# Ecological site FX053A99X160
# Thin Breaks (TB)

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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 gravels. 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 have 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 with approximately 50 percent of the land area in 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 the Stipa-Agropyron, Stipa-Bouteloua-Agropyron, and Stipa-Bouteloua faciations (Coupland, 1950; 1961). Cool season grasses predominate 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, forming 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 Grassland 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) • Alliance: Schizachyrium scoparium Northwestern Great Plains Grassland Alliance • Association: Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Grassland 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

This provisional ecological site is common throughout MLRA 53A. Figure 1 illustrates the distribution of this ecological site based on current data. This map is approximate, is not intended to be definitive, and may be subject to change. Thin Breaks is an extensive ecological site occurring on moderately steep to very steeply sloping landscapes, usually occuring in areas that have been dissected by streams or rivers and where bedrock occurs near the surface. This site is characterized by lithic or paralithic bedrock within 40 inches of the soil surface and a relatively young, undeveloped soil profile, which is lacking features such as an argillic horizon. Soils typically have an ochric epipedon, but may have a mollic epipedon in some cases. Characteristic vegetation is little bluestem (Schizachyrium scoparium), sideoats grama (Bouteloua curtipendula), and needle and thread (Hesperostipa comata).

## Associated sites

| | |
|---|---|
| **FX053A99X029** | **Limy Steep (LyStp)**<br><br>This site occurs upslope from the Thin Breaks ecological site It most commonly occupies a shoulder position were the soil depth is greater than 40 inches. |
| **FX053A99X131** | **Shallow Clay (SwC)**<br><br>This site occurs on moderate to steeply sloping hillslopes adjacent to the Thin Breaks ecological site where soils contain greater than 35 percent clay. It typically occupies a similar slope position to the Thin Breaks ecological site. |

## Similar sites

| | |
|---|---|
| **FX053A99X131** | **Shallow Clay (SwC)**<br><br>This site differs from Thin Breaks in that the clay content is greater than 35 percent and depth to bedrock is less than 20 inches. |
| **FX053A99X029** | **Limy Steep (LyStp)**<br><br>This site differs from the Thin Breaks ecological site in that the soil depth is greater than 40 inches and soils are typically derived from glacial till rather than residuum. Composition of cool-season bunchgrasses is significantly higher. |
| **FX053A99X040** | **Loamy Steep (LoStp)**<br><br>This site differs from Thin Breaks ecological site in that the soil is typically greater than 40 inches deep and derived from glacial till. When moderately deep (20 to 40 inches) soils are well developed (evidenced by a mollic epipedon and argillic horizon). |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Schizachyrium scoparium*<br>(2) *Bouteloua curtipendula* |

## Legacy ID

R053AY721MT

## Physiographic features

The Thin Breaks ecological site largely occurs where the till plain has been dissected by streams or rivers and bedrock occurs near the surface. It occurs on a variety of slope positions including side slopes, nose slopes, and headslopes. Typical landforms are hillslopes, bluffs, and escarpments. Slopes vary from 0 to 60 percent, but are typically greater than 15 percent .

**Figure 1. General distribution of the Thin Breaks ecological site by map unit extent.**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Geomorphic position, hills | (1) Side Slope<br>(2) Nose Slope<br>(3) Head Slope |
| Landforms | (1) Till plain > Hillslope<br>(2) Till plain > Bluff<br>(3) Till plain > Escarpment |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 550 – 1,010 m |
| Slope | 20 – 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) | 120-160 days |
| Precipitation total (characteristic range) | 280-380 mm |
| Frost-free period (average) | 110 days |
| Freeze-free period (average) | 140 days |
| Precipitation total (average) | 330 mm |

- (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 an 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. Steep slopes combined with bedrock at relatively shallow depths result in very high runoff potential. Intense precipitation events deliver large amounts of surface runoff downslope. 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

The soils that best represent the central concept of this ecological site are Cabba and Cambert. The Cabba soil is in the Ustorthents great group and is characterized by a surface horizon that lacks enough organic matter to have a mollic epipedon and by paralithic bedrock within 20 inches of the soil surface. The Cambert soil is in the Haplustepts great group and and is characterized by a surface horizon that lacks enough organic matter to have a mollic epipedon and by paralithic bedrock between 20 and 40 inches below the soil surface. Both soils have mixed mineralogy and the typical parent material is loamy or silty residuum. The soil moisture regime for all soils in this ecological site concept is typic ustic, 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. These soils have a frigid soil temperature regime (Soil Survey Staff, 2014).

Surface horizon textures found in this site are typically loam or silt loam, but maybe also include sandy loam and silty clay loam. Clay content is typically 18 to 25 percent and sand content is typically less than 70 percent. The underlying horizons are typically weakly developed and an argillic horizon is lacking. Subsurface textures are typically similar to the surface horizon. Organic matter content in the surface horizon typically ranges from 1 to 3 percent, and moist colors vary from light olive brown (2.5Y 5/4) to very dark grayish brown (10YR 3/2). Typically the surface horizon that lacks enough organic matter to have a mollic epipedon, but not always. The upper 5 inches of these soils frequently reacts with hydrochloric acid and the calcium carbonate equivalent varies from 0 to 10 percent. In the upper 20 inches, electrical conductivity is less than 4, and the sodium absorption ratio is less than 13. Soil pH classes are slightly to moderately alkaline in the surface horizon and moderately to strongly alkaline in the subsurface horizons. The soil depth class for this site can be very shallow (less than 10 inches), but is typically shallow to moderately deep (10 to 40 inches). Content of coarse fragments in the upper 20 inches of soil is less than 35 percent.

**Table 5. Representative soil features**

| | |
|---|---|
| Parent material | (1) Residuum |
| Surface texture | (1) Loam<br>(2) Silt loam |
| Drainage class | Well drained |
| Depth to restrictive layer | 0 – 100 cm |
| Soil depth | 0 – 100 cm |
| Available water capacity (0-101.6cm) | 14.73 – 18.54 cm |
| Calcium carbonate equivalent (0-12.7cm) | 0 – 10 % |
| Electrical conductivity (0-50.8cm) | Not specified |
| Sodium adsorption ratio (0-50.8cm) | 0 – 10 |
| Soil reaction (1:1 water) (0-101.6cm) | 7.4 – 10 |
| Subsurface fragment volume <=3" (0-50.8cm) | 0 – 30 % |

| | |
|---|---|
| Subsurface fragment volume >3" (0-50.8cm) | 0 – 30 % |

## Ecological dynamics

The information in this ecological site description, including the state-and-transition model (STM) (Figure 3), 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 Thin Breaks provisional ecological site in MLRA 53A consists of four states: the Historic Reference state (1), the Current Potential state (2), the Altered 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).
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. 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 the mid-statured grasses and an increase in shortgrasses such as blue grama (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 warm season grasses such as blue grama (Coupland, 1958, 1961). Further degradation of the site due to improper grazing can result in a community dominated by shortgrasses such as blue grama and prairie Junegrass (Koeleria cristata).

Most, if not all, extant examples of this site have some degree of invasion by non-native species. Non-native grasses such as crested wheatgrass (Agropyron cristatum), and bluegrasses (Poa spp.) are the most common invasive species. 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 creeping juniper (Juniperus horizontalis) and non-native grasses (Murphy and Grant, 2005; Gucker, 2006; Vermeire et al., 2011). Conversely, fire return intervals 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 the relatively 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) diagram (Figure 2) 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

## Additional community tables

**Table 6. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 7. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 8. Community 2.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 9. Community 3.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 10. Community 3.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 11. Community 4.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

## Inventory data references

Data for this provisional ecological site was obtained from one low-intensity plot and one medium-intensity plot representing the Contemporary Reference State (2). Two medium intensity plots from similar sites in the adjacent MLRA 54 were used as supplementary references. These plots were used in conjunction with a review of the scientific literature and professional experience to approximate the plant communities for the Contemporary Reference State (2). Information for remaining states was obtained from professional experience and a review of the scientific literature. All community phases are considered provisional based on these plots and the sources identified in this ecological site description.

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### Approval

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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 | 04/25/2025 |
| Approved by | |
| 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:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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):**

---

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:**