USDA Natural Resources Conservation Service

Ecological site F107XB011MO Calcareous Loess Exposed Backslope Woodland

Last updated: 5/21/2020
Accessed: 02/10/2025

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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

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), Loess Hills (251Cb) Subsection; Nebraska Rolling Hills Section (251H), 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 Dry-Mesic Oak Forest and Woodland (4213100)

Ecological Systems (National Vegetation Classification System, Nature Serve 2015): North-Central Interior Dry-Mesic Oak Forest and Woodland (CES202.046)

Eilers and Roosa (1994): Upland Woods

Iowa Department of Natural Resources (INAI nd): Eastern Dry Forest

Missouri Natural Heritage Program (Nelson 2010): Dry Loess/Glacial Till Woodland

Nebraska Game and Parks Commission (Steinauer and Rolfsmeier 2003): Oak – Hickory – Ironwood Forest

Plant Associations (National Vegetation Classification System, Nature Serve 2015): Quercus alba – (Quercus velutina) – Carya ovata/Ostrya virginiana Forest (CEGL002011)

Ecological site concept

Calcareous Loess Exposed Backslope Woodlands are mapped in complex with Calcareous Loess Protected Backslope Forests and occur within the green areas on the map (Figure 1). They occur on south- and west-facing backslopes with slopes greater than fifteen percent. Soils are Inceptisols that are well-drained and very deep. These sites are developed from loess with a significant component of carbonates at or near the surface, resulting in an alkaline (increased pH) environment. 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 Calcareous Loess Upland Woodland and Calcareous Loess Protected Backslope Forest ecological sites.

The historic pre-European settlement vegetation on this site was dominated by oak-hickory woodlands. Bur oak (Quercus macrocarpa Michx.) is associated with calcareous soils and thus forms the dominant oak component (Gucker 2011). Northern red oak (Quercus rubra L.), white oak (Quercus alba L.), and black oak (Quercus velutina Lam.) are associated oak components, with the southern ranges of this ecological site also supporting chinquapin oak (Quercus muehlenbergii Engelm.) (LANDFIRE 2009; Steinauer and Rolfsmeier 2010). The hickory component occurs on a latitudinal gradient, grading from bitternut hickory (Carya cordiformis (Wangenh.) K. Koch) in the north to shagbark hickory (Carya ovata (Mill.) K. Koch) in the south. The shrub layer consists of New Jersey tea (Ceanothus americanus L.). Diagnostic species in the herbaceous layer included whitetinge sedge (Carex albicans Willd. ex Spreng.) and hairy sunflower (Helianthus hirsutus Raf.). Other herbaceous species associated with an undisturbed community could include pointedleaf ticktrefoil (Desmodium glutinosum (Muhl. ex Willd.) Alph. Wood), wild yam (Dioscorea villosa L.), button eryngo (Eryngium yuccifolium Michx.), black-seed ricegrass (Patis racemosa (Sm.) Romasch., P.M. Peterson & R.J. Soreng), and American ginseng (Panax quinquefolius L.) (Steinauer and Rolfsmeier 2010; Nelson 2010). Fire was the primary disturbance factor that maintained this site, while drought, native mammal grazing, ice damage, and periodic insect defoliation were likely secondary factors (LANDFIRE 2009).

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

F107XB009MO	**Calcareous Loess Upland Woodland** Calcareous Loess Upland Woodlands support a similar oak-hickory community, but landscape position results in a moister environment and more productive bur oak component
F107XB004MO	**Deep Loess Protected Backslope Woodland** Deep Loess Protected Backslope Woodlands support a similar oak-hickory community, but the dominant oak is white oak

Table 1. Dominant plant species

Tree	(1) *Quercus macrocarpa* (2) *Carya ovata*
Shrub	(1) *Ceanothus americanus*
Herbaceous	(1) *Carex albicans* (2) *Helianthus hirsutus*

Physiographic features

Calcareous Loess Exposed Backslope Woodlands occur on uplands on backslopes with slopes greater than fifteen percent on south- and west-facing aspects on dissected till plains (Figure 2). This ecological site is unique to the Loess Hills landform situated on elevations ranging from approximately 500 to 1,600 feet ASL. This site does not experience flooding but rather generates runoff to adjacent, downslope ecological sites.

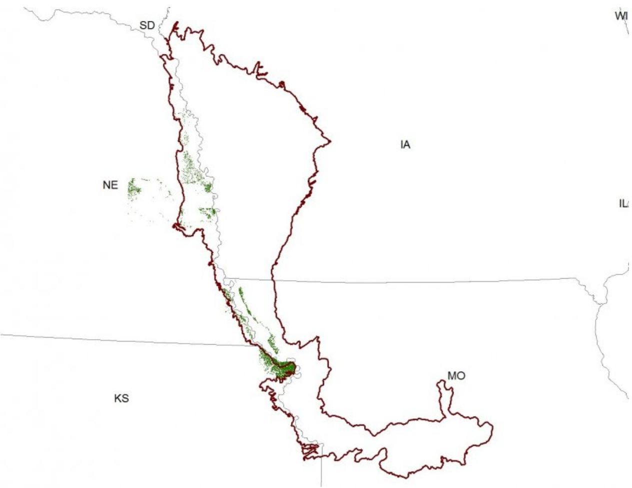


Figure 2. Figure 1. Location of Calcareous Loess Exposed Backslope Woodland ecological site within MLRA 107B.

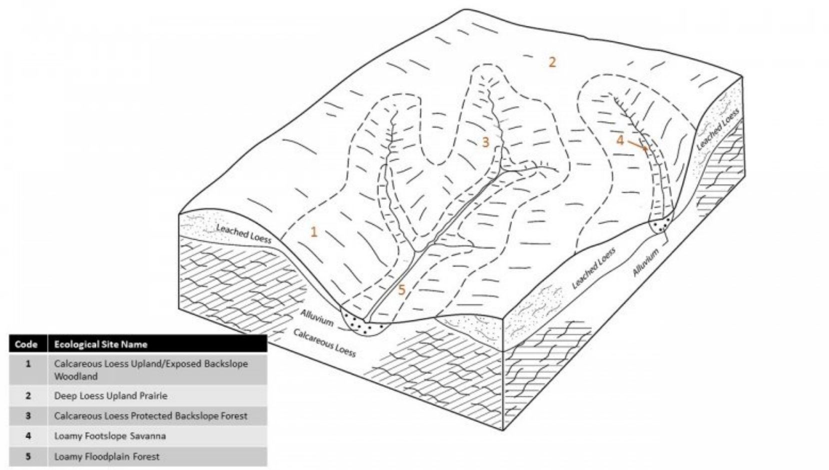


Figure 3. Figure 2. Representative block diagram of Calcareous Loess Exposed Backslope Woodland and associated ecological sites.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope
Slope shape across	(1) Linear (2) Convex
Slope shape up-down	(1) Concave (2) Convex
Landforms	(1) Loess hill
Flooding frequency	None
Ponding frequency	None
Elevation	499–1,601 ft
Slope	15–45%
Water table depth	80 in
Aspect	W, S, SW

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 you travel. The average freeze-free period of this ecological site is about 189 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 30 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 41 and 62°F, respectively.

Climate data and analyses are derived from 30-year average gathered from four 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)	140-151 days
Freeze-free period (characteristic range)	169-186 days
Precipitation total (characteristic range)	31-36 in
Frost-free period (actual range)	136-155 days
Freeze-free period (actual range)	164-192 days
Precipitation total (actual range)	31-37 in
Frost-free period (average)	146 days
Freeze-free period (average)	178 days
Precipitation total (average)	33 in

Climate stations used

- (1) AUBURN 5 ESE [USC00250435], Auburn, NE

- (2) TROY 3N [USC00148250], Troy, KS
- (3) OREGON [USC00236357], Oregon, MO
- (4) TEKAMAH [USC00258480], Tekamah, NE

Influencing water features

Calcareous Loess Exposed Backslope Woodlands are not influenced by wetland or riparian water features. Precipitation is the main source of water for this ecological site. Infiltration is moderate (Hydrologic Group B), and surface runoff is medium to high. Precipitation infiltrates the soil surface and percolates downward 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).

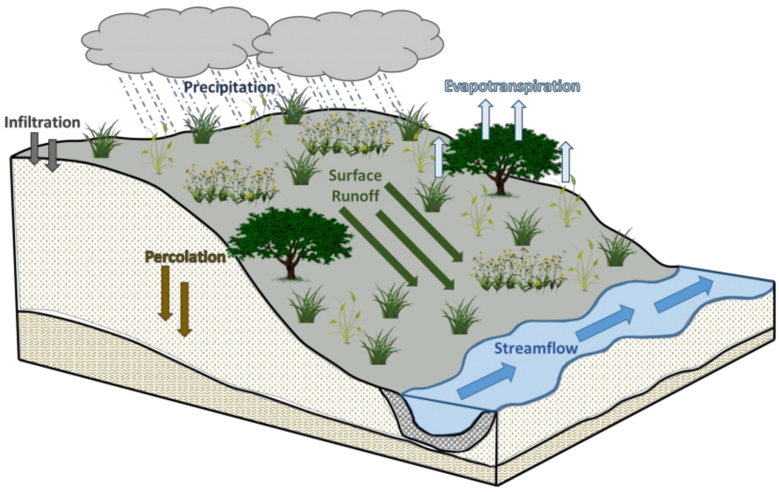


Figure 10. Figure 5. Hydrologic cycling in Calcareous Loess Exposed Backslope Woodland ecological site.

Soil features

Soils of Calcareous Loess Exposed Backslope Woodlands are in the Inceptisol order, further classified as Typic Eutrudepts, with moderate infiltration and medium to high runoff potential. The soil series associated with this site includes Pohocco and Timula. The parent material is calcareous 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. Average clay content is low limiting compaction susceptibility, but erosion from wind and water can be high.

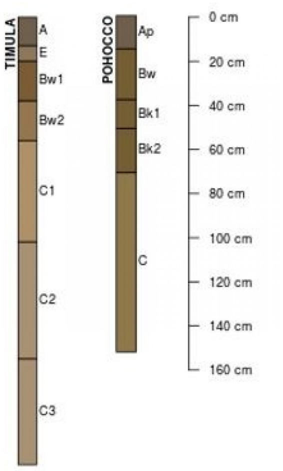


Figure 11. Figure 6. Profile sketches of soil series associated with

Calcareous Loess Exposed Backslope Woodland.

Table 4. Representative soil features

Parent material	(1) Calcareous loess
Surface texture	(1) Silt loam
Family particle size	(1) Fine-silty (2) Coarse-silty
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	80 in
Available water capacity (0-40in)	8 in
Calcium carbonate equivalent (0-40in)	0–35%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–8.4

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 and savannas or woodlands and forests (Novacek et al. 1985; Nelson 2005). Calcareous Loess Exposed Backslope Woodlands form an aspect of this vegetative continuum. This ecological site occurs on south and west aspects of upland backslopes on calcareous soils. Species characteristic of this ecological site consist of oaks and hickories.

Fire is the most important ecosystem driver for maintaining this ecological site (Dey and Kabrick 2015). Fire intensity typically consisted of periodic, low-to-moderate severity surface fires (LANDFIRE 2009). Ignition sources included summertime lightning strikes from convective storms and bimodal, human ignitions during the spring and fall seasons. Native Americans regularly set fires to improve sight lines for hunting, driving large game, improving grazing and browsing habitat, agricultural and village clearing, and enhancing vital ethnobotanical plants (Day 1953; Barrett 1980). Historic fire frequency has been estimated to occur on average every 6.6 years in the Loess Hills region (Stambaugh et al. 2006).

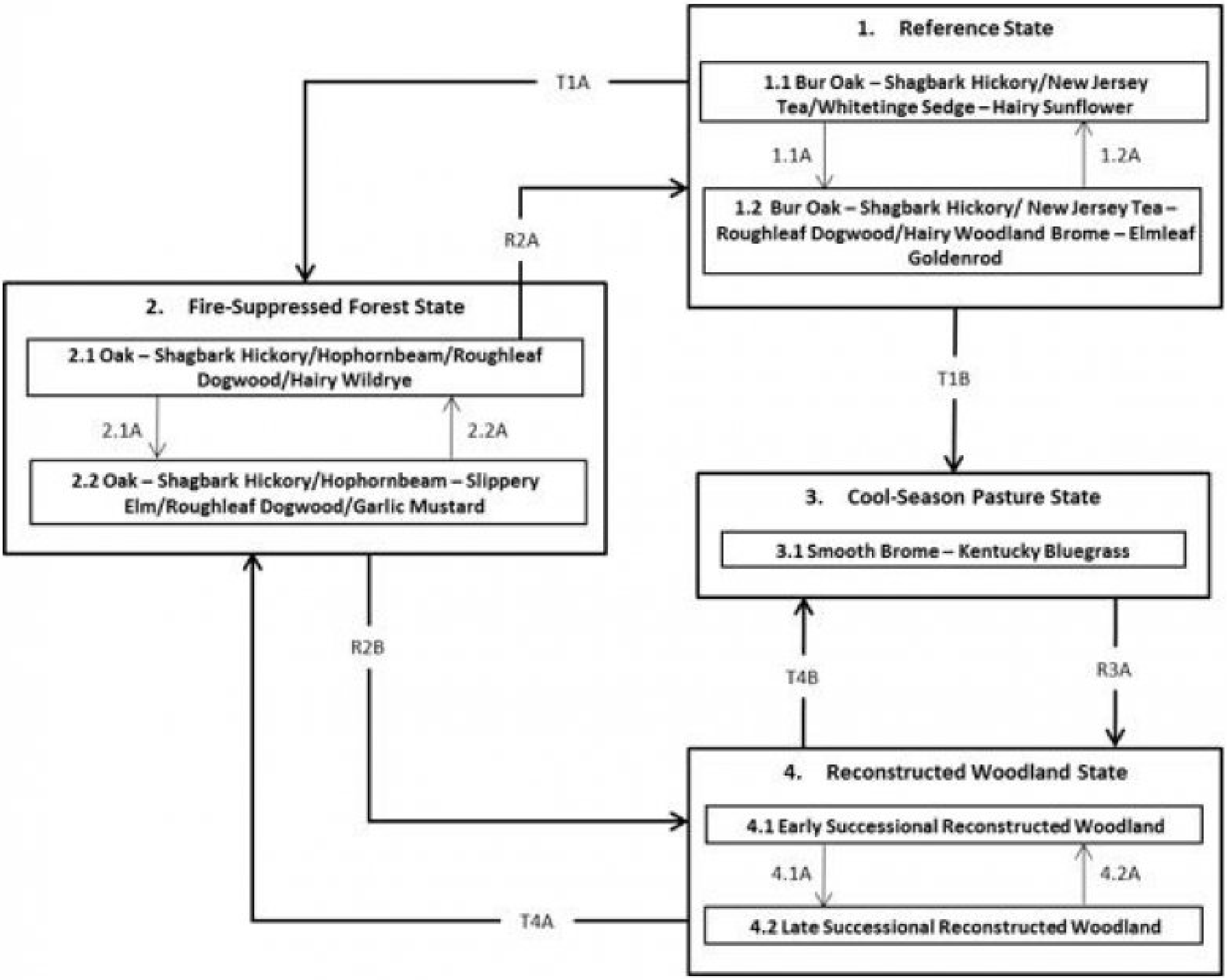
Drought has also played a role in shaping the woodland ecosystems in the Loess Hills. The periodic episodes of reduced soil moisture in conjunction with the well-drained soils have favored the proliferation of plant species tolerant of such conditions (Stambaugh et al. 2006). In addition, drought can also slow the growth of plants and result in dieback of certain species. When coupled with fire, periods of drought can also greatly delay the recovery of woody vegetation, substantially altering the extent of shrubs and trees (Pyne et al. 1996).

Grazing by native ungulates, ice storms, and periodic insect pest damage serve as an important secondary disturbance factors in wooded ecosystems, helping to shape stand composition, structure, condition, and functional complexity (Irland 2000; Briggs et al. 2002; LANDFIRE 2009). Grazing from native ungulates, such as bison (Bison bison), encourages the growth of woody plants by reducing understory species as well as reducing fine fuels that help carry fire into the woodlands (Briggs et al. 2002). Damage to stands from storms and pests can vary from minor, patchy effects of individual trees to major stand effects that could shift overstory composition (Irland 2000). In the case of Calcareous Loess Exposed Backslope Woodlands, periodic canopy openings from ice storms and insect defoliation as well as reduced competition from grasses and sedges can provide opportunities for the shade-intolerant oaks to regenerate.

Today, many Calcareous Loess Exposed Backslope Woodland sites have been extensively logged and converted to cool-season pastures for livestock grazing. Areas where slopes are less than twenty percent may have been converted to cropland, but these comprise a small portion of the landscape. Sites where reference community woodlands occur have experienced a shift in species composition and cover due to a successful long-term fire suppression policy. The current woodlands exhibit a more-closed canopy plant community that has limited oak regeneration. In addition, invasion by non-native species (e.g., garlic mustard (*Alliaria petiolata* (M. Bieb.) Cavara & Grande), common buckthorn (*Rhamnus cathartica* L.), multiflora rose (*Rosa multiflora* Thunb.), tree of heaven (*Ailanthus altissima* (Mill.) Swingle), and oriental bittersweet (Celastrus orbiculata Thunb.)) is rapidly threatening the remaining native community. A return to the historic plant community may not be possible but efforts to recover ecological functioning can improve the woodland ecosystem services.

State and transition model

F107BY011MO Calcareous Loess Exposed Backslope Woodland



Code	Process
T1A, T4A	Fire suppression in excess of 50 years
T1B, T4B	Tree removal and interseeding of non-native cool-season grasses
1.1A	Fire return interval reduced to every 10-15 years
1.2A	Fire return interval increased to every 5-10 years
R2A	Selective tree thinning and prescribed fire
2.1A	Fire suppression 50-65 years
2.2A	Single fire event
R2B, R3A	Tree planting, timber stand improvement, and prescribed fire
4.1A	Application of stand improvement practices
4.2A	Reconstruction experiences a setback from extreme weather event or improper timing of management action

State 1
Reference State

The reference plant community is categorized as a dry oak-hickory woodland. The two community phases within the reference state are dependent on a fire frequency of every one to ten years. Shorter fire intervals maintain dominance by bur oaks, while less frequent intervals allow other oak species and hickories to increase their dominance. Drought, ice storm, periodic insect defoliation, and native grazing disturbances have less impact in the reference phases, but do contribute to overall species composition, diversity, cover, and productivity.

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- shagbark hickory (*Carya ovata*), tree
- New Jersey tea (*Ceanothus americanus*), shrub
- roughleaf dogwood (*Cornus drummondii*), shrub
- hairy woodland brome (*Bromus pubescens*), grass
- whitetinge sedge (*Carex albicans*), grass
- elmleaf goldenrod (*Solidago ulmifolia*), other herbaceous

Community 1.1
Bur Oak – Shagbark Hickory / New Jersey Tea / Whitetinge Sedge – Hairy Sunflower

Bur oak is the dominant tree component of this phase with lesser components of northern red oak, white oak, black oak, and chinquapin oak, while shagbark hickory or bitternut hickory occurs as a canopy associate. Canopy coverage is estimated to range between 21 to 60 percent and is maintained by surface fires every five years (LANDFIRE 2009). New Jersey tea is the dominant shrub component, but leadplant (*Amorpha canescens* Pursh) and prairie willow (*Salix humilis* Marshall) can frequently occur (Nelson 2010). The herbaceous layer is moderately vegetated, typically with whitetinge sedge and hairy sunflower. Other common understory species include hairy wildrye (*Elymus villosus* Muhl. ex Willd.), clustered blacksnakeroot (*Sanicula odorata* (Raf.) K.M. Pryer & L.R. Phillippe), and white snakeroot (*Ageratina altissima* (L.) R.M. King & H. Rob.) (Steinauer and Rolfsmeier 2010).

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- shagbark hickory (*Carya ovata*), tree
- New Jersey tea (*Ceanothus americanus*), shrub
- whitetinge sedge (*Carex albicans*), grass
- hairy sunflower (*Helianthus hirsutus*), other herbaceous

Community 1.2
Bur Oak – Shagbark Hickory/New Jersey Tea – Roughleaf Dogwood/Hairy Woodland Brome – Elmleaf Goldenrod

This reference community phase can occur when fire frequency is reduced to approximately every ten to fifteen years (LANDFIRE 2009). Oaks and hickories continue to serve as the dominant canopy cover, but the reduced fire interval allows the canopy cover to increase. New Jersey tea and roughleaf dogwood (*Cornus drummondii* C.A. Mey) form a dense shrub layer, and the understory sees an increase of slightly more shade-intolerant species such as hairy woodland brome (*Bromus pubescens* Muhl. ex Willd.) and elmleaf goldenrod (*Solidago ulmifolia* Muhl. ex Willd.) (Steinauer and Rolfsmeier 2010).

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- shagbark hickory (*Carya ovata*), tree
- New Jersey tea (*Ceanothus americanus*), shrub
- roughleaf dogwood (*Cornus drummondii*), shrub
- hairy woodland brome (*Bromus pubescens*), grass
- elmleaf goldenrod (*Solidago ulmifolia*), other herbaceous

Pathway P1.1A
Community 1.1 to 1.2

Natural succession as a result of an average fire return interval of ten to fifteen years.

Pathway P1.2A
Community 1.2 to 1.1

Natural succession as a result of surface fires within ten years

State 2
Fire Suppressed Forest State

Fire suppression can transition the reference oak-hickory open woodland community into a closed-canopy forest state. This state is evidenced by an overstocked and overgrown canopy that exceeds 80 percent cover with a sparse herbaceous understory. Bur oak recruitment is suppressed as a result of the shaded conditions (LANDFIRE 2009; Nelson 2010). Non-native invasive species can readily colonize these sites including garlic mustard, common buckthorn, multiflora rose, tree of heaven, and oriental bittersweet (LANDFIRE 2009; Steinauer and Rolfsmeier 2010).

Dominant plant species

- shagbark hickory (*Carya ovata*), tree
- oak (*Quercus*), tree
- hophornbeam (*Ostrya virginiana*), shrub
- roughleaf dogwood (*Cornus drummondii*), shrub
- slippery elm (*Ulmus rubra*), shrub
- hairy wildrye (*Elymus villosus*), grass

Community 2.1
Oak – Shagbark Hickory/Hophornbeam/Roughleaf Dogwood/Hairy Wildr

This community phase represents a structural change of the reference oak-hickory woodland state. Lack of fire produces a forest structure of moderate height (30 to 80 feet) with trees are large (21-33 inch DBH) and canopy cover ranging 80 to 100 percent (LANDFIRE 2009). Hickories remain a dominant component, while northern red oaks and black oaks begin to replace bur oaks. Hophornbeam and roughleaf dogwood become dominant in the subcanopy and shrub canopy, respectively. The herbaceous layer diversity is reduced and becomes less dense as it is populated with only shade-tolerant species such hairy wildrye (Steinauer and Rolfsmeier 2010).

Dominant plant species

- oak (*Quercus*), tree
- shagbark hickory (*Carya ovata*), tree
- hophornbeam (*Ostrya virginiana*), shrub
- roughleaf dogwood (*Cornus drummondii*), shrub
- hairy wildrye (*Elymus villosus*), grass

Community 2.2
Oak – Shagbark Hickory/Hophornbeam – Slippery Elm/Roughleaf Dogwood/Garlic Mustard

Sites in this community phase have continued to have fire suppressed. The forest structure is similar to the previous community phase. Bur oaks are virtually absent from this phase as a result of the closed-canopy structure, and northern red oak and black oaks co-dominate with hickory. Hophornbeam and slippery elm (*Ulmus rubra* Muhl.) form a dense subcanopy as roughleaf dogwood, multiflora rose, and common buckthorn form a dense understory. The herbaceous layer becomes sparse allowing the non-native garlic mustard to invade and spread rapidly due to its ability to suppress re-establishment of native species (Stinson et al. 2006; Nelson 2010; Steinauer and Rolfsmeier 2010).

Dominant plant species

- oak (*Quercus*), tree
- shagbark hickory (*Carya ovata*), tree
- hophornbeam (*Ostrya virginiana*), shrub
- slippery elm (*Ulmus rubra*), shrub

- roughleaf dogwood (*Cornus drummondii*), shrub
- garlic mustard (*Alliaria petiolata*), other herbaceous

Pathway P2.1A
Community 2.1 to 2.2

Fire is removed from the landscape in excess of 65 years.

Pathway P2.2A
Community 2.2 to 2.1

Fire occurs within 50 years.

State 3
Cool Season Pasture State

The cool-season pasture state occurs when the reference state has been anthropogenically-altered for livestock production. Early settlers harvested the trees for timber and fuel and seeded such non-native cool-season species as smooth brome (*Bromus inermis* Leyss.) and Kentucky bluegrass (*Poa pratensis* L.), converting the woodland to pasture (Smith 1998; IDNR 2013). Over time, as lands were continually grazed by large herds of cattle, the non-native species were able to spread and expand across the site, reducing the native species diversity.

Dominant plant species

- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 3.1
Smooth Brome – Kentucky Bluegrass

The cool-season pasture state occurs when the reference state has been anthropogenically-altered for livestock production. Early settlers harvested the trees for timber and fuel and seeded such non-native cool-season species as smooth brome (*Bromus inermis* Leyss.) and Kentucky bluegrass (*Poa pratensis* L.), converting the woodland to pasture (Smith 1998; IDNR 2013). Over time, as lands were continually grazed by large herds of cattle, the non-native species were able to spread and expand across the site, reducing the native species diversity.

State 4
Reconstructed Woodland State

The combination of natural and anthropogenic disturbances occurring today has resulted in a number of forest health issues, and restoration back to the historic reference condition is likely not possible. Woodlands and forests are being stressed by non-native diseases and pests, habitat fragmentation, permanent changes in soil hydrology, past uncontrolled livestock grazing, and overabundant deer populations on top of naturally-occurring disturbances (severe weather and native pests) (Flickinger 2010). However, these habitats provide multiple ecosystem services including carbon sequestration; clean air and water; soil conservation; wildlife habitat; biodiversity support; timber, fiber, and fuel products; as well as a variety of cultural activities (e.g., hiking, camping, hunting) (Millennium Ecosystem Assessment 2005; Flickinger 2010). Therefore, conservation of forests and woodlands should still be pursued. Woodland reconstructions are an important tool for repairing natural ecological functioning and providing habitat protection for numerous species of Calcareous Loess Exposed Backslope Woodlands. Therefore ecological restoration should aim to aid the recovery of degraded, damaged, or destroyed ecosystems. A successful restoration will have the ability to structurally and functionally sustain itself, demonstrate resilience to the ranges of stress and disturbance, and create and maintain positive biotic and abiotic interactions (SER 2002). The reconstructed woodland state is the result of a long-term commitment involving a multi-step, adaptive management process.

Community 4.1
Early Successional Reconstructed Woodland

This community phase represents the early community assembly from woodland reconstruction. It is highly dependent on the current condition of the woodland based on past and current land management actions, invasive species, and proximity to land populated with non-native pests and diseases. Therefore, no two sites will have the same early successional composition. Technical forestry assistance should be sought to develop suitable stewardship management plans.

Community 4.2
Late Successional Reconstructed Woodland

Appropriately timed management practices (e.g., prescribed fire, hazardous fuels management, forest stand improvement, continuing integrated pest management) applied to the early successional community phase can help increase the stand maturity, pushing the site into a late successional community phase over time. A late successional reconstructed woodland will have an uneven-aged canopy and a well-developed understory.

Pathway P4.1A
Community 4.1 to 4.2

Application of stand improvement practices in line with a developed management plan.

Pathway P4.2A
Community 4.2 to 4.1

– Reconstruction experiences a setback from extreme weather event or improper timing of management actions.

Transition T1A
State 1 to 2

– Fire suppression efforts transition this site to the fire-suppressed forest state (2).

Transition T1B
State 1 to 3

Tree removal and interseeding non-native cool-season grasses transition this site to the cool-season pasture state (3).

Restoration pathway R2A
State 2 to 1

Selective tree thinning and prescribed fire is used to restore this site to the reference state (1).

Transition R2B
State 2 to 4

Site preparation, invasive species control (native and non-native), tree planting, and prescribed fire transition this site to the reconstructed woodland state

Restoration pathway R3A
State 3 to 4

Site preparation, invasive species control (native and non-native), tree planting, and prescribed fire transition this site to the reconstructed woodland state (4).

Restoration pathway T4A
State 4 to 2

Fire (or fire surrogate) suppression efforts transition this site to the fire-suppressed forest state (2).

Transition T4B
State 4 to 3

– Tree removal and interseeding non-native cool-season grasses transition this site to the cool-season pasture state (3).

Additional community tables

Animal community

Wildlife (MDC 2006)

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.

Birds associated with this ecological site include Worm-eating warbler, Whip-poor-will, Great Crested Flycatcher, Ovenbird, Pileated Woodpecker, Wood Thrush, Red-eyed Vireo, Northern Parula, Louisiana Waterthrush (near streams), and Broad-winged Hawk.

Reptile and amphibian species associated with mature forests include: ringed salamander, spotted salamander, marbled salamander, central newt, long-tailed salamander, dark-sided salamander, southern red-backed salamander, three-toed box turtle, western worm snake, western earth snake, and American toad.

Other information

Forestry

Management: Site index values range from 45 to 50 for oak. Timber management opportunities are poor to fair. 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 small 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, and should be used with caution on a particular site if timber management is the primary objective. Favor white oak, bur oak, chinkapin oak, and black 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

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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	02/10/2025
Approved by	Chris Tecklenburg
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:**

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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):**

---

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:

---

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:

17. **Perennial plant reproductive capability:**