture, infiltration rates would have been similar to community phase 1.1. While the timing of energy capture would have remained similar to that of plant community phase 1.1, total energy capture may have been slightly reduced due to a decrease in overall leaf area.

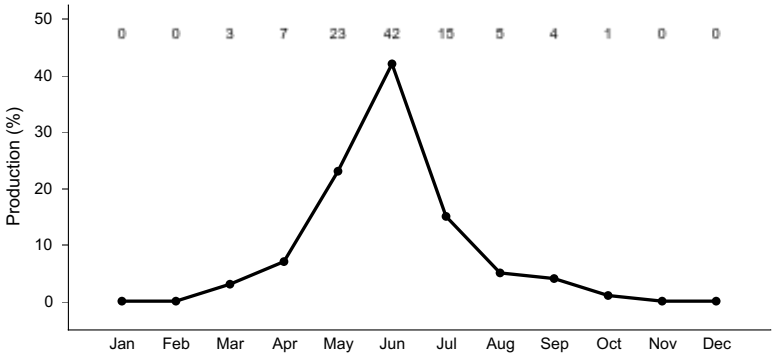


Figure 9. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 1.3
Active Blowout/Blowout Grass/Sand Bluestem/Pioneer Species

This plant community phase was not stable. It consisted of bare areas that were continually eroded by wind. Vegetation was spare and scattered. Patches of sand bluestem would have been scattered across the site with blowout grass and other pioneer perennial and annual species comprising the majority of the vegetation. Bare ground was common and with active wind erosion very evident. Soil deposition on leeward side of blowouts was common.

Pathway 1.1a
Community 1.1 to 1.2

Repeated heavy grazing either due to proximity to water or following short term fire intervals followed by intense grazing will reduce the dominance of tall warm-season grasses and shift the competitive advantage to the more grazing tolerant mid statured cool-season bunchgrasses such as needleandthread and sand dropseed and short statured grass-likes and warm-season short statured grasses like blue grama. This shift may have been facilitated by periods of below normal precipitation.

Pathway 1.2b
Community 1.2 to 1.1

A return to normal precipitation patterns, grazing and fire regime allows for recovery of tall statured warm-season species and mid statured cool-season porcupine grass.

Pathway 1.2a

Community 1.2 to 1.3

Excessive disturbances such as heavy grazing due to proximity to a perennial water source and/or prolonged drought would have significantly reduced perennial plant cover, reduced soil surface cover and increased basal gap distance. This, coupled with the repeated disturbances, would have increased the amount of soil erosion due to wind resulting in a “blowout” condition.

Pathway 1.3a
Community 1.3 to 1.2

Several years of above normal precipitation and a reduction or elimination of the grazing disturbance would have allowed the sand bluestem, blowout grass and pioneer annuals and perennials to increase in number and extent. This additional cover would begin to alter the wind patterns at the soil surface and the site/community would shift toward community phase 1.2.

State 2
Native/Invaded

This state is similar to the reference state in appearance and function. The invasion of introduced cool-season sodgrasses has altered the natural range of variability for this ecological site. This state still has a strong component of warm and cool season grass species, but invasive introduced cool-season sodgrasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include grazing by domestic livestock and infrequent fires.

Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub
- sand bluestem (*Andropogon hallii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- needle and thread (*Hesperostipa comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- longbract spiderwort (*Tradescantia bracteata*), other herbaceous
- field sagewort (*Artemisia campestris*), other herbaceous
- blazing star (*Liatris*), other herbaceous
- goldenrod (*Solidago*), other herbaceous

Community 2.1
Sand Bluestem/Prairie Sandreed/Needlegrass

This community phase most closely resembles plant phase 1.1 in appearance and ecological function (e.g., hydrologic, biotic and soil/site stability). This community is maintained with grazing systems that allow for adequate recovery periods following grazing events, and potentially the combination of grazing and prescribed burning which closely mimics the natural disturbance regime. Tall statured warm-season grasses such as sand bluestem and prairie sandreed are co-dominant with mid statured cool-season bunchgrass such as needleandthread and porcupine grass. Other grasses and grass-likes species include little bluestem, Canada wildrye, sand dropseed, prairie Junegrass, blue grama, and sedge. Trace amounts of Kentucky bluegrass and/or smooth bromegrass are also present. A variety of leguminous and non-leguminous perennial forbs including bracted spiderwort, dotted gayfeather, goldenrod, green sagewort, hairy goldaster, silky purple prairie clover and sunflower are present. Shrubs include fringed sagewort, leadplant and rose. In this community phase, grasses and grass-likes constitute about 85 to 95 percent, forbs 5 to 10 percent and shrub 1 to 5 percent of the annual production. The basic difference between this community phase and 1.1 of the Reference State is the presence of minor amounts of introduced cool-season grasses and forbs. The ecological processes are functioning at levels very close to those of plant community phase 1.1. Slight departure may be noted within the functional/structural indicator due to the presence of a functional/structural group(s) not expected for the site.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1457	2001	2544
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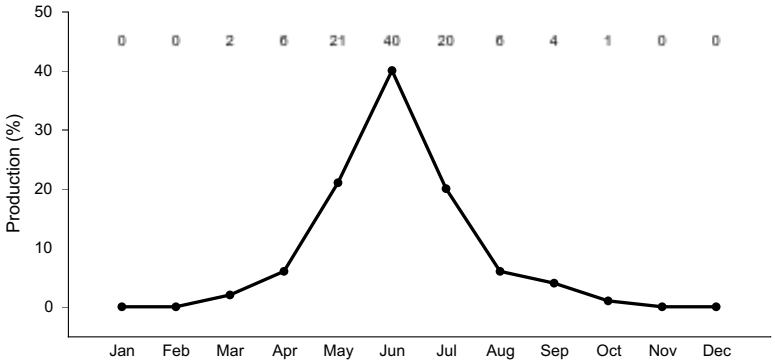

Figure 11. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 2.2
Sun Sedge/Sand Dropseed/Blue Grama

Grasses and grass-like species still dominate this phase but the overall productivity of these species is reduced and the number and amount of forbs has increased. Prairie sandreed, sand bluestem and porcupine grass decrease but are still present. Short statured grasses and grass-likes as well as sand dropseed and Kentucky bluegrass increase in amount and extent. Forbs such as green sagewort, goldenrod, western ragweed, western yarrow and prairie coneflower also increase. The shift to the shallower rooted, short statured blue grama and sedges coupled with an increase in bare ground results in higher soil surface temperatures as compared to plant community phase 1.1. Due to soil texture, infiltration rates would be similar to community phase 1.1. While the timing of energy capture would remain similar to that of plant community phase 1.1, total energy capture is slightly reduced due to a decrease in overall leaf area.

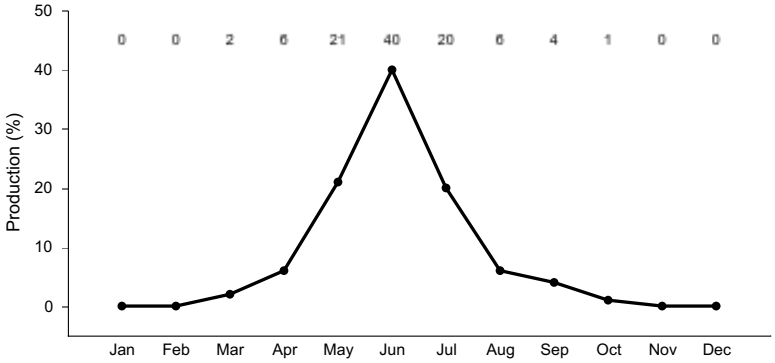

Figure 12. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Community 2.3
Active Blowout/Blowout Grass/Sand Bluestem/Pioneer Species

This plant community phase is not stable. It consists of bare areas that were continually eroded by wind. Vegetation is spare and scattered. Patches of sand bluestem may be scattered across the site with blowout grass and other pioneer perennial and annual species like sandbur comprising the majority of the vegetation. Bare ground is common and with active wind erosion very evident. Soil deposition on leeward side of blowouts is common.

Pathway 2.1a
Community 2.1 to 2.2

Heavy continuous grazing or heavy late seasonal grazing will shift the competitive advantage away from the tall warm-season rhizomatous grasses and mid statured cool-season bunchgrasses to more grazing tolerant short statured grasses and grass-likes. Periods of below normal precipitation will intensify the impact of the grazing and further facilitate this transition. Prolonged periods of drought would also result in this shift, with or without the grazing pressure.

Pathway 2.2b
Community 2.2 to 2.1

This community pathway is initiated by implementation of prescribed grazing management which includes adequate recovery periods following each grazing event, and stocking levels which match the available resources. If properly implemented, this will shift the competitive advantage away from the introduced cool-season species and back to the tall statured warm-season rhizomatous grasses mid statured porcupine grass. The addition of properly timed prescribed burning may expedite this shift.

Pathway 2.2a
Community 2.2 to 2.3

Excessive disturbances such as heavy grazing due to proximity to a perennial water source or off road vehicle use and/or prolonged drought would significantly reduce perennial plant cover, reduce soil surface cover and increase basal gap distance. This, coupled with the repeated disturbances, increases the amount of soil erosion due to wind resulting in a “blowout” condition.

Pathway 2.3a
Community 2.3 to 2.2

Implementation of prescribed grazing management which includes adequate recovery periods following each grazing event, and stocking levels which match the available resources will allow the remaining vegetation to re-colonize and stabilize the site. Depending upon the level of grazing management, complete deferment of the site for a couple of growing seasons may be necessary to speed the transition. Variation in seasonal precipitation may speed or delay recovery.

State 3
Introduced

This state is the result of invasion and dominance of Kentucky bluegrass and/or other non-native grasses and forbs. 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 the non-native species. These events may reduce the dominance of the sodgrasses, but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish and dominate before the sodgrasses rebound and again dominate the system.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass

Community 3.1
Introduced Species

Although remnant populations of native grasses such as prairie junegrass and forbs such as green sagewort still occupy this plant community phase, it is dominated by non-native species, primarily Kentucky bluegrass. The impact of transition from a diverse native plant community to an introduced cool-season rhizomatous dominated community is a reduction in infiltration, and shift to an early to mid spring energy capture timeframe and a reduction in nutrient cycling. Due to soil texture and the droughty nature of the soils, this site is not as prone to the formation of a tight Kentucky bluegrass sod like more productive sites. However, once established, this plant community phase is very resistant to change and resilient to disturbances. Since Kentucky bluegrass is not a very drought

tolerant species, periods of long term severe drought may result in this community shifting to something resembling plant community phase 2.3. However, once normal moisture patterns are restored, the resilient Kentucky bluegrass will recover and once again, dominate the site.

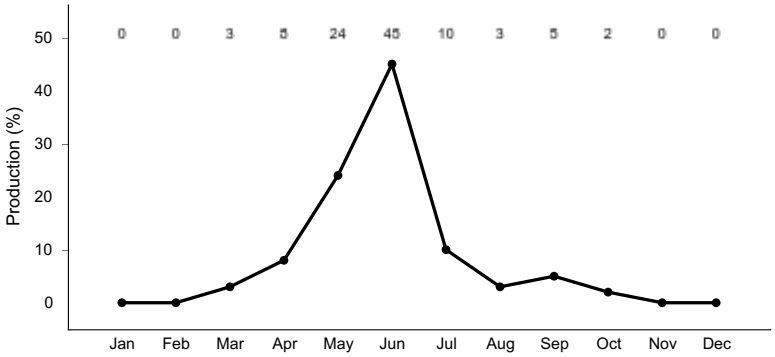

Figure 13. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

State 4
Cropland

This state is the result of annual cropping.

Transition T1a
State 1 to 2

This is the transition from the native 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 warm season rhizomatous grasses and cool season bunch grasses and an increase in cool-season sodgrasses. This transition is compounded by a change in the historic grazing and fire regime where native herbivores would follow periodic fires with grazing. This historic grazing/fire sequence has largely been replaced chronic season-long or heavy late season grazing. Complete rest from grazing and suppression of fire can also lead to this transition. The threshold between states is crossed when Kentucky bluegrass, smooth brome, and other introduced species become established on the site. These species typically are part of functional/structural groups that were not present in the Reference State.

Transition T1b
State 1 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Transition T2a
State 2 to 3

Complete rest from grazing and elimination of fire are the two major contributors to this transition, especially when Kentucky bluegrass is present. Plant litter accumulation at the base of the native plants reduces vigor of the warm season species and shifts the competitive advantage to the more shade tolerant introduced grass species. Studies indicate that soil biological activity is altered; this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in sodgrass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition.

Transition T2b
State 2 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Transition T3a
State 3 to 4

Removal of vegetative cover and tilling for agricultural crop production.

Restoration pathway R4a
State 4 to 2

It may be possible using selected native plant materials and agronomic practices to approach something very near the functioning of the Native/Invaded State (State 2). Application of chemical herbicides and the use of mechanical seeding methods using adapted varieties of the dominant native grasses are possible and can be successful. After establishment of the native grasses, management objectives must include the maintenance of those species, the associated reference state functions, and continued treatment of the introduced sodgrasses. Application of long termed prescribed grazing and prescribed burning may be the most effective management strategies for maintaining the site in State 2.

Restoration pathway R4b
State 4 to 3

It may be possible using selected introduced and/or plant materials and agronomic practices to approach something very near the functioning of the Native/Invaded State (State 2). Application of chemical herbicides and the use of mechanical seeding methods using adapted varieties of the dominant native grasses are possible and can be successful. After establishment, management objectives must include the maintenance of the established species, the associated reference state functions, and continued treatment to maintain the vigor of the stand. Application of long termed prescribed grazing and prescribed burning may be the most effective management strategies for maintaining the site in State 2.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-season Grasses**			353–588	
	sand bluestem	ANHA	*Andropogon hallii*	353–471	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	235–353	–
2	**Cool-season Bunchgrasses**			118–353	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	235–353	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	24–71	–
	Canada wildrye	ELCA4	*Elymus canadensis*	24–47	–
3	**Mid Warm-season Grasses**			235–353	
	little bluestem	SCSC	*Schizachyrium scoparium*	118–235	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	24–118	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	47–118	–
4	**Short Warm-season Grasses**			24–118	
	blue grama	BOGR2	*Bouteloua gracilis*	47–118	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–71	–
5	**Other Native Grasses**			24–118	
	Grass, native	2GN	*Grass, native*	47–118	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	24–71	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	24–47	–

			scribnerianum		
6	**Grass-likes**			118–235	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	24–118	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	47–118	–
	Schweinitz's flatsedge	CYSC3	*Cyperus schweinitzii*	0–24	–
Forb					
7	**Forbs**			118–235	
	longbract spiderwort	TRBR	*Tradescantia bracteata*	24–71	–
	field sagewort	ARCA12	*Artemisia campestris*	24–71	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–71	–
	Forb, perennial	2FP	*Forb, perennial*	24–71	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	24–47	–
	goldenrod	SOLID	*Solidago*	0–47	–
	blazing star	LIATR	*Liatris*	24–47	–
	silky prairie clover	DAVI	*Dalea villosa*	24–47	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	24–47	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	24–47	–
	flat-top goldentop	EUGR5	*Euthamia graminifolia*	0–47	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	24–47	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	24–47	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–24	–
	milkweed	ASCLE	*Asclepias*	0–24	–
	spotted sandmat	CHMA15	*Chamaesyce maculata*	0–24	–
	thymeleaf sandmat	CHSES	*Chamaesyce serpyllifolia ssp. serpyllifolia*	0–24	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–24	–
	narrowleaf stoneseed	LIIN2	*Lithospermum incisum*	0–24	–
	Lewis flax	LILE3	*Linum lewisii*	0–24	–
	onion	ALLIU	*Allium*	0–24	–
Shrub/Vine					
8	**Shrubs**			118–235	
	leadplant	AMCA6	*Amorpha canescens*	24–47	–
	prairie sagewort	ARFR4	*Artemisia frigida*	24–47	–
	hawthorn	CRATA	*Crataegus*	0–24	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–24	–
	chokecherry	PRVI	*Prunus virginiana*	0–24	–
	sumac	RHUS	*Rhus*	0–24	–
	currant	RIBES	*Ribes*	0–24	–
	rose	ROSA5	*Rosa*	0–24	–
	blackberry	RUBUS	*Rubus*	0–24	–
	prairie willow	SAHU2	*Salix humilis*	0–24	–
	snowberry	SYMPH	*Symphoricarpos*	0–24	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–24	–
	common pricklyash	ZAAM	*Zanthoxylum americanum*	0–24	–

	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–24	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–24	–

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-season Grasses**			353–588	
	sand bluestem	ANHA	*Andropogon hallii*	353–471	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	235–353	–
2	**Cool-season Bunchgrasses**			118–353	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	235–353	–
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3	**Mid Warm-season Grasses**			235–353	
	little bluestem	SCSC	*Schizachyrium scoparium*	118–235	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	24–118	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	47–118	–
4	**Short Warm-season Grasses**			24–118	
	blue grama	BOGR2	*Bouteloua gracilis*	47–118	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–71	–
5	**Other Native Grasses**			24–118	
	Grass, native	2GN	*Grass, native*	47–118	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	24–71	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	24–47	–
6	**Grass-likes**			118–235	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	24–118	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	47–118	–
	Schweinitz's flatsedge	CYSC3	*Cyperus schweinitzii*	0–24	–
7	**Non-Native Grasses**			24–71	
	Kentucky bluegrass	POPR	*Poa pratensis*	24–47	–
	Grass, perennial	2GP	*Grass, perennial*	0–24	–
Forb					
8	**Forbs**			118–235	
	longbract spiderwort	TRBR	*Tradescantia bracteata*	24–71	–
	field sagewort	ARCA12	*Artemisia campestris*	24–71	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–71	–
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	silky prairie clover	DAVI	*Dalea villosa*	24–47	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	24–47	–

	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	24–47	–
	flat-top goldentop	EUGR5	*Euthamia graminifolia*	0–47	–
	common sunflower	HEAN3	*Helianthus annuus*	0–47	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	24–47	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	24–47	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–24	–
	milkweed	ASCLE	*Asclepias*	0–24	–
	spotted sandmat	CHMA15	*Chamaesyce maculata*	0–24	–
	thymeleaf sandmat	CHSES	*Chamaesyce serpyllifolia ssp. serpyllifolia*	0–24	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–24	–
	narrowleaf stoneseed	LIIN2	*Lithospermum incisum*	0–24	–
	Lewis flax	LILE3	*Linum lewisii*	0–24	–
	onion	ALLIU	*Allium*	0–24	–
Shrub/Vine					
9	**Shrubs**			118–235	
	leadplant	AMCA6	*Amorpha canescens*	24–47	–
	prairie sagewort	ARFR4	*Artemisia frigida*	24–47	–
	hawthorn	CRATA	*Crataegus*	0–24	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–24	–
	chokecherry	PRVI	*Prunus virginiana*	0–24	–
	sumac	RHUS	*Rhus*	0–24	–
	currant	RIBES	*Ribes*	0–24	–
	rose	ROSA5	*Rosa*	0–24	–
	blackberry	RUBUS	*Rubus*	0–24	–
	prairie willow	SAHU2	*Salix humilis*	0–24	–
	snowberry	SYMPH	*Symphoricarpos*	0–24	–
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	common pricklyash	ZAAM	*Zanthoxylum americanum*	0–24	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–24	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–24	–

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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Contributors

Stan Boltz, NRCS Range Management Specialist
David Dewald, NRCS State Biologist
Jody Forman, NRCS Range Management Specialist
Jeff Printz, NRCS State Range Management Specialist
Kevin Sedivec, Extension Rangeland Management Specialist
Shawn Dekeyser, North Dakota State University
Rob Self, The Nature Conservancy
Lee Voigt, NRCS Range Management Specialist
Ezra Hoffman, Ecological Site Specialist, NRCS

Approval

Suzanne Mayne-Kinney, 2/23/2024

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	11/21/2024
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:**