USDA Natural Resources
Conservation Service

Ecological site FX053A99X131
Shallow Clay (SwC)

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General information

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

MLRA notes

Major Land Resource Area (MLRA): 053A–Northern Dark Brown Glaciated Plains

The Northern Dark Brown Glaciated Plains, MLRA 53A, is a large, agriculturally and ecologically significant area. It consists of approximately 6.1 million acres and stretches 140 miles from east to west and 120 miles from north to south, encompassing portions of 8 counties in northeastern Montana and northwestern North Dakota. This region represents part of the southern edge of the Laurentide Ice Sheet during maximum glaciation. It is one of the driest and westernmost areas within the vast network of glacially derived prairie pothole landforms of the Northern Great Plains and falls roughly between the Missouri Coteau to the east and the Brown Glaciated Plains to the west. Elevation ranges from 1,800 feet (550 meters) to 3,300 feet (1,005 meters).

Soils are primarily Mollisols, but Inceptisols and Entisols are also common. Till from continental glaciation is the predominant parent material, but alluvium and bedrock are also common. Till deposits are typically less than 50 feet thick (Soller, 2001). Underlying the till is sedimentary bedrock largely consisting of Cretaceous shale, sandstone, and mudstone (Vuke et al., 2007). The bedrock is commonly exposed on hillslopes, particularly along drainageways. Significant alluvial deposits occur in glacial outwash channels and along major drainages, including portions of the Missouri, Poplar, and Big Muddy Rivers. Large eolian deposits of sand occur in the vicinity of the ancestral Missouri River channel east of Medicine Lake (Fullerton et al., 2004). The northwestern portion of the MLRA contains a large unglaciated area containing paleoterraces and large deposits of sand and gravel known as the Flaxville gravel.

Much of this MLRA was glaciated towards the end of the Wisconsin age, and the maximum glacial extent occurred approximately 20,000 years ago (Fullerton and Colton, 1986; Fullerton et al., 2004). Subsequent erosion from major stream and river systems has created numerous drainageways throughout much of the MLRA. The result is a geologically young landscape that is predominantly a dissected till plain interspersed with alluvial deposits and dominated by soils in the Mollisol and Inceptisol orders. Much of this area is typic ustic, making these soils very productive and generally well suited to production agriculture.

Dryland farming is the predominant land use, and approximately 50 percent of the land area is used for cultivated crops. Winter, spring, and durum varieties of wheat are the major crops, with over 48 million bushels produced annually (USDA-NASS, 2017). Areas of rangeland typically are on steep hillslopes along drainages. The rangeland is mostly native mixed-grass prairie similar to the Stipa-Agropyron, Stipa-Bouteloua-Agropyron, and Stipa-Bouteloua faciations (Coupland, 1950, 1961). Cool-season grasses dominate and include rhizomatous wheatgrasses, needle and thread, western porcupine grass, and green needlegrass. Woody species are generally rare; however, many of the steeper drainages support stands of trees and shrubs, such as green ash and chokecherry. Seasonally ponded, prairie pothole wetlands may occur throughout the MLRA, but the greatest concentrations are in the east and northeast where receding glaciers stagnated and formed disintegration moraines with hummocky topography and numerous areas of poorly drained soils.

Classification relationships

NRCS Soil Geography Hierarchy
• Land Resource Region: Northern Great Plains
• Major Land Resource Area (MLRA): 053A Northern Dark Brown Glaciated Plains

National Hierarchical Framework of Ecological Units (Cleland et al., 1997; McNab et al., 2007)
• Domain: Dry
• Division: Temperate Steppe
• Province: Great Plains-Palouse Dry Steppe Province 331
• Section: Glaciated Northern Grasslands Section 331L
• Subsection: Glaciated Northern Grasslands Subsection 331La
• Landtype association/Landtype phase: N/A

National Vegetation Classification Standard (Federal Geographic Data Committee, 2008)
• Class: Mesomorphic Shrub and Herb Vegetation Class (2)
• Subclass: Temperate and Boreal Grassland and Shrubland Subclass (2.B)
• Formation: Temperate Grassland and Shrubland Formation (2.B.2)
• Division: Central North American and Shrubland Division (2.B.2.Nb)
• Macrogroup: Hesperostipa comata - *Pascopyrum smithii* - Festuca hallii Grassland Macrogroup (2.B.2.Nb.2)
• Group: *Pascopyrum smithii* - Hesperostipa comata - Schizachyrium scoparium Mixedgrass Prairie Group (2.B.2.Nb.2.c)

EPA Ecoregions
• Level 1: Great Plains (9)
• Level 2: West-Central Semi-Arid Prairies (9.3)
• Level 3: Northwestern Glaciated Plains (42)
• Level 4: Glaciated Dark Brown Prairie (42i)
Glaciated Northern Grasslands (42j)

Ecological site concept

Shallow Clay is an ecological site of limited extent occurring in areas where the till plain has been dissected by streams or rivers and underlying bedrock has been exposed. The distinguishing characteristics of this site are lithic or paralithic bedrock less than 20 inches from the soil surface and a clay content of greater than 35 percent. Soils for this ecological site are typically shallow or very shallow (less than 20 inches to bedrock), well drained, and derived from clayey residuum, or clayey alluvium over shale. Characteristic vegetation is western wheatgrass (*Pascopyrum smithii*) and green needlegrass (*Nassella viridula*).

Associated sites

FX053A99X701	**Clay (Cl)** This site is generally upslope from the Shallow Clay ecological site. It is most common on summits where the slope is less than 15 percent and soil depth is 20 inches deep or greater.
FX053A99X160	**Thin Breaks (TB)** This site is adjacent to the Shallow Clay ecological site but occurs over sandstone, siltstone, or mudstone bedrock. It typically occupies a backslope position similar to the Shallow Clay ecological site.

Similar sites

FX053A99X701	**Clay (Cl)** This site differs from the Shallow Clay ecological site in that depth to bedrock is greater than 20 inches.
FX053A99X160	**Thin Breaks (TB)** This site differs from the Shallow Clay ecological site in that the soil is derived from sandstone, siltstone, or mudstone bedrock rather than shale. Clay content is 35 percent or less.

Table 1. Dominant plant species

Tree	Not specified

Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Legacy ID

R053AY717MT

Physiographic features

This ecological site largely occurs where the till plain has been dissected by streams or rivers and underlying bedrock has been exposed. This site is typically in backslope positions on hillslopes, badlands, and bluffs. Slopes vary but are typically 15 to 60 percent.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope
Landforms	(1) Badlands > Hillslope (2) Breaks > Hillslope (3) Breaks > Bluff
Flooding frequency	None
Ponding frequency	None
Elevation	549–1,006 m
Slope	15–60%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	0–60%

Climatic features

The Northern Dark Brown Glaciated Plains is a semi-arid region with a temperate continental climate that is characterized by frigid winters and warm to hot summers (Coupland, 1958; Richardson and Hanson, 1977; Heidel et al., 2000). The majority of precipitation occurs as steady, soaking, frontal system rains in late spring to early summer. Summer rainfall comes mainly from convection thunderstorms that typically deliver scattered amounts of rain in intense bursts. These storms may be accompanied by damaging winds and large-diameter hail and result in flash flooding along low-order streams. Approximately 80 percent of the annual precipitation occurs during the growing season. June is the wettest month, followed by July and May (Richardson and Hanson, 1977; Heidel et al., 2000). Average annual precipitation ranges from 11 inches (280 mm) near Richey, Montana, to 15 inches (380 mm) in the Little Muddy drainage near Williston, North Dakota, but precipitation varies greatly from year to year. On average, severe drought and very wet years occur with the same frequency, which is 1 out of 10 years (Coupland, 1958; Heidel et al., 2000). Extreme climatic variations, especially droughts, have the greatest influence on species cover and production (Coupland, 1958, 1961; Biondini et al., 1998). The frost-free period for this ecological site ranges from 90 to 130 days, and the freeze-free period ranges from 115 to 155 days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	90-130 days
Freeze-free period (characteristic range)	115-155 days

Precipitation total (characteristic range)	279-381 mm
Frost-free period (average)	110 days
Freeze-free period (average)	135 days
Precipitation total (average)	330 mm

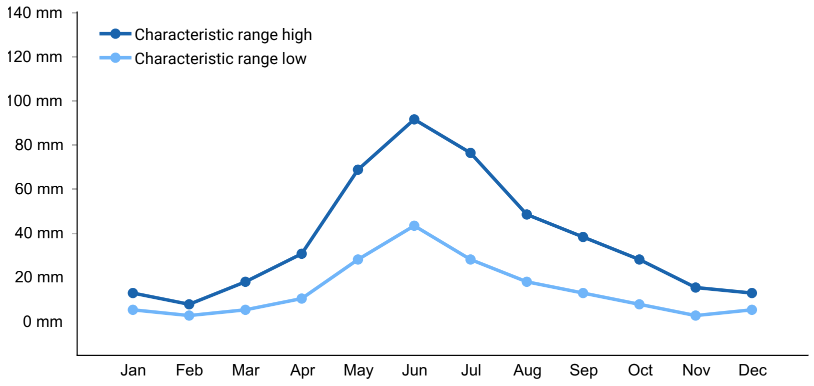


Figure 1. Monthly precipitation range

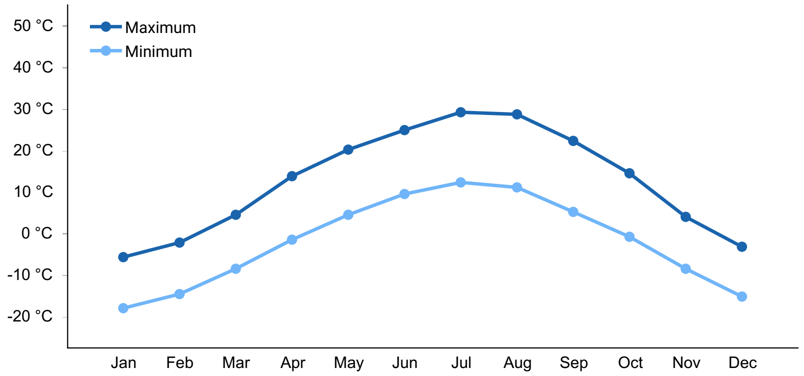


Figure 2. Monthly average minimum and maximum temperature

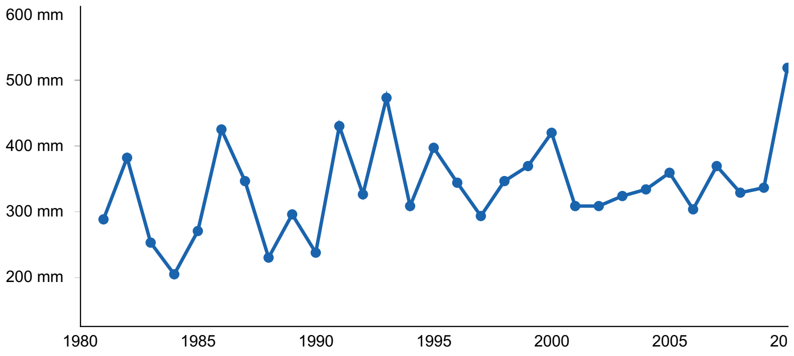


Figure 3. Annual precipitation pattern

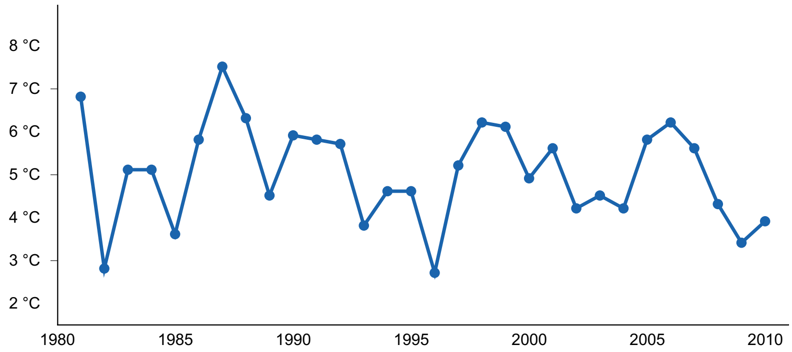


Figure 4. Annual average temperature pattern

Climate stations used

- (1) BREDETTE [USC00241088], Poplar, MT
- (2) CULBERTSON [USC00242122], Culbertson, MT
- (3) OPHEIM 10 N [USC00246236], Opheim, MT
- (4) OPHEIM 12 SSE [USC00246238], Opheim, MT
- (5) PLENTYWOOD [USC00246586], Plentywood, MT
- (6) SCOBEY 4 NW [USC00247425], Scobey, MT
- (7) SIDNEY [USC00247560], Sidney, MT
- (8) VIDA 6 NE [USC00248569], Vida, MT
- (9) WILLISTON SLOULIN INTL AP [USW00094014], Williston, ND

Influencing water features

This is upland ecological site and is not influenced by a water table or run in from adjacent sites. Due to the semi-arid climate in which it occurs, the water budget is normally contained within the soil pedon. Soil moisture is recharged by spring rains, but it but rarely exceeds field capacity before being depleted by evapotranspiration. Steep slopes and high clay content combined with bedrock at relatively shallow depths result in very high runoff potential. During intense precipitation events, the site delivers moisture to downslope sites via surface runoff. Moisture loss through evapotranspiration exceeds precipitation for the majority of the growing season and soil moisture is the primary limiting factor for plant production on this ecological site.

Soil features

Soils for this ecological site are typically shallow or very shallow (less than 20 inches to bedrock), well drained, and derived from clayey residuum, or clayey alluvium over shale. They have a typic ustic moisture regime, which means that the soils are moist in some or all parts for either 180 cumulative days or 90 consecutive days during the growing season but are dry in some or all parts for over 90 cumulative days, and a frigid soil temperature regime (Soil Survey Staff, 2014).

Surface horizon textures are typically clay, silty clay, clay loam, or silty clay loam and contain greater than 35 percent clay. The underlying horizons typically contain 35 to 60 percent clay and have clay, clay loam, or silty clay loam textures. Calcium carbonate equivalent is typically less than 15 percent throughout the soil profile. In the upper 20 inches of soil, electrical conductivity is less than 4 and the sodium absorption ratio is less than 13. Soil pH classes are moderately acid to slightly alkaline in the surface horizon and neutral to strongly alkaline in the subsurface horizons. Content of coarse fragments is less than 35 percent in the upper 20 inches of soil.

Table 5. Representative soil features

Parent material	(1) Residuum–shale
Surface texture	(1) Clay (2) Silty clay (3) Clay loam (4) Silty clay loam

Drainage class	Well drained
Soil depth	0–51 cm
Calcium carbonate equivalent (0-50.8cm)	0–15%
Electrical conductivity (0-50.8cm)	0–3 mmhos/cm
Sodium adsorption ratio (0-50.8cm)	0–12

Ecological dynamics

The information in this ecological site description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

The Shallow Clay provisional ecological site in MLRA 53A consists of four states: the Historic Reference State (1), the Contemporary Reference State (2), the Shortgrass State (3), and the Invaded State (4). Plant communities associated with this ecological site evolved under the combined influences of climate, grazing, and fire. Extreme climatic variability results in frequent droughts, which have the greatest influence on the relative contribution of species cover and production (Coupland, 1958, 1961; Biondini et al., 1998). Due to the dominance of cool-season graminoids, annual production is highly dependent upon mid- to late-spring precipitation (Heitschmidt and Vermeire, 2005; Anderson, 2006).

The historic ecosystem experienced periodic lightning-caused fires with estimated fire return intervals of 6 to 25 years (Bragg, 1995). Historically, Native Americans also set periodic fires. The majority of lightning-caused fires occurred in July and August, whereas Native Americans typically set fires during spring and fall to correspond with the movement of bison (Higgins, 1986). The precise effects of the historic fire return interval are not definitive, but in general the mixed-grass ecosystem was resilient to fire. Potential effects are generally temporary and may include reduction of litter, fluctuations in production, and changes in species composition (Vermeire et al., 2011, 2014).

Native grazers also shaped these plant communities. American Bison (Bison bison) were the dominant historic grazer, but pronghorn (Antilocapra americana), elk (Cervus canadensis), and deer (Odocoileus spp.) were also common. Additionally, small mammals such as prairie dogs (Cynomys spp.) and ground squirrels (Urocitellus spp.) influenced this plant community (Salo et al., 2004). Grasshoppers and periodic outbreaks of Rocky Mountain locusts (Melanoplus spretus) also played an important role in the ecology of these communities (Lockwood, 2004). The mixed-grass ecosystem was resilient to grazing, although localized areas could experience shifts in species composition due to heavy grazing.

Following European settlement, fire was largely eliminated, domestic livestock replaced native ungulates as the primary grazers, and non-native species were introduced to the ecosystem. Aside from drought, livestock grazing is now the principle disturbance on the landscape.

Improper grazing of this site can result in a reduction in the cover of mid-statured grasses and an increase in shortgrasses such as blue grama and prairie Junegrass (Koeleria cristata) (Smoliak et al., 1972; Smoliak, 1974). Improper grazing practices include any practices that do not allow sufficient opportunity for plants to physiologically recover from a grazing event or multiple grazing events within a given year and/or that do not provide adequate cover to prevent soil erosion over time. These practices may include, but are not limited to, overstocking, continuous grazing, and/or inadequate seasonal rotation moves over multiple years. Periods of extended drought (approximately 3 years or more) can reduce mid-statured, cool-season grasses and shift the species composition of this community to one dominated by shortgrasses (Coupland, 1958, 1961). Further degradation of the site due to improper grazing can result in a community dominated by subshrubs, such as broom snakeweed and rubber rabbitbrush, and shortgrasses.

Most, if not all, extant examples of this site have some degree of invasion by non-native species. The biennial forb yellow sweetclover commonly appears in seasonal abundances, but is not generally considered invasive. Non-native bluegrasses (Poa spp.) are the most common invasive species concern. These species are widespread throughout the Northern Great Plains can invade relatively undisturbed grasslands (Heidinga and Wilson, 2002; Henderson and Naeth, 2005; Toledo et al., 2014). In most cases native ecological function is relatively intact, but in some cases non-native grasses will displace native species and dominate the ecological functions of the site.

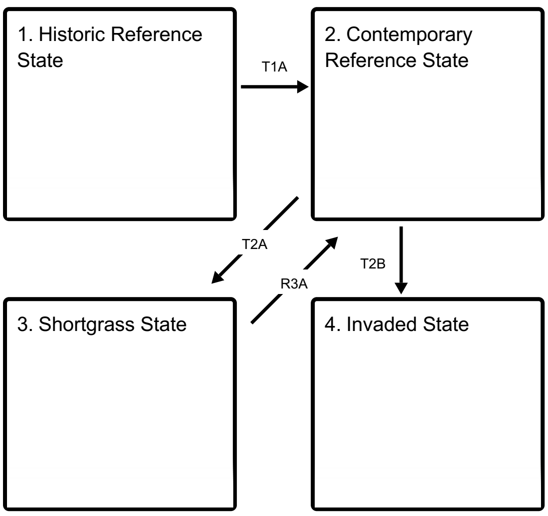
The effects of an altered fire regime are not completely understood at the time of this writing, but evidence suggests that long-term fire suppression can result in accumulations of litter and may contribute to increased abundance of non-native grasses (Murphy and Grant, 2005; Vermeire et al., 2011; Whisenant, 1990). Conversely, fire return intervals of less than 6 years, such as annual burning, can reduce productivity and shift species composition toward warm-season, short-statured grasses (Shay et al., 2001; Smith and McDermid, 2014).

Due to the steep slopes and shallow soils, this ecological site is generally not suitable for cropland. In general, this site has not been converted to cropland and has remained in native vegetation.

The state-and-transition model (STM) suggests possible pathways that plant communities on this site may follow as a result of a given set of ecological processes and management. The site may also support states not displayed in the STM diagram. Landowners and land managers should seek guidance from local professionals before prescribing a particular management or treatment scenario. Plant community responses vary across this MLRA due to variability in weather, soils, and aspect. The reference community phase may not necessarily be the management goal. The lists of plant species and species composition values are provisional and are not intended to cover the full range of conditions, species, and responses for the site. Species composition by dry weight is provided when available and is considered provisional based on the sources identified in the narratives associated with each community phase.

State and transition model

Ecosystem states



T1A - Introduction of non-native species, such as Kentucky bluegrass and sweetclover.

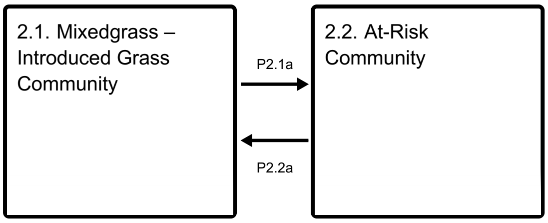
T2A - Prolonged drought, improper grazing management, or a combination of these factors

T2B - Displacement of native species by non-native invasive species (Kentucky bluegrass, noxious weeds, etc.)

R3A - Range seeding, grazing land mechanical treatment, timely moisture, proper grazing management (management intensive, costly, and may be unfeasible in some cases)

State 1 submodel, plant communities

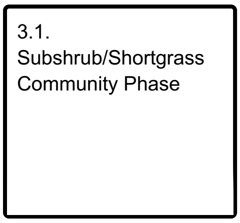
State 2 submodel, plant communities



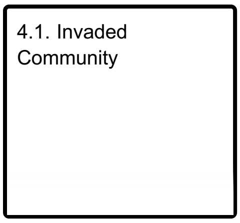
P2.1a - Drought, improper grazing management

P2.2a - Return to normal or above average precipitation, proper grazing management

State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Historic Reference State

The Historic Reference State (1) contains one community phase characterized rhizomatous wheatgrasses and mid-statured bunchgrasses. This state is considered extinct and is included here for historical reference purposes. It evolved under the combined influences of climate, grazing, and fire, with climatic variation having the greatest influence on cover and production. In general, this state was resilient to grazing; however, localized areas likely received heavy grazing, which resulted in the species composition shifting to short-statured species. Fire most likely resulted in a short-term shift in species composition to more warm-season grasses such as blue grama and fewer cool-season bunchgrasses.

Community 1.1
Mixedgrass Community

The Mixedgrass Community Phase (1.1) was characterized by rhizomatous wheatgrasses and mid-statured bunchgrasses. Rhizomatous wheatgrasses were dominantly thickspike wheatgrass (*Elymus lanceolatus*) in the north and gradually transitioned to western wheatgrass (*Pascopyrum smithii*) in the south as conditions became warmer and drier. Green needlegrass (*Nassella viridula*) was the dominant mid-statured bunchgrass. Blue grama (*Bouteloua gracilis*) and prairie Junegrass (*Koeleria macrantha*) were the predominant shortgrasses and occurred at low cover (Coupland, 1950, 1961). Forbs comprised about 10 percent of the cover and shrubs about 1 to 5 percent.

State 2
Contemporary Reference State

The Contemporary Reference State (2) contains two community phases characterized by mid-statured bunchgrasses and sedges such as threadleaf sedge. It evolved under the combined influences of climate, grazing, and fire, with climatic variation having the greatest influence on cover and production. This state differs from the historical reference state in that it is influenced by introduced plant species and has altered fire and grazing regimes. In general, this state is resilient to grazing and fire, although these factors can influence species composition in localized areas

Community 2.1
Mixedgrass – Introduced Grass Community

The Mixedgrass – Introduced Grass Community Phase (2.1) is predominantly native mid-statured grasses but has some degree of non-native grass establishment. Plant communities are dominantly thickspike wheatgrass and green needlegrass in the north and gradually transition to western wheatgrass and green needlegrass in the south as conditions became warmer and drier. Blue grama and prairie Junegrass are the predominant shortgrasses and they occur at low cover. (Coupland, 1950, 1961). Forbs comprise about 10 percent of the cover and shrubs about 1 to 5 percent. Non-native species typically comprise 1 to 3 percent of the plant community and may include yellow sweetclover (*Melilotus officinalis*) and Kentucky bluegrass (*Poa pratensis*).

Community 2.2
At-Risk Community

The At-Risk Community Phase (2.2) occurs when site conditions decline due to drought or improper grazing management. It is characterized by an increase in shortgrasses and a decline in mid-statured grasses. Cover of shortgrasses equals or exceeds the cover of mid-statured grasses. Mid-statured rhizomatous wheatgrasses are in decline and have been substantially reduced in both cover and vigor. Mid-statured bunchgrasses such as green needlegrass are rare or absent. Shortgrasses such as blue grama and prairie Junegrass are increasing. Subshrubs such as broom snakeweed (*Gutierrezia sarothrae*) and rubber rabbitbrush (*Ericameria nauseosa*) may also increase in this phase.

Pathway P2.1a
Community 2.1 to 2.2

Drought, improper grazing management, or a combination of these factors can shift the Mixedgrass - Introduced Grass Community Phase (2.1) to the At-Risk Community Phase (2.2). These factors favor an increase in shortgrasses such as blue grama and a decrease in midgrasses (Coupland, 1961).

Pathway P2.2a
Community 2.2 to 2.1

Normal or above-normal spring precipitation and proper grazing management transition the At-Risk Community Phase (2.2) back to the Mixedgrass - Introduced Grass Community Phase (2.1).

State 3
Shortgrass State

The Shortgrass State (3) consists of one community phase. The dynamics of this state are driven by long-term drought, improper grazing management, or a combination of these factors. Shortgrasses increase with long-term improper grazing at the expense of cool-season midgrasses (Coupland, 1961; Biondini and Manske, 1996). In particular, communities dominated by blue grama can alter soil properties, creating conditions that resist establishment of other grass species (Dormaar and Willms, 1990; Dormaar et al., 1994). Reductions in stocking rates can reduce shortgrass cover and increase the cover of cool-season midgrasses, although this recovery may take decades (Dormaar and Willms, 1990; Dormaar et al., 1994).

Community 3.1
Subshrub/Shortgrass Community Phase

The Subshrub/Shortgrass Community Phase (3.1) occurs when site conditions decline due to long-term drought or improper grazing. Mid-statured grasses such as green needlegrass and rhizomatous wheatgrasses have been largely eliminated. Subshrubs such as broom snakeweed and rubber rabbitbrush dominate the plant community. Shortgrasses such as blue grama and prairie Junegrass are common. Unpalatable forbs such as curlycup gumweed (*Grindelia squarrosa*) may also be common.

State 4
Invaded State

The Invaded State (4) occurs when invasive plant species invade adjacent native grassland communities and displace the native species. Data suggest that the diversity of native species declines significantly when invasive species exceed 30 percent of the plant community. Non-native perennial grasses, such as Kentucky bluegrass, are the most widespread concerns. Kentucky bluegrass is widespread throughout the Northern Great Plains (Toledo et al., 2014) and is very competitive. It displaces native species by forming dense root mats, altering nitrogen cycling, and having allelopathic effects on germination (DeKeyser et al., 2013). It may also alter soil surface hydrology and modify soil surface structure (Toledo et al., 2014). Plant communities dominated by Kentucky bluegrass have significantly less cover of native grass and forb species (Toledo et al., 2014; DeKeyser et al., 2009). Invasive grass species can invade relatively undisturbed grasslands, and it is not clear what triggers them to displace native species. In some cases, they have been found to substantially increase under long-term grazing exclusion (DeKeyser et al., 2009, 2013; Grant et al., 2009), but a consistent correlation to grazing management practices cannot be made at this time. Noxious weeds such as leafy spurge and Canada thistle are not widespread in MLRA 53A, but they can be a concern in localized areas. These species are very aggressive perennials. They typically displace native species and dominate ecological function when they invade a site. In some cases, these species can be suppressed through intensive management (herbicide application, biological control, or intensive grazing management). Control efforts are unlikely to eliminate noxious weeds, but their density can be sufficiently suppressed so that species composition and structural complexity are similar to that of the Contemporary Reference State (2). However, cessation of control methods will most likely result in recolonization of the site by the noxious species.

Community 4.1
Invaded Community

Encroachment by introduced grasses, noxious weeds, and other invasive species is common. Reduced plant species diversity, simplified structural complexity, and altered biologic processes result in a state that is substantially departed from both the Reference State (1) and the Contemporary Reference State (2).

Transition T1A
State 1 to 2

Introduction of non-native species occurred in the early 20th century. The naturalization of these species in relatively undisturbed grasslands, coupled with changes in fire and grazing regimes, transitions the Reference State (1) to the Contemporary Reference State (2).

Transition T2A
State 2 to 3

Prolonged drought, improper grazing management, or a combination of these factors weakens the resilience of the Contemporary Reference State (2) and drives its transition to the Shortgrass State (3). The Contemporary Reference State (2) transitions to the Shortgrass State (3) when mid-statured grasses become rare and contribute little to production. Subshrubs and shortgrasses such as blue grama and prairie Junegrass dominate the plant community.

Transition T2B
State 2 to 4

The Contemporary Reference State (2) transitions to the Invaded State (4) when aggressive perennial grasses or noxious weeds displace native species. The most common concerns are introduced bluegrasses, which are widespread invasive species in the Northern Great Plains (Henderson and Naeth, 2005; Toledo et al., 2014). The precise triggers of this transition are not clear, but data suggest that exclusion of grazing and fire may be a contributing factor in some cases (DeKeyser et al., 2013). In addition, other rangeland health attributes, such as reproductive capacity of native grasses and soil quality, have been substantially altered.

Restoration pathway R3A

State 3 to 2

A reduction in livestock grazing pressure alone may not be sufficient to reduce the cover of shortgrasses in the Shortgrass State (3) (Dormaar and Willms, 1990). Blue grama, in particular, can resist displacement by other species (Dormaar and Willms, 1990; Laycock, 1991; Dormaar et al., 1994; Lacey et al., 1995). Intensive management, such as reseeding and mechanical treatment, may be necessary (Hart et al., 1985), but these practices are labor intensive, costly, and may not be possible on this site due to topography. Therefore, returning the Shortgrass State (3) to the Contemporary Reference State (2) may require considerable energy and cost, and may not be feasible within a reasonable amount of time.

Conservation practices

Prescribed Grazing
Grazing Land Mechanical Treatment
Range Planting

Additional community tables

Inventory data references

No field plots were available for this site. A review of the scientific literature and professional experience was used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on this information and the sources identified in this ecological site description.

Other references

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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	05/13/2025
Approved by	Kirt Walstad
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:**