Ecological site R055DY009SD
Sandy

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 ecological is typically located on glaciated uplands – lake plains and outwash plains and on till plains and lake plains mantled with moderately coarse-textured, eolian deposits. It is on flats, rises, and hills. Included in the site are coarse-loamy stream terraces with rare or occasional, brief flooding. The soils are very deep. The dark-colored surface soil is more than 7 inches thick. Surface and subsoil textures (to depth of more than 20 inches) typically are fine sandy loam to sandy loam; but a loam surface layer is allowable if <10 inches thick. The subsoil forms a ribbon <1 inch long. Some soils have loamy till, silty lake sediments, or sandy outwash at a depth below 20 inches. Soil on this site is moderately well drained to somewhat excessively drained. Slopes range from 0 to 6 percent. On the landscape, this site is above the Claypan, Limy Subirrigated, Loamy Overflow, and Subirrigated ecological sites and below the Thin Loamy site. The Loamy ecological site occurs on similar landscape positions; it

has loam to silty clay loam textures throughout the surface and subsoil layers.

Associated sites

R055DY020SD	**Loamy Overflow** This site occurs in upland swales and base slopes – run-on landscape positions. The surface and subsoil layers form a ribbon 1 to 2 inches long.
R055DY010SD	**Loamy** This site occurs on similar landscape positions. The surface and subsoil layers to a depth >20 inches form a ribbon 1 to 2 inches long.
R055DY013SD	**Claypan** This site occurs lower on the landscape or in micro-lows. It has a dense, root-restrictive upper subsoil which forms a ribbon >1 inch long. Commonly, visible salts occur below a depth of 16 inches.
R055DY006SD	**Limy Subirrigated** This site occurs lower of the landscape. The soil is highly calcareous in the upper part of the subsoil and has redoximorphic features at a depth of 18 to 30 inches. All textures are included in this site.
R055DY003SD	**Subirrigated** This site occurs on concave flats and in shallow depressions which have occasional, brief ponding early in the growing season. It has redoximorphic features at a depth of 18 to 30 inches. It is >16 inches to a highly calcareous subsoil. All textures are included in this site.
R055DY012SD	**Thin Upland** This site occurs on higher, convex slopes on till plains and lake plains – a run-off landscape position. The surface and subsoil layers form a ribbon 1 to 2 inches long. It is highly calcareous (strong or violent effervescence) within a depth of 8 inches.

Similar sites

R055DY010SD	**Loamy** This site typically occurs on linear slopes on till plains and lake plains on run-off landscape positions; it also occurs on high terraces which are no longer impacted by flooding. The surface and subsoil layers form a ribbon 1 to 2 inches long.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Calamovilfa longifolia* (2) *Hesperostipa comata*

Physiographic features

This site typically occurs on glaciated uplands – lake plains and outwash plains and on till plains and lake plains mantled with moderately coarse-textured, eolian deposits. It is on flats, rises, and hills. A few areas occur on coarse-loamy stream terraces with rare or occasional, brief flooding. Slope ranges from 0 to 6 percent.

Table 2. Representative physiographic features

Landforms	(1) Lake plain (2) Till plain (3) Outwash plain (4) Stream terrace
Runoff class	Very low to medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None

Elevation	299–649 m
Slope	0–6%
Ponding depth	0 cm
Water table depth	102–165 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

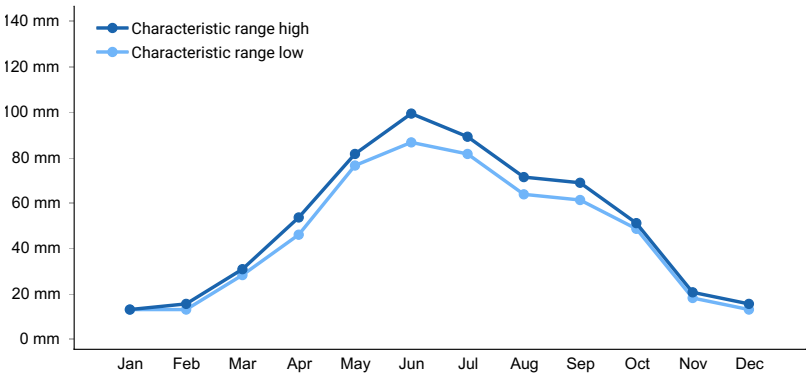


Figure 1. Monthly precipitation range

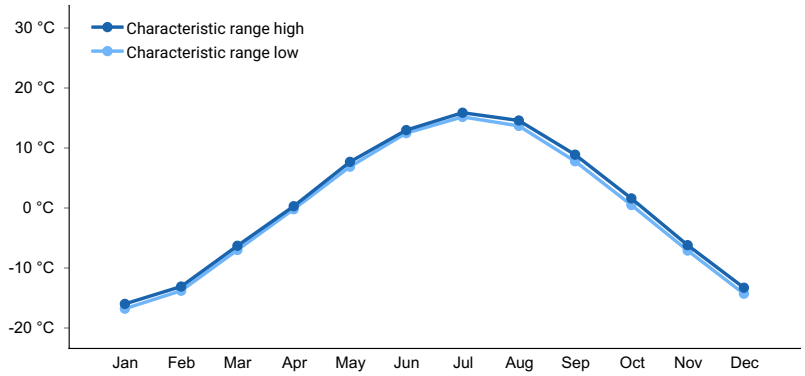


Figure 2. Monthly minimum temperature range

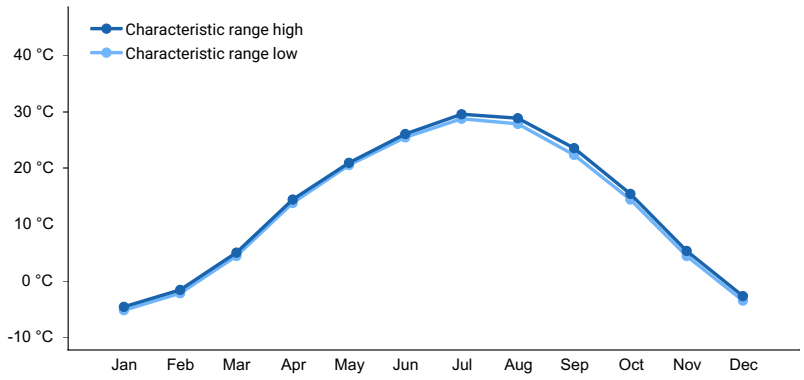


Figure 3. Monthly maximum temperature range

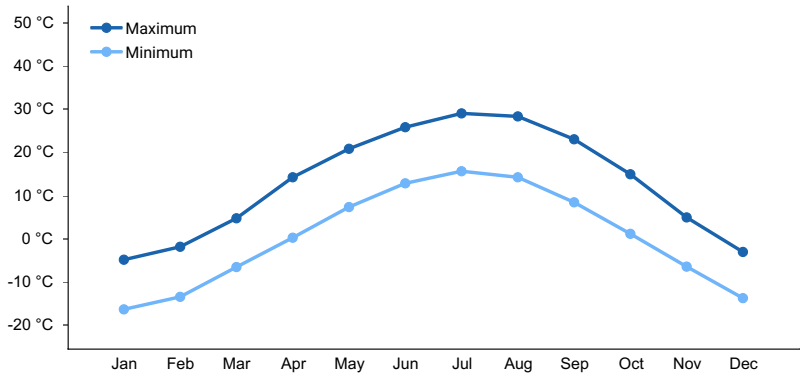


Figure 4. Monthly average minimum and maximum temperature

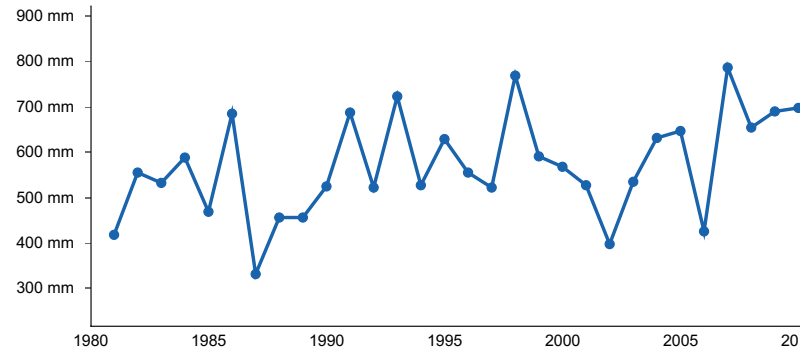


Figure 5. Annual precipitation pattern

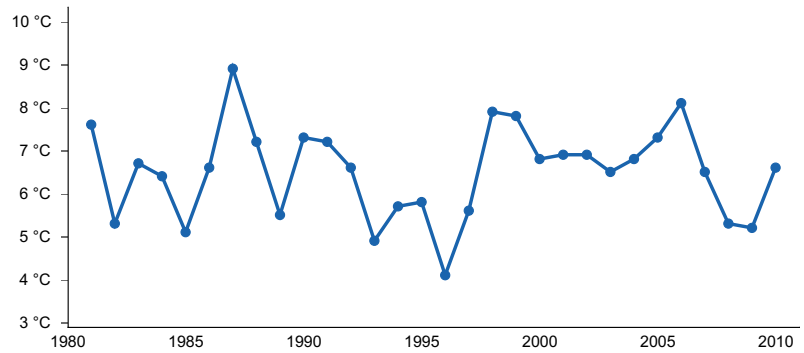


Figure 6. Annual average temperature pattern

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. On stream terraces, if flooding occurs it is brief and too early in the growing season to provide significant additional water for plant growth . Depth to the water table exceeds 3 feet in the spring and exceeds 4 feet in the summer months. On slopes exceeding 6 percent, the water table is typically deeper than 6 feet throughout the growing season. Surface infiltration is moderate or moderately rapid. Saturated hydraulic conductivity is high in the upper part of the soil. Where a contrasting texture is present below a depth 20 inches, saturated hydraulic conductivity ranges from moderately high to very high. Water loss is through percolation below the root zone and through evapotranspiration.

Wetland description

Not Applicable.

Soil features

Soils associated with Sandy ES are in the Mollisol order and are classified further as Calcic Hapludolls, Pachic Hapludolls, Typic Hapludolls, and Fluventic Hapludolls. These soils were developed under prairie vegetation. They formed in glaciolacustrine deposits, glaciofluvial deposits, in eolian deposits over till or glaciolacustrine materials, or in stream alluvium.

The common features of soils in this site are the moderately coarse textures to a depth exceeding 20 inches (forms a ribbon <1 inch long) and a drainage class of somewhat excessive to moderately well - where present, redoximorphic features are deeper than 3 feet. The surface layer is most commonly fine sandy loam or sandy loam, but loam also occurs (<10 inches thick). The soils are very deep; some have medium or coarse textured soil materials at a depth >20 inches.

This site should show slight to no evidence of rills, wind-scoured areas, or pedestaled plants. Water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact. Sub-surface soil layers are non-restrictive to water movement and root penetration.

Major soil series correlated to the Sandy site are: Egeland, Embden, and Swenoda.

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) Glaciolacustrine deposits (2) Glaciofluvial deposits (3) Eolian deposits (4) Alluvium
Surface texture	(1) Sandy loam (2) Fine sandy loam
Drainage class	Moderately well drained to well drained
Permeability class	Moderately rapid to 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)	10.16–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0–21%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.3
Subsurface fragment volume <=3" (0-101.6cm)	0–6%
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 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 Prairie Sandreed/Needle and Thread/Bluestem Plant Community Phase (1.1). Under adverse impacts, a slow decline in vegetative vigor and composition will occur. Under favorable conditions the site has the potential to resemble the Prairie Sandreed/Needle and Thread/Bluestem Plant Community Phase. This community phase and the Reference State has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered. Community phases, community pathways, states, transitions, thresholds and restoration pathways have been determined through similar studies and experience.

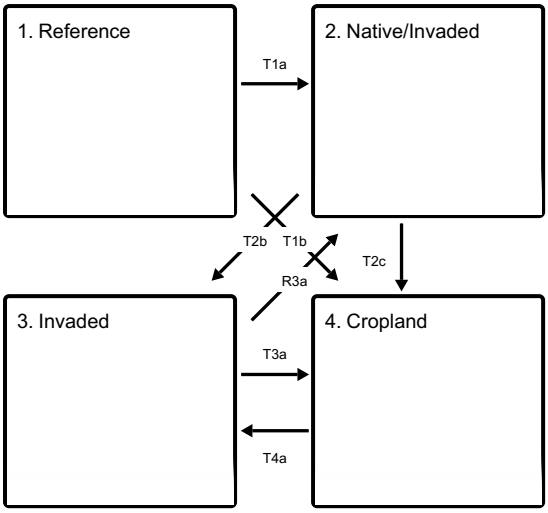
The natural disturbance regime consisted of sporadic fires caused both by natural and Native American ignition sources. These fires occurred during any season of the year, but were concentrated in the spring and late summer or early fall. Lightening fires occurred most frequently in July and August while 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. Continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the Reference State. Species such as western wheatgrass and blue grama will initially increase. Big bluestem, green needlegrass, and sideoats grama will decrease in frequency and production. In time, heavy continuous grazing will likely cause a stable dominance of Kentucky bluegrass and blue grama. These species then will have a competitive advantage which prevents other species from establishing or increasing. This plant community is less productive than the Reference State. Runoff increases and infiltration will decrease. Soil erosion will be minimal. 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. In time, shrubs such as western snowberry and chokecherry will likely increase and become co-dominant with the Kentucky bluegrass and smooth bromegrass.

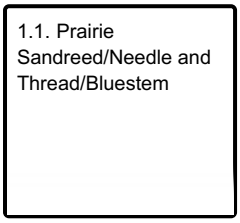
The following diagram illustrates the common states, community phases, community pathways, transitions and restoration pathways that can occur on the site. These are the most common plant community phases and states based on current knowledge and experience, and changes may be made as more data is collected.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

State and transition model

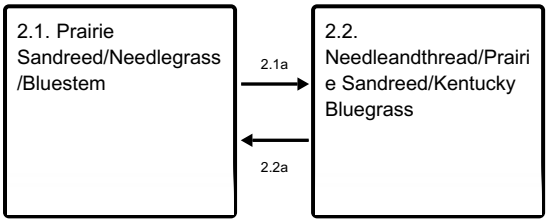
Ecosystem states



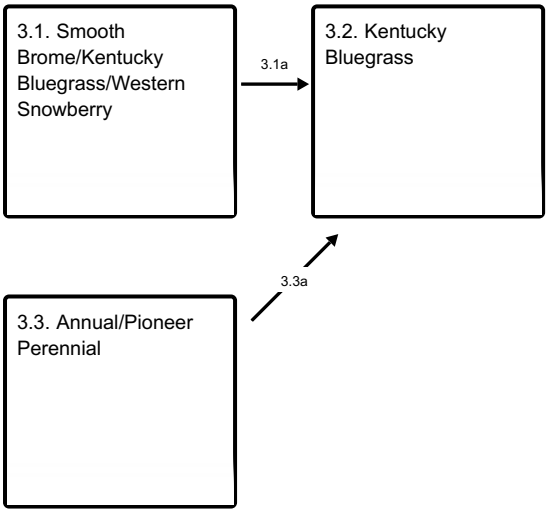
State 1 submodel, plant communities



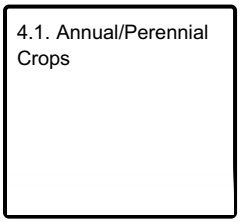
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. This state is dominated by warm- and cool-season grasses. The primary disturbance mechanisms for this site in the reference condition include frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictate the dynamics that occur 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.

Dominant plant species

- prairie sandreed (*Calamovilfa longifolia*), grass
- needle and thread (*Hesperostipa comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass

Community 1.1
Prairie Sandreed/Needle and Thread/Bluestem

This community phase was the most dominant both temporally and spatially. The prevailing climate and weather patterns favor the development of this community phase dominated by tall warm-season and mid cool-season grasses such as prairie sandreed, needleandthread, porcupine grass, big bluestem, and little bluestem. Other grass and grass-likes species occurring include green needlegrass, sideoats grama, prairie Junegrass, western wheatgrass, slender wheatgrass, bearded wheatgrass, blue grama, and sedge. A variety of leguminous and non-leguminous perennial forbs are present but only in slight amounts. This is the reference plant community phase and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. This is a naturally nitrogen deficient plant community.

Dominant plant species

- prairie sandreed (*Calamovilfa longifolia*), grass
- needle and thread (*Hesperostipa comata*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1950	2809	3536
Forb	151	235	336
Shrub/Vine	28	94	163
Total	**2129**	**3138**	**4035**

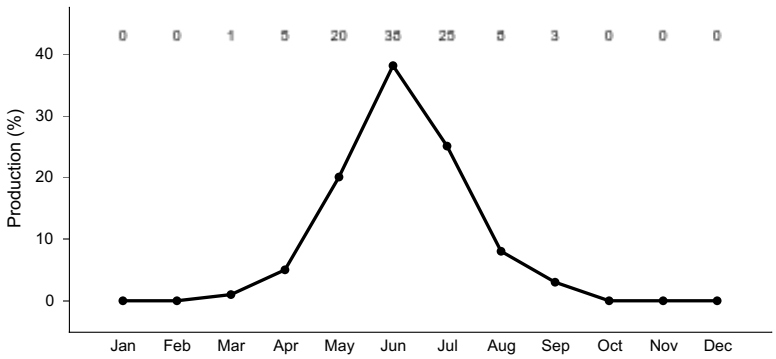


Figure 8. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

State 2
Native/Invaded

This state is very similar to the reference state. The invasion of introduced cool-season sodgrasses has altered the natural range of variability for this ecological site. This state still has a strong component of warm-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. Timing of fires and grazing coupled with weather events dictate the dynamics that occur within this state. The warm-season native grass can decline and an increase in introduced sod grasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season-long grazing.

Dominant plant species

- prairie sandreed (*Calamovilfa longifolia*), grass
- needle and thread (*Hesperostipa comata*), grass
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass

Community 2.1
Prairie Sandreed/Needlegrass/Bluestem

This community phase most closely resembles the Reference State in appearance and ecological functions (e.g., hydrologic, biotic and soil/site stability). The warm-season dominated 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. This community phase is dominated by tall warm-season and mid cool-season grasses such as prairie sandreed, needleandthread, porcupine grass, big bluestem, and little bluestem. Other grass and grass-likes species occurring include green needlegrass, sideoats grama, prairie Junegrass, western wheatgrass, slender wheatgrass, bearded wheatgrass, blue grama, and sedge. A variety of leguminous and non-leguminous perennial forbs are present but only in slight amounts. 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. This is likely a naturally nitrogen deficient plant community, but perhaps less so than the Reference State. A change in the nutrient cycle on this ecological site possibly due to the introduction of non-native leguminous forb species may be a causative factor leading to the eventual dominance of cool-season introduced grasses in the Invaded State.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1950	2809	3536
Forb	151	235	336
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Total	**2129**	**3138**	**4035**

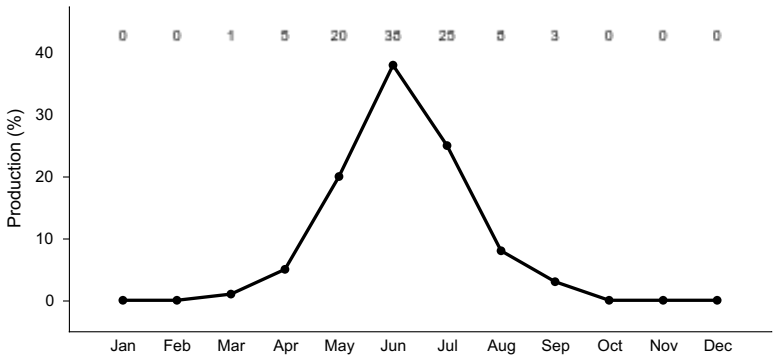

Figure 10. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Community 2.2
Needleandthread/Prairie Sandreed/Kentucky Bluegrass

Grazing pressure reduces the tall, less grazing tolerant species, while the shorter more grazing tolerant species increase. Litter amounts are reduced, and energy capture shifts to slightly earlier in the growing season due to a decline in the warm-season grass component. Non-native grasses, such as Kentucky bluegrass and smooth brome tend to increase and may begin to dominate this plant community. Needleandthread and prairie sandreed are still the dominant grasses in the early stages of this transition. Significant grass species include needleandthread, prairie sandreed, and Kentucky bluegrass. Other grasses present include big bluestem, porcupine grass, sideoats grama, green needlegrass, prairie junegrass, western wheatgrass, blue grama, sedge, and possibly smooth brome. The common forbs include cudweed sagewort, goldenrod, green sagewort, western salsify, heath aster, scurfpea and western ragweed. Western snowberry, fringed sagewort, and prairie rose are the principal shrubs. This community phase is often dispersed throughout the pasture, in an overgrazed/undergrazed pattern, typically referred to as patch grazing. Some areas (overgrazed) will exhibit the impacts of heavy use, while other areas (undergrazed) will have a build-up of litter and a high amount of plant decadence. This is a typical pattern found in properly stocked pastures grazed season-long. In the undergrazed patches, litter buildup reduces plant vigor and density, and native seedling recruitment declines. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to small colonies. In the overgrazed patches, plant vigor is reduced and the competitive advantage goes towards the grazing tolerant short statured species such as Kentucky bluegrass, blue grama, and sedge. This community phase is approaching the threshold which would readily lead to the Invaded State. If management is significantly altered, this community phase can still be reverted back to the Prairie Sandreed/Needlegrass/Bluestem community. Grazing management that allow for adequate recovery periods will tend to restore the ecological functions of this site. Fire can play a role in reducing the introduced cool-season species. The combination of grazing and fire may be the most effective in moving this community phase towards a community resembling the Reference State. Soil erosion is low. Infiltration is reduced, while runoff is increased compared to the Reference State.

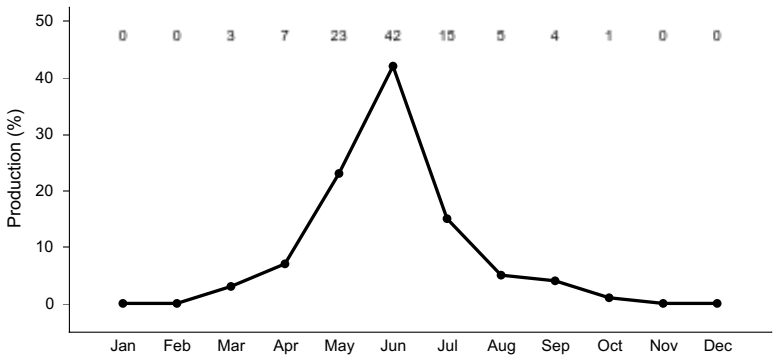

Figure 11. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Pathway 2.1a

Community 2.1 to 2.2

This community pathway is triggered by a change in the natural disturbance regime, most often caused by continuous grazing without adequate recovery periods. Chronic heavy grazing for extended periods during the growing season will also favor this shift. Included with areas affected by a lack of adequate recovery periods may be areas that receive little or no grazing, which may also lead to the increase of introduced cool-season species. Along this pathway, the timing of energy capture shifts from early to mid summer to spring and early summer. The change in plant functional and structural groups and the composition and distribution of the vegetation causes a decrease in production and an increase in runoff with a corresponding decrease in infiltration. Nutrient cycling is restricted as the rooting depth of the vegetation decreases with the change in functional and structural groups. Plant community diversity is reduced with a loss of native leguminous forbs and minor grass components.

Pathway 2.2a
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 from the introduced cool-season species to the tall and mid warm-season grass species. The addition of prescribed burning may expedite this shift.

State 3
Invaded

This state is the result of invasion and dominance of Kentucky bluegrass and/or smooth bromegrass. This state is characterized by these two species and an increasing thatch layer that effectively blocks introduction of other plants into the system. 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 these two 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. This state also includes the Annual, Pioneer Perennial community phase which is highly variable depending on the disturbance which causes this transition (T4). Over time, the Annual, Pioneer Perennial community phase will likely become dominated by introduced cool-season grasses, and shift to the Kentucky Bluegrass community phase (3.2).

Dominant plant species

- western snowberry (*Symphoricarpos occidentalis*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass

Community 3.1
Smooth Brome/Kentucky Bluegrass/Western Snowberry

This community phase is dominated by the cool-season sodgrasses including smooth brome and Kentucky bluegrass. Western snowberry can increase and become a major component in this community phase. Remnants of native warm- and cool-season grasses are still present, but greatly reduced. Infiltration is reduced and runoff is increased when compared to the Reference State. Nutrient cycling is limited by the rooting depth of these species, the lack of leguminous forbs, and the alteration of the soil biotic community. Energy capture into the system is restricted to a short window provided by the early season species.

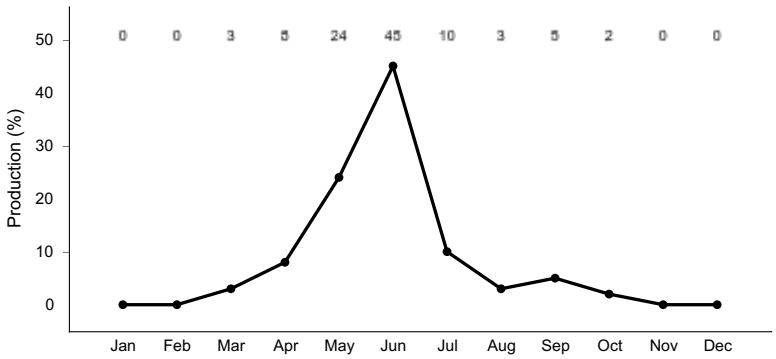

Figure 12. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.2
Kentucky Bluegrass

This community phase is dominated by Kentucky bluegrass with lesser amounts of sedge. The longer this community phase persists, the more resilient it becomes. Natural or management disturbances that reduce the cover of Kentucky bluegrass are very short lived due to the abundance of rhizomes of Kentucky bluegrass in the soil and the lack of propagules of other species present. Production is limited to the sod forming species. Energy capture into this system is limited to one early growing species. Runoff increases and is the highest of any plant community phase on this ecological site. Nutrient cycling is severely limited to the shallow rooting depth of the Kentucky bluegrass and production is limited.

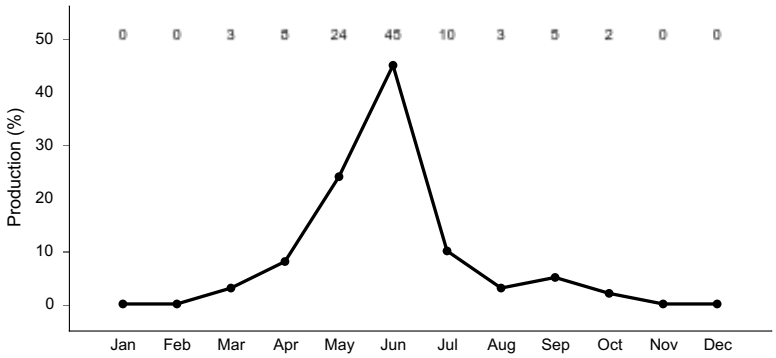

Figure 13. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Community 3.3
Annual/Pioneer Perennial

The Annual, Pioneer Perennial community phase is highly variable depending on the level and duration of disturbance related to the T4 transitional pathway. In this MLRA, the most probable origin of this phase is secondary succession following cropland abandonment. This plant community will initially include a variety of annual forbs and grasses. Overtime, the introduced cool-season perennial grasses will begin to establish on this site.

Pathway 3.1a
Community 3.1 to 3.2

This pathway is initiated by heavy continuous season-long grazing. The heavy continuous grazing favors those plants which can tolerate repeated defoliation (Kentucky bluegrass and sedges). Smooth brome will decrease with heavy use due to its elevated growth point. Western snowberry will experience mechanical damage and will decrease in production and cover. Grazing pressure will reduce litter cover resulting in elevated soil surface temperatures increasing evaporation rates and reducing biological activity.

Pathway 3.3a
Community 3.3 to 3.2

With grazing and time, the grazing tolerant Kentucky bluegrass will continue to increase leading to community phase 3.2. In the absence of grazing, this pathway will lead to a community phase resembling 3.1 with the primary difference being the lack of western snowberry and remnant native grass species.

State 4
Cropland

This state is the result of annual cropping

Community 4.1
Annual/Perennial Crops

The result of of this plant community is annual/perennial crops.

Transition T1a
State 1 to 2

This is the transition from the native warm-season grass dominated reference state to a state that has been invaded by introduced cool-season grass species. When propagules of Kentucky bluegrass are present, this transition occurs as natural and/or management actions favor a decline in the composition of warm-season rhizomatous 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 by 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 T2b
State 2 to 3

Heavy continuous season-long grazing is the primary driver of this transition. The very grazing tolerant species have the competitive advantage during this transition. The opportunity for high intensity spring burns (which can serve to reduce the introduced cool-season species) is severely reduced by early green up and the lack of fuel. The nutrient cycle is impaired due to a shift from perennial native legumes to introduced biennial legumes and the lack of available carbon for soil biota due to accumulation in the surface layer root mat. These two factors result in reduced soil biological activity. 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 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 T2c
State 2 to 4

Removal of vegetative cover and tilling for agricultural crop production

Restoration pathway R3a
State 3 to 2

It may be possible using selected plant materials and agronomic practices to approach something very near the functioning of the Native/Invaded State (State 2). Application of chemical herbicides, prescribed burning 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.

Transition T3a
State 3 to 4

This transition occurs with cessation of cropping practices.

Transition T4a
State 4 to 3

This transition occurs with cessation of cropping practices being applied.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-season Grasses**			471–1098	
	prairie sandreed	CALO	*Calamovilfa longifolia*	314–785	–
	big bluestem	ANGE	*Andropogon gerardii*	157–628	–
2	**Needlegrass**			314–628	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–471	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	157–471	–
	green needlegrass	NAVI4	*Nassella viridula*	31–157	–
3	**Mid Warm-season Grasses**			157–314	
	sideoats grama	BOCU	*Bouteloua curtipendula*	31–314	–
	little bluestem	SCSC	*Schizachyrium scoparium*	157–314	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–157	–
4	**Wheatgrass**			31–157	
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	31–157	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	31–157	–
	western wheatgrass	PASM	*Pascopyrum smithii*	31–157	–
5	**Other Native Grasses**			31–157	
	Grass, perennial	2GP	*Grass, perennial*	0–157	–
	blue grama	BOGR2	*Bouteloua gracilis*	31–157	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	31–157	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–94	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–94	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–94	–
6	**Grass-likes**			157–314	
	sedge	CAREX	*Carex*	157–314	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–157	–

Forb					
7	**Forbs**			157–314	
	Forb, native	2FN	*Forb, native*	31–157	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	31–94	–
	field sagewort	ARCA12	*Artemisia campestris*	31–94	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–94	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	31–63	–
	purple prairie clover	DAPU5	*Dalea purpurea*	31–63	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–63	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	31–63	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	31–63	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	31–63	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	31–63	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	31–63	–
	dotted blazing star	LIPU	*Liatris punctata*	31–63	–
	soft-hair marbleseed	ONBEB	*Onosmodium bejariense var. bejariense*	31–63	–
	scurfpea	PSORA2	*Psoralidium*	31–63	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	31–63	–
	goldenrod	SOLID	*Solidago*	31–63	–
	white heath aster	SYER	*Symphyotrichum ericoides*	31–63	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	31–63	–
	American vetch	VIAM	*Vicia americana*	31–63	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–31	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–31	–
	tall blazing star	LIAS	*Liatris aspera*	0–31	–
Shrub/Vine					
8	**Shrubs**			31–157	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	31–94	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–94	–
	leadplant	AMCA6	*Amorpha canescens*	31–94	–
	prairie sagewort	ARFR4	*Artemisia frigida*	31–63	–
	rose	ROSA5	*Rosa*	31–63	–
	white meadowsweet	SPAL2	*Spiraea alba*	31–63	–

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**			471–1098	
	prairie sandreed	CALO	*Calamovilfa longifolia*	314–785	–
	big bluestem	ANGE	*Andropogon gerardii*	157–628	–
2	**Needlegrass**			314–628	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–471	

	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–471	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	157–471	–
	green needlegrass	NAVI4	*Nassella viridula*	31–157	–
3	**Mid Warm-season Grasses**			157–314	
	sideoats grama	BOCU	*Bouteloua curtipendula*	31–314	–
	little bluestem	SCSC	*Schizachyrium scoparium*	157–314	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–157	–
4	**Wheatgrass**			31–157	
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	31–157	–
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	western wheatgrass	PASM	*Pascopyrum smithii*	31–157	–
5	**Other Native Grasses**			31–157	
	Grass, perennial	2GP	*Grass, perennial*	0–157	–
	blue grama	BOGR2	*Bouteloua gracilis*	31–157	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	31–157	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–94	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–94	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–94	–
6	**Grass-likes**			157–314	
	sedge	CAREX	*Carex*	157–314	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–157	–
7	**Non-Native Grasses**			31–126	
	smooth brome	BRIN2	*Bromus inermis*	31–63	–
	Kentucky bluegrass	POPR	*Poa pratensis*	31–63	–
	Grass, perennial	2GP	*Grass, perennial*	0–31	–
Forb					
8	**Forbs**			157–314	
	Forb, native	2FN	*Forb, native*	31–157	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	31–94	–
	field sagewort	ARCA12	*Artemisia campestris*	31–94	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–94	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	31–63	–
	purple prairie clover	DAPU5	*Dalea purpurea*	31–63	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–63	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	31–63	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	31–63	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	31–63	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	31–63	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	31–63	–
	dotted blazing star	LIPU	*Liatris punctata*	31–63	–
	soft-hair marbleseed	ONBEB	*Onosmodium bejariense var. bejariense*	31–63	–
	scurfpea	PSORA2	*Psoralidium*	31–63	–

	scurfpea	PSORAL	*Pediomelum*	31–63	
	upright prairie coneflower	RACO3	*Ratibida columnifera*	31–63	–
	goldenrod	SOLID	*Solidago*	31–63	–
	white heath aster	SYER	*Symphyotrichum ericoides*	31–63	–
	longbract spiderwort	TRBR	*Tradescantia bracteata*	31–63	–
	American vetch	VIAM	*Vicia americana*	31–63	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–31	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–31	–
	tall blazing star	LIAS	*Liatris aspera*	0–31	–
Shrub/Vine					
9	**Shrubs**			31–157	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–94	–
	leadplant	AMCA6	*Amorpha canescens*	31–94	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	31–94	–
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	rose	ROSA5	*Rosa*	31–63	–
	white meadowsweet	SPAL2	*Spiraea alba*	31–63	–

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, 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:**