USDA Natural Resources Conservation Service

Ecological site R055DY016SD
Very Shallow

Last updated: 11/14/2024
Accessed: 11/23/2024

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 Very Shallow ecological site is located on uplands – primarily on outwash plains and on terraces and moraines dissected by rivers, streams and drainageways; it also occurs on high beach ridges along some lake shores. The soils are very shallow (<14 inches) to layers high in coarse sand and gravel (15 to 60 percent gravel). In some soils this layer contains significant amounts (>25%) of shale fragments. The thin surface layer is typically sandy loam, gravelly sandy loam, or loamy coarse sand; but gravelly loam, cobbly loam, and coarse sandy loam also occur. Where the soils have been cultivated, the surface layer may be very gravelly. Soil on this site is excessively drained. Slopes range from 0 to 35 percent. On the landscape, this site is above the Shallow Gravel, Loamy, and Subirrigated ecological sites. On moraines, the Thin Loamy site occurs on similar landscape positions; it is highly calcareous with loamy or silty textures to a depth of 40 inches or more.

Associated sites

R055DY003SD	**Subirrigated** This site occurs lower on the landscape on beach ridges. It has redoximorphic features at a depth of 18 to 30 inches. Where a highly calcareous subsoil layer occurs, it is at a depth >16 inches. All textures are included in this site.
R055DY014SD	**Shallow Gravel** This site occurs lower on the landscape. The depth to sand and gravel is 14 to 20 inches.
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.
R055DY012SD	**Thin Upland** This site occurs on shoulder slopes of moraines. The soil does not have a sand and gravel layer. 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

R055DY014SD	**Shallow Gravel** This site occurs lower on the landscape. The depth to sand and gravel is 14 to 20 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Hesperostipa comata* (2) *Bouteloua gracilis*

Physiographic features

This site occurs on uplands – on glacial outwash plains, on terraces, on dissected moraines, and on high beach ridges along lake shores. It is on upper back slopes, shoulder slope and summits. Parent materials are gravelly glaciofluvial or beach deposits. Slopes range from 0 to 25 percent but generally fall between 7 to 14 percent. .

Table 2. Representative physiographic features

Landforms	(1) Moraine (2) Beach ridge (3) Outwash plain
Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	299–649 m
Slope	7–14%
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

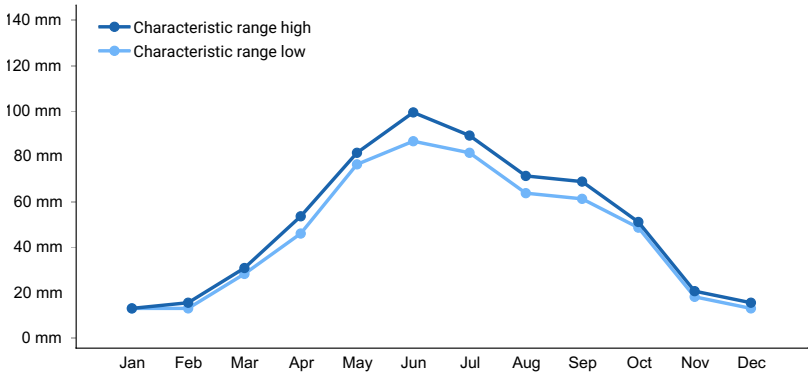


Figure 1. Monthly precipitation range

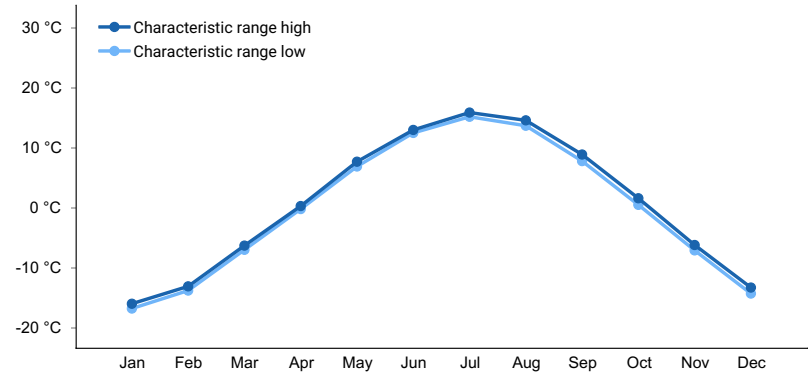


Figure 2. Monthly minimum temperature range

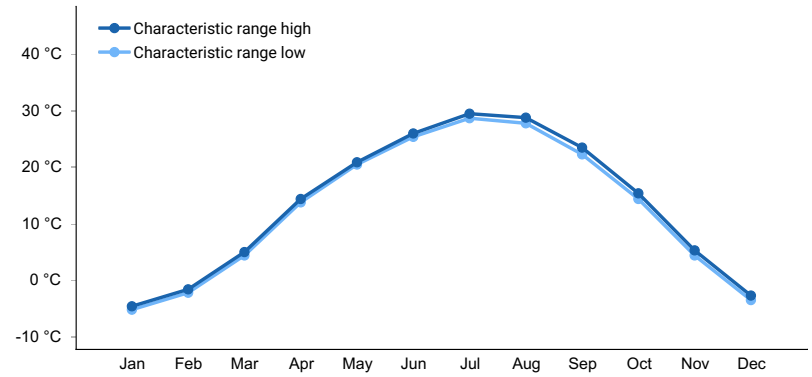


Figure 3. Monthly maximum temperature range

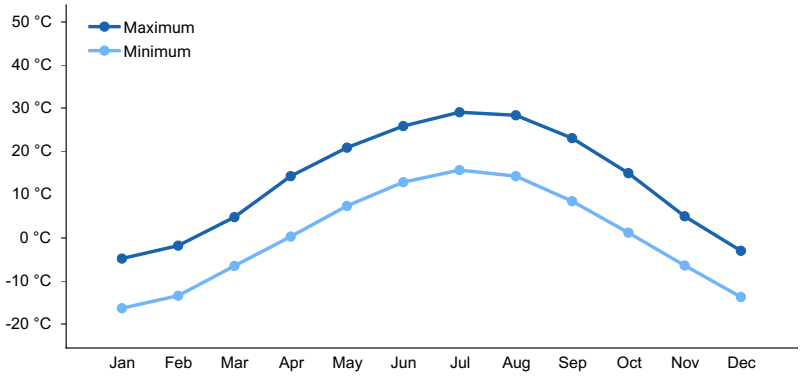


Figure 4. Monthly average minimum and maximum temperature

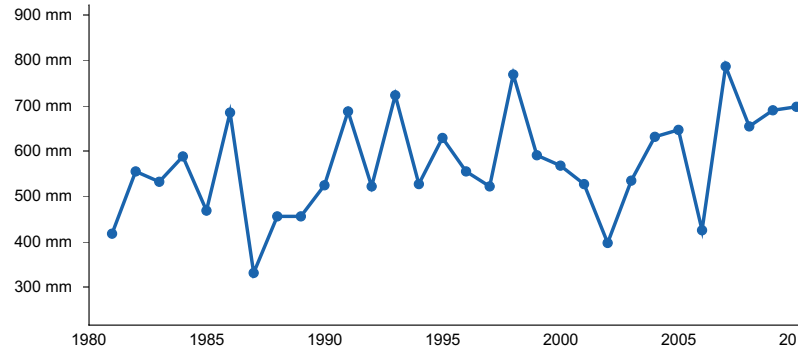


Figure 5. Annual precipitation pattern

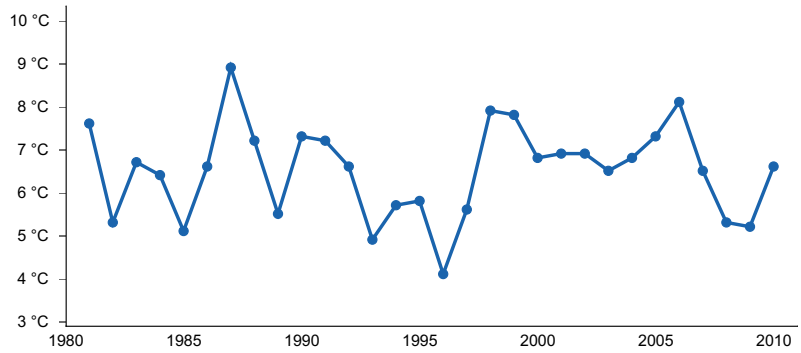


Figure 6. Annual average temperature pattern

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.

Soil features

Soils associated are in the Mollisol and Entisol orders. The Mollisols are classified further as Entic Hapludolls. The

Entisols are classified further as Typic Udorthents. These soils were developed under prairie vegetation. They formed in glaciofluvial deposits or beach deposits.

The common feature of soils in this site is the very shallow depth (<14 inches) to layers high in coarse sand and gravel (15 to 60 percent gravel). In some soils this layer contains significant amounts (>25%) of shale fragments. Due to the high amounts of gravel, these soils are very droughty and have limited plant production. The soils are excessively drained. The thin surface layer is typically sandy loam, gravelly sandy loam, or loamy coarse sand; but gravelly loam, cobbly loam and coarse sandy loam also occur. Where soils have been cultivated, the surface layer may be very gravelly.

Salinity and sodicity are none. Soil reaction is neutral to moderately alkaline. Calcium carbonate content is none to low in the surface soil and low to moderately high below. Some soils have layers of calcium carbonate accumulation in the upper part of the gravelly layers (typically as coatings on undersides of rock fragments).

This site should show no evidence of rills, wind-scoured areas, or pedestaled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is very unstable but intact. Sub-surface soil layers are restrictive to root penetration. These soils are mainly susceptible to water erosion. The hazard of water erosion increases as slope increases. Very low available water capacity caused by the shallow rooting depth strongly influences the soil/water/pant relationship. Loss of the soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to the Very Shallow site are: Sioux.

Access Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx) for specific local soils information.

Table 4. Representative soil features

Parent material	(1) Glaciofluvial deposits
Surface texture	(1) Sandy loam (2) Loamy coarse sand (3) Loam (4) Coarse sandy loam
Drainage class	Excessively drained
Permeability class	Rapid to very rapid
Depth to restrictive layer	25–51 cm
Soil depth	25–51 cm
Surface fragment cover <=3"	13–35%
Surface fragment cover >3"	3–10%
Available water capacity (0-152.4cm)	2.54–6.35 cm
Calcium carbonate equivalent (0-101.6cm)	1–15%
Soil reaction (1:1 water) (0-101.6cm)	6.8–8.4
Subsurface fragment volume <=3" (0-101.6cm)	14–58%
Subsurface fragment volume >3" (0-101.6cm)	0%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors

that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.

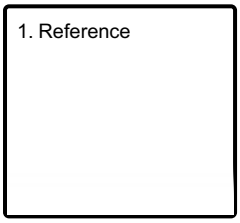
This ecological site is naturally resilient, and quite resistant to change. Also, due to the relatively steep slopes and naturally low fertility of the soils, this site generally avoids more intensive disturbances such as farming. However, continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence can cause this site to depart from the Needleandthread/Sedge/Blue Grama Plant Community Phase. Sedges and gramas can increase and eventually develop into a sod, while many of the mid statured grasses will decrease (e.g., needleandthread and western wheatgrass). Even with these disturbances, many of the mid statured grasses will remain in the community at reduced levels, allowing recovery to occur once the disturbances are removed.

Interpretations are primarily based on the Needleandthread/Sedge/Blue Grama Plant Community Phase (1.1). It 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 used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

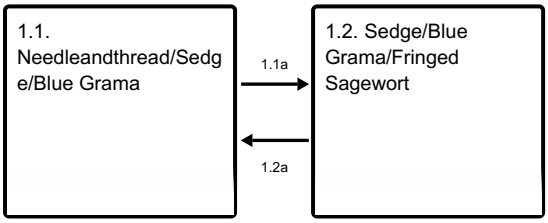
The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes may be made as more data is collected. Narratives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

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. This state is dominated by cool-season grasses, with warm-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included grazing by large herding ungulates and fluctuations in levels of precipitation. Grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, this state can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The dominant tall and mid grass species can decline and a corresponding increase in short statured species will occur.

Dominant plant species

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

- needle and thread (*Hesperostipa comata ssp. comata*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass
- threadleaf sedge (*Carex filifolia*), grass
- blazing star (*Liatris*), other herbaceous
- hairy false goldenaster (*Heterotheca villosa*), other herbaceous
- prairie clover (*Dalea*), other herbaceous
- blacksamson echinacea (*Echinacea angustifolia*), other herbaceous

Community 1.1
Needleandthread/Sedge/Blue Grama

The Needleandthread/Blue Grama/Sedge Plant Community Phase is the plant community upon which interpretations are primarily based. This is also considered to be climax. This plant community can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use and adequate recovery periods following each grazing event. The potential vegetation is about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. Cool-season grass and grass-like species dominate this plant community, with warm-season grasses being subdominant. The major grass or grass-like species include needleandthread, blue grama, western wheatgrass, and threadleaf sedge. Other grasses occurring on the site include threeawn, plains muhly, slender wheatgrass, sand dropseed, and prairie junegrass. The significant forbs include dotted gayfeather, hairy goldaster, purple coneflower, and prairie clover. Significant shrubs are fringed sagewort and rose. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. This plant community is stable and protected from excessive erosion.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	796	1357	1805
Forb	73	157	241
Shrub/Vine	28	55	84
Total	**897**	**1569**	**2130**

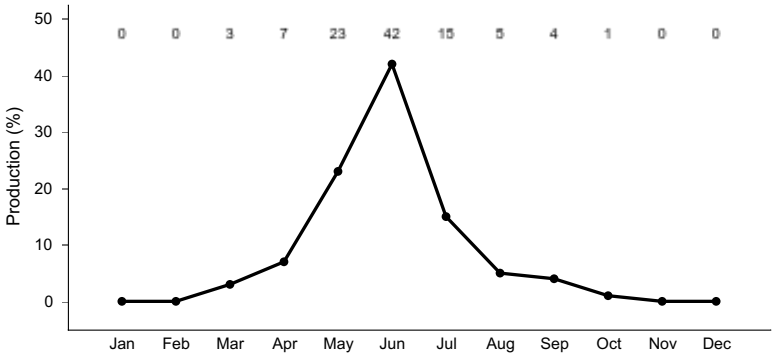


Figure 8. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Community 1.2
Sedge/Blue Grama/Fringed Sagewort

This plant community can develop from the adverse effects of heavy, continuous grazing in conjunction with extended periods of below-average precipitation. Short grass and grass-like species increase to dominate the site and annual production decreases. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives blue grama and sedges a competitive advantage over cool and warm-season mid-grasses. Blue grama and threadleaf sedge are the dominant grass/grass-like species. Other

grasses may include western wheatgrass, needleandthread, prairie junegrass and threeawn. Significant forbs include green sagewort, cutleaf ironplant, scurfpeas, heath aster, and western yarrow. Fringed sagewort is the dominant shrub. Non-native species such as Kentucky bluegrass, cheatgrass, and Japanese bromegrass may begin to invade this phase, but will typically not increase to the point of dominance. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the 1.1 Needleandthread/Sedge/Blue Grama Plant Community Phase. Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

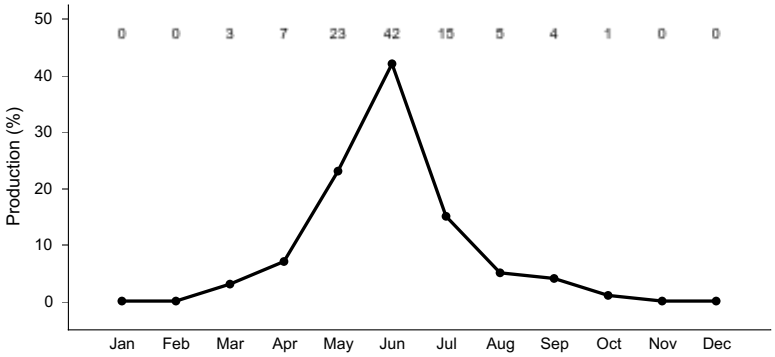


Figure 9. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Pathway 1.1a
Community 1.1 to 1.2

Heavy continuous grazing (grazing the same area for extended portions of the growing season well above recommended stocking rates and without adequate recovery periods), especially when coupled with extended periods of below average precipitation will convert the plant community to the 1.2 Sedge/Blue Grama/Fringed Sagewort Plant Community Phase.

Pathway 1.2a
Community 1.2 to 1.1

Grazing and fire returned to normal disturbance regime levels and frequencies or prescribed grazing (alternating season of use and providing adequate recovery periods) will convert this plant community to the 1.1 Needleandthread/Sedge/Blue Grama Plant Community Phase.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Grasses**			235–471	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–471	–
	western wheatgrass	PASM	*Pascopyrum smithii*	31–157	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–78	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	0–78	–
2	**Warm-season Grasses**			235–471	
	blue grama	BOGR2	*Bouteloua gracilis*	78–314	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	16–157	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	16–47	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	16–31	–

	sand dropseed	SPCR	*Sporobolus cryptandrus*	16–31	–
3	**Other Native Grasses**			16–78	
	Grass, perennial	2GP	*Grass, perennial*	0–47	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	16–31	–
4	**Grass-likes**			78–235	
	threadleaf sedge	CAFI	*Carex filifolia*	78–204	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–78	–
Forb					
5	**Forbs**			78–235	
	blazing star	LIATR	*Liatris*	16–126	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	16–63	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–63	–
	velvety goldenrod	SOMO	*Solidago mollis*	16–47	–
	prairie clover	DALEA	*Dalea*	16–47	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	16–47	–
	field sagewort	ARCA12	*Artemisia campestris*	16–31	–
	Forb, annual	2FA	*Forb, annual*	16–31	–
	Forb, perennial	2FP	*Forb, perennial*	16–31	–
	white heath aster	SYER	*Symphyotrichum ericoides*	16–31	–
	spiny phlox	PHHO	*Phlox hoodii*	16–31	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	16–31	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	16–31	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–16	–
	cutleaf anemone	PUPAM	*Pulsatilla patens ssp. multifida*	0–16	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–16	–
	onion	ALLIU	*Allium*	0–16	–
	pussytoes	ANTEN	*Antennaria*	0–16	–
	plains milkvetch	ASGI5	*Astragalus gilviflorus*	0–16	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–16	–
Shrub/Vine					
6	**Shrubs**			31–78	
	prairie sagewort	ARFR4	*Artemisia frigida*	16–63	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–47	–
	rose	ROSA5	*Rosa*	16–31	–

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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USDA, NRCS, Various Published Soil Surveys.

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:

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

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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

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17. **Perennial plant reproductive capability:**
