

Ecological site F107XB004MO

Deep Loess Protected Backslope Woodland

Last updated: 5/21/2020
Accessed: 10/06/2026

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): 107X—Iowa and Missouri Deep Loess Hills

The Iowa and Missouri Deep Loess Hills (MLRA 107B) includes the Missouri Alluvial Plain, Loess Hills, Southern Iowa Drift Plain, and Central Dissected Till Plains landform regions (Prior 1991; Nigh and Schroeder 2002). It spans four states (Iowa, 53 percent; Missouri, 32 percent; Nebraska, 12 percent; and Kansas 3 percent), encompassing over 14,000 square miles (Figure 1). The elevation ranges from approximately 1,565 feet above sea level (ASL) on the highest ridges to about 600 feet ASL along the Missouri River near Glasgow in central Missouri. Local relief varies from 10 to 20 feet in the major river floodplains, to 50 to 100 feet in the dissected uplands, and loess bluffs of 200 to 300 feet along the Missouri River. Loess deposits cover most of the area, with deposits reaching a thickness of 65 to 200 feet in the Loess Hills and grading to about 20 feet in the eastern extent of the region. Pre-Illinoian till, deposited more than 500,000 years ago, lies beneath the loess and has experienced extensive erosion and dissection. Pennsylvanian and Cretaceous bedrock, comprised of shale, mudstones, and sandstones, lie beneath the glacial material (USDA-NRCS 2006). The vegetation in the MLRA has undergone drastic changes over time. Spruce forests dominated the landscape 30,000 to 21,500 years ago. As the last glacial maximum peaked 21,500 to 16,000 years ago, they were replaced with open tundras and parklands. The end of the Pleistocene Epoch saw a warming climate that initially prompted the return of spruce forests, but as the warming continued, spruce trees were replaced by deciduous trees (Baker et al. 1990). Not until approximately 9,000 years ago did the vegetation transition to prairies as climatic conditions continued to warm and subsequently dry. Between 4,000 and 3,000 years ago, oak savannas began intermingling within the prairie landscape, while the more wooded and forested areas maintained a foothold in sheltered areas. This prairie-forest transition ecosystem formed the dominant landscapes until the arrival of European settlers (Baker et al. 1992).

Classification relationships

Major Land Resource Area (MLRA): Iowa and Missouri Deep Loess Hills (107B) (USDA-NRCS 2006) USFS Subregions: Central Dissected Till Plains Section (251C); Deep Loess Hills (251Ca), Loess Hills (251Cb) Subsection; Nebraska Rolling Hills Section (251H), Yankton Hills and Valleys (251Ha), Pawnee City-Seneca Rolling Hill (251Hd) (Cleland et al. 2007) U.S. EPA Level IV Ecoregion: Steeply Rolling Loess Prairies (47e), Rolling Loess Prairies (47f), Nebraska/Kansas Loess Hills (47h) (USEPA 2013) Biophysical Setting (LANDFIRE 2009): North-Central Interior Maple-Basswood Forest (4213140) Ecological Systems (National Vegetation Classification System, Nature Serve 2015): North-Central Interior Maple-Basswood Forest (CES202.696) Eilers and Roosa (1994): Upland Woods Iowa Department of Natural Resources (INAI nd): Central Mesic Forest Lauver et al. (1999): *Acer saccharum* – [*Acer nigrum*] – *Tilia americana* – *Quercus rubra*/*Ostrya virginiana* Forest Missouri Natural Heritage Program (Nelson 2010): Mesic Loess/Glacial Till Forest Nebraska Game and Parks Commission (Steinauer and Rolfsmeier 2010): Red Oak – Basswood – Ironwood Forest Plant Associations (National Vegetation Classification System, Nature Serve 2015): *Acer saccharum* – *Acer nigrum* – *Tilia americana* – *Quercus rubra*/*Ostrya virginiana* Forest (CEGL002061)

Ecological site concept

Deep Loess Protected Backslope Woodlands are mapped in complex with Deep Loess Exposed Backslope Savannas and are located within the green areas on the map (Figure 1). They occur on north- and east-facing backslopes with slopes greater than fifteen percent. Soils are Alfisols, Entisols, Inceptisols, and Mollisols that are well-drained and very deep, formed from loess. These fine-silty, fertile soils have high soil uniformity resulting in increased nutrient- and water-holding capacity, increased organic matter retention, and good soil aeration that allows deep penetration by plant roots, which generally results in high plant productivity (Catt 2001). These sites occur adjacent to Deep Loess Upland Prairies and Deep Loess Exposed Backslope Savanna ecological sites. The historic pre-European settlement vegetation on this site was dominated by northern red oak (*Quercus rubra* L.) and American basswood (*Tilia americana* L.). Other tree species can include bitternut hickory (*Carya cordiformis* (Wangenh.) K. Koch), shagbark hickory (*Carya ovata* (Mill.) K. Koch), and white oak (*Quercus alba* L.), and sugar maple (*Acer saccharum* Marshall) becomes an important component on the eastern side of the Missouri River. The shrub layer is typically populated with pawpaw (*Asimina triloba* (L.) Dunal) and slippery elm (*Ulmus rubra* Muhl.).

Herbaceous species typical of an undisturbed plant community associated with this ecological site include narrowleaf wild leek (*Allium burdickii* (Hanes) A.G. Jones), American spikenard (*Aralia racemosa* L.), blue cohosh (*Caulophyllum thalictroides* (L.) Michx.), and American ginseng (*Panax quinquefolius* L.) (Ladd and Thomas 2015; Steinauer and Rolfsmeier 2010; Nelson 2010). Historically, catastrophic windthrow was the primary disturbance factor that maintained the composition of this site, while extreme drought, periodic pest outbreaks, browsing by native ungulates, and infrequent fires can limit woody species survival and recruitment (LANDFIRE 2009; Nelson 2010; Gucker 2011). Compared to calcareous loess wooded ecological sites in the MLRA, Deep Loess Protected Backslope Woodlands have no soil carbonates. The resulting lower pH environment slows the mineralization of nitrogen as well as leaves other important nutrients (phosphorus, iron, manganese) more available for plant uptake making these sites slightly more productive than their calcareous counterparts (Larcher 2003). In addition, Deep Loess Protected Backslope Woodlands have a higher clay content which increases the water holding capacity.

Associated sites

F107XB009MO	Calcareous Loess Upland Woodland Calcareous loess soils on slopes less than 15 percent including Pohocco and Timula
F107XB011MO	Calcareous Loess Exposed Backslope Woodland Calcareous loess soils on slopes greater than 15 percent with south and west aspects, including Pohocco and Timula
R107XB002MO	Deep Loess Upland Prairie Leached soils on slopes less than 15 percent including Arents, Contrary, Deroin, Higginsville, Melia, Monona, Ponca, Sibley, Sibleyville, Strahan, Udarents, Udorthents, Wakenda

Similar sites

R107XB003MO	Deep Loess Exposed Backslope Savanna Deep Loess Exposed Backslope Savannas only occur on south and west aspects
F107XB009MO	Calcareous Loess Upland Woodland Calcareous Loess Upland Woodlands have calcareous soils and only occur on slopes less than fifteen percent and are bur oak dominated
F107XB011MO	Calcareous Loess Exposed Backslope Woodland Calcareous Loess Exposed Backslope Woodlands have calcareous soils and only occur on south- and west aspects and are bur oak dominated
F107XB010MO	Calcareous Loess Protected Backslope Forest Calcareous Loess Protected Backslope Forests are similar in landscape position but are bur oak dominated and soils are calcareous

Table 1. Dominant plant species

Tree	(1) <i>Quercus rubra</i> (2) <i>Tilia americana</i>
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Shrub	(1) <i>Asimina triloba</i> (2) <i>Ulmus rubra</i>
Herbaceous	(1) <i>Carex jamesii</i> (2) <i>Sanguinaria canadensis</i>

Physiographic features

Deep Loess Protected Backslope Woodlands occur on uplands on backslopes with slopes greater than fifteen percent on north- and east-facing aspects on dissected till plains (Figure 2). This ecological site is unique to the Loess Hills landform situated on elevations ranging from approximately 400 to 1,400 feet ASL. This site does not experience flooding but rather generates runoff to adjacent, downslope ecological sites.

Figure 1. Figure 1. Location of Deep Loess Protected Backslope Woodland ecological site within MLRA 107B.

Figure 2. Figure 2. Representative block diagram of Deep Loess Protected Backslope Woodland and associated ecological sites.

Table 2. Representative physiographic features

Slope shape across	(1) Linear (2) Convex
Slope shape up-down	(1) Concave (2) Convex
Landforms	(1) Hillslope (2) Loess hill
Flooding frequency	None
Ponding frequency	None
Elevation	120 – 450 m
Slope	20 – 50 %
Water table depth	200 cm
Aspect	N, NE, E

Climatic features

The Iowa and Missouri Deep Loess Hills falls into two Köppen-Geiger climate classifications (Peel et al. 2007): hot humid continental climate (Dfa) dominates the majority of the MLRA with small portions in the south falling into the humid subtropical climate (Cfa). In winter, dry, cold air masses periodically shift south from Canada. As these air masses collide with humid air, snowfall and rainfall result. In summer, moist, warm air masses from the Gulf of Mexico migrate north, producing significant frontal or convective rains (Decker 2017). Occasionally, high pressure will stagnate over the region, creating extended droughty periods. These periods of drought have historically occurred on 22-year cycles (Stockton and Meko 1983).

The soil temperature regime of MLRA 107B is classified as mesic, where the mean annual soil temperature is between 46 and 59°F (USDA-NRCS 2006). Temperature and precipitation occur along a north-south gradient, where temperature and precipitation increase the further south one travels. The average freeze-free period of this ecological site is about 186 days, while the frost-free period is about 160 days (Table 2). The majority of the precipitation occurs as rainfall in the form of convective thunderstorms during the growing season. Average annual precipitation is 36 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 40 and 62°F, respectively.

Climate data and analyses are derived from 30-year average gathered from seven National Oceanic and Atmospheric Administration (NOAA) weather stations contained within the range of this ecological site (Table 4).

Table 3 Representative climatic features

Frost-free period (characteristic range)	130-160 days
Freeze-free period (characteristic range)	160-190 days
Precipitation total (characteristic range)	810-970 mm
Frost-free period (actual range)	130-160 days
Freeze-free period (actual range)	150-190 days
Precipitation total (actual range)	810-1,040 mm
Frost-free period (average)	150 days
Freeze-free period (average)	180 days
Precipitation total (average)	890 mm

- (1) OREGON [USC00236357], Oregon, MO
- (2) LEXINGTON 3E [USC00234904], Lexington, MO
- (3) CASTANA EXP FARM [USC00131277], Mapleton, IA
- (4) LOGAN [USC00134894], Logan, IA
- (5) MAPLETON NO.2 [USC00135123], Mapleton, IA
- (6) SIDNEY [USC00137669], Sidney, IA
- (7) KANSAS CITY INTL AP [USW00003947], Kansas City, MO

Influencing water features

Deep Loess Protected Backslope Woodlands are not influenced by wetland or riparian water features. Precipitation is the main source of water for this ecological site. Infiltration is slow to moderate (Hydrologic Groups B and C), and surface runoff is low to very high. Precipitation infiltrates the soil surface and percolates through the horizons unimpeded by any restrictive layer. The Dakota bedrock

aquifer in the northern region of this ecological site is typically deep and confined, leaving it generally unaffected by recharge. However, there are surficial aquifers in the Pennsylvanian strata in the southern extent of the ecological site that are shallow and allow some recharge (Prior et al. 2003). Surface runoff contributes some water to downslope ecological sites. Evapotranspiration rates occur on a latitudinal gradient, with the northern end of the ecological site receiving a greater number of days with sun and high winds resulting in a higher average evapotranspiration rate compared to the southern end (Visher 1954).

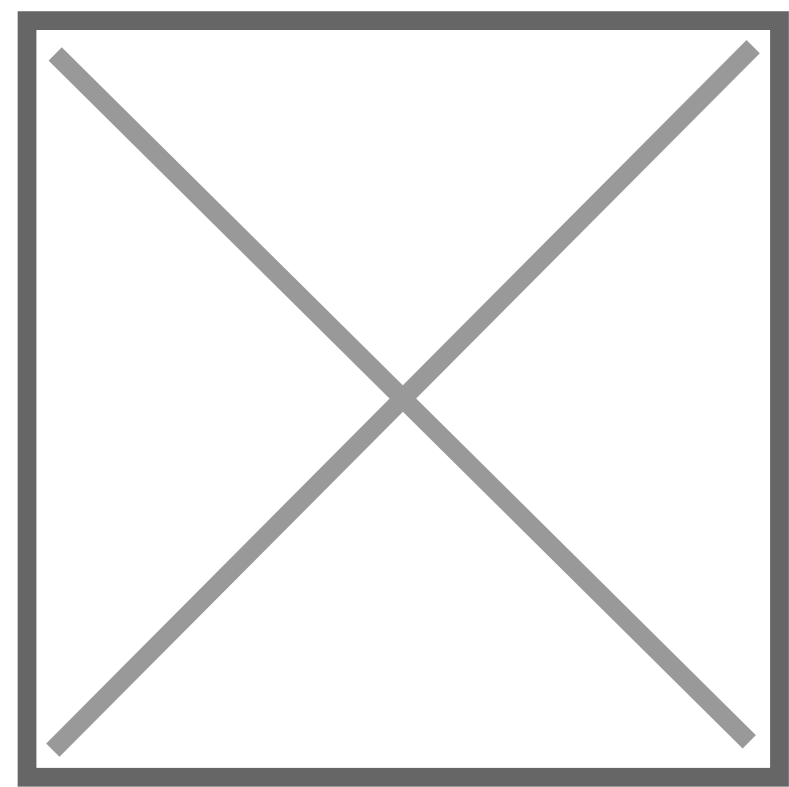


Figure 9. Figure 5. Hydrologic cycling in Deep Loess Protected Backslope Woodland.

Soil features

Soils of Deep Loess Protected Backslope Woodlands are in the Alfisol and Entisol orders, further classified as Mollic Hapludalfs and Typic Hapludalfs with slow to moderate infiltration and low to high runoff potential. The soil series associated with this site includes Knox, Menfro, Udarents, and Udorthents. The parent material is fine-silty loess, and the soils are well-drained and very deep with no coarse fragments. Soil pH classes are slightly acid to moderately alkaline. No rooting restrictions are noted for the soils of this ecological site.

Figure 10. Figure 6. Profile sketch of soil series associated with Deep Loess Protected Backslope Woodland.

Table 4. Representative soil features

Parent material	(1) Loess
Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Fine-silty
Drainage class	Well drained

Permeability class	Slow to moderately slow
Soil depth	200 cm
Available water capacity (0-101.6cm)	20.32 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	5.6 – 7.3

Ecological dynamics

The Loess Hills region lies within the transition zone between the eastern deciduous forests and the Great Plains. The heterogeneous topography of the area results in variable microclimates and fuel matrices that in turn are able to support prairies, savannas, woodlands, or forests (Novacek et al. 1985; Nelson 2010). Deep Loess Protected Backslope Forests form an aspect of this vegetative continuum. This ecological site occurs on north- and east-facing aspects of upland backslopes on loess soils. Species characteristic of this ecological site consist of northern red oak, hickory, and basswood with a shade-tolerant understory.

Catastrophic windthrow events are a major disturbance factor in Deep Loess Protected Backslope Woodlands. Within MLRA 107B, such events are mostly caused from tornadoes and associated winds and generally occur in the early summer months. Immediate responses to high wind events can alter forest structure and species richness or evenness, thereby impacting species diversity. Composition can also shift to one containing more early-successional species (Peterson 2000). Windthrow events that maintain the reference community have been modeled to occur approximately every 10 years (LANDFIRE 2009).

This ecological site is mostly populated with fire-sensitive species, indicating that fire was not a major disturbance factor. Rather, high-intensity, low-frequency fires typically followed catastrophic wind events or extreme periods of drought. These large stand-replacing fires were estimated to have occurred in intervals greater than 1,000 years. Periodic, light surface fires, occurring approximately on a 50-year fire-rotation interval, would help shape the composition and structure of young (

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 11. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

Wildlife Wild turkey, white-tailed deer, and eastern gray squirrel depend on hard and soft mast food sources and are typical upland game species of this type. Oaks provide hard mast; scattered shrubs provide soft mast; native legumes provide high-quality wildlife food; Sedges and native cool-season grasses provide green browse; patchy native warm-season grasses provide cover and nesting habitat; and a diversity of forbs provides a diversity and abundance of insects. Post-burn areas can provide temporary bare-ground – herbaceous cover habitat important for turkey poults and quail chicks. Bird species associated with mature communities include Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Eastern Wood-Pewee, Broad-winged Hawk, Great-Crested Flycatcher, Summer Tanager, and Red-eyed Vireo. Reptile and amphibian species associated with this ecological site include tiger salamander, small-mouthed salamander, ornate box turtle, northern fence lizard, five-lined skink, broad-headed skink, flat-headed snake, and rough earth snake.

Other information

Forestry Management: Site index values range from 68 to 81 for oak. Timber management opportunities are good. Create group openings of at least 2 acres. Large clearcuts should be minimized if possible to reduce impacts on wildlife and aesthetics. Uneven-aged management using single tree selection or group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Using prescribed fire as a management tool could have a negative impact on timber quality, may not be fitting, or should be used with caution on a particular site if timber management is the primary objective. Favor white oak and northern red oak. Limitations: No major equipment restrictions or limitations exist. Erosion is a hazard when slopes exceed 15 percent. On steep slopes greater than 35 percent, traction problems increase and equipment use is not recommended.

Inventory data references

No field plots were available for this site. A review of the scientific literature and professional experience were 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 these plots and the sources identified in ecological site description.

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Approval

Chris Tecklenburg, 5/21/2020

Acknowledgments

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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)	Lisa Kluesner
Contact for lead author	

Date	10/06/2026
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:

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:
