Ecological site F107XB026MO
Wet Floodplain Woodland

Last updated: 5/21/2020
Accessed: 02/08/2025

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)

USFS Subregions: Central Dissected Till Plains Section (251C); Missouri River Alluvial Plain (251Cg) (Cleland et al. 2007)

U.S. EPA Level IV Ecoregion: Missouri Alluvial Plain (47d)

Biophysical Setting (LANDFIRE 2009): Eastern Great Plains Floodplain System (4214690)

Ecological Systems (National Vegetation Classification System, Nature Serve 2015): North-Central Interior Floodplain (CES202.694)

Eilers and Roosa (1994): Missouri River Alluvium Region: Riverine Systems

Lauver et al. (1999): Quercus macrocarpa – Quercus shumardii – Carya cordiformis/Chasmanthuim latifolium Forest

Missouri Natural Heritage Program (Nelson 2010): Mesic Bottomland Forest

Nebraska Game and Parks Commission (Steinauer and Rolfsmeier 2010): Mesic Bur Oak Forest and Woodland

Plant Associations (National Vegetation Classification System, Nature Serve 2015): Fraxinus pennsylvanica – Celtis spp. – Quercus spp. – Platanus occidentalis Floodplain Forest (CEGL002410)

Ecological site concept

Wet Floodplain Woodlands are located within the green areas on the map (Figure 1). They occur on elevated terraces in floodplains. Soils are Entisols and Mollisols that are somewhat-poorly drained and very deep, formed from alluvium. The site experiences irregular, brief flooding, resulting in a plant community comprised of both upland and hydrophytic woody and herbaceous vegetation (Nelson 2010). These sites occur adjacent to other floodplain forest ecological sites.

The historic pre-European settlement vegetation on this site was dominated by a semi-closed canopy of deciduous trees with an understory of shade-tolerant shrubs and spring ephemerals (LANDFIRE 2009). Bur oak (Quercus macrocarpa Michx.) and American sycamore (Platanus occidentalis L.) are the dominant trees in this ecological site, while black walnut (Juglans nigra L.), American elm (Ulmus americana L.), and slippery elm (Ulmus rubra Muhl) form an important sub-canopy component. The shrub layer is moderately-developed and can include wild plum (Prunus americana Marshall) and coralberry (Symphoricarpos orbiculatus Moench). Herbaceous species typical of an undisturbed plant community associated with this ecological site include Short's rockcress (Arabis shortii (Fernald) Gleason) and evening campion (Silene nivea (Nutt.) Muhl. Ex Otth) (Drobney et al. 2001; Steinauer and Rolfsmeier 2010; Nelson 2010; Ladd and Thomas 2015). Historically, irregular flooding was the primary disturbance factor, while windthrow events, insect and disease outbreaks, and infrequent fires were secondary factors (Rolsfmeier 2007; LANDFIRE 2009; Nelson 2010).

Associated sites

F107XB015MO	**Sandy/Loamy Floodplain Forest** Sandy alluvium soils on floodplains adjacent to stream channel including Alluvial land, Buckney, Carr, Grable, Haynie, Hodge, Kenmoor, Psammaquents, Riverwash, Sarpy, Treloar, and Waubonsie
F107XB016MO	**Loamy Floodplain Forest** Silty alluvium soils on floodplains adjacent to stream channel including Blake, Danbury, Floris, Gilliam, Grable, Grable variant, Haynie, Haynie variant, Kenridge, Landes, Lossing, McPaul, Modale, Modale variant, Moniteau, Morconick, Motark, Moville, Nodaway, Omadi, Paxico, Ray, Rodney, Scroll, Ticonic, Udifluvents, Udorthents, and Waubonsie
F107XB017MO	**Clayey Floodplain Forest** Clayey alluvium soils on floodplains adjacent to stream channel including Albaton, Blencoe, Blend, Leta, Myrick, Onawet, Owego, Parkville, Percival, and SansDessein

Similar sites

F107XB015MO	**Sandy/Loamy Floodplain Forest** Sandy/Loamy Floodplain Forests are similar in landscape position but parent material is sandy alluvium
F107XB017MO	**Clayey Floodplain Forest** Clayey Floodplain Forests are lower in landscape position and parent material is clayey alluvium
F107XB016MO	**Loamy Floodplain Forest** Loamy Floodplain Forests are similar in landscape position but parent material is silty alluvium

Table 1. Dominant plant species

Tree	(1) *Quercus macrocarpa* (2) *Platanus occidentalis*
Shrub	(1) *Juglans nigra* (2) *Ulmus americana*
Herbaceous	(1) *Elymus virginicus* (2) *Verbesina alternifolia*

Physiographic features

Wet Floodplain Woodlands occur in floodplains less subject to flooding within the Missouri River alluvial valley (Figure 2). This ecological site is unique to the Loess Hills landform situated on elevations ranging from approximately 340 to 1,650 feet ASL. This site experiences rare to frequent flooding with surface water or soil saturation lasting for approximately two to fifteen percent of the growing season (Nelson 2010).

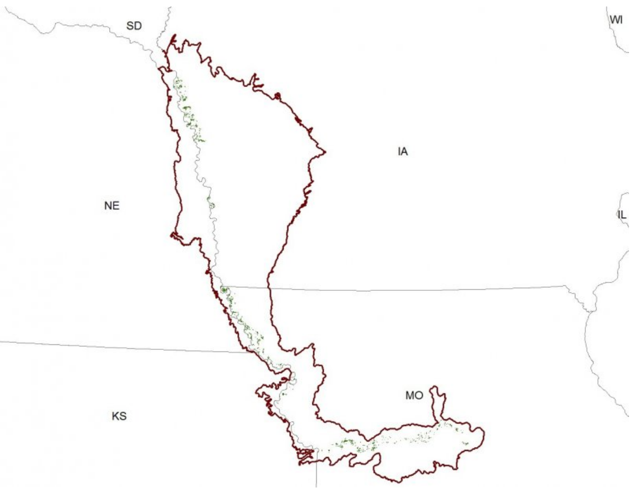


Figure 2. Figure 1. Location of Wet Floodplain Woodland ecological site within MLRA 107B.

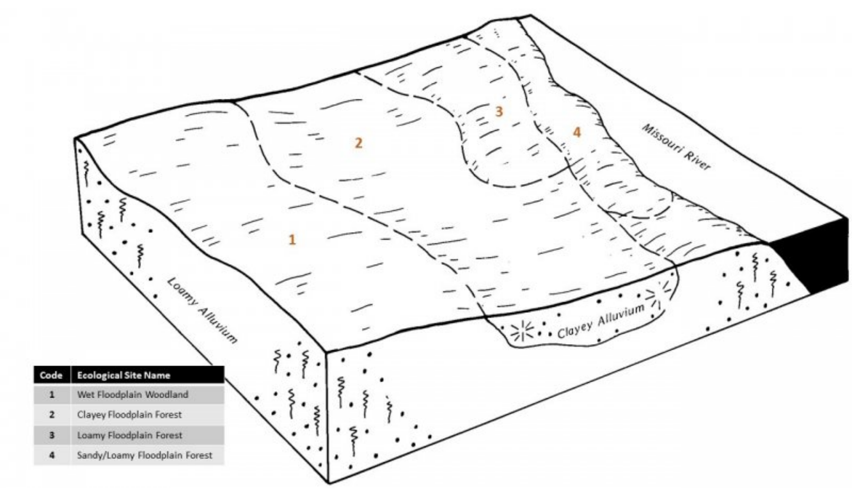


Figure 3. Figure 2. Representative block diagram of Wet Floodplain Woodland and associated ecological sites.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) Flood plain
Flooding duration	Very long (more than 30 days) to long (7 to 30 days)

Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	341–1,650 ft
Slope	0–2%
Water table depth	12–30 in
Aspect	Aspect is not a significant factor

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 184 days, while the frost-free period is about 163 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 37 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 41 and 63°F, respectively.

Climate data and analyses are derived from 30-year average gathered from eleven 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)	133-153 days
Freeze-free period (characteristic range)	164-185 days
Precipitation total (characteristic range)	32-40 in
Frost-free period (actual range)	131-160 days
Freeze-free period (actual range)	157-186 days
Precipitation total (actual range)	29-43 in
Frost-free period (average)	145 days
Freeze-free period (average)	175 days
Precipitation total (average)	35 in

Climate stations used

- (1) GLENWOOD 3SW [USC00133290], Glenwood, IA
- (2) BRUNSWICK [USC00231037], De Witt, MO
- (3) ST JOSEPH ROSECRANS AP [USW00013993], Wathena, MO
- (4) OMAHA EPPLEY AIRFIELD [USW00014942], Omaha, NE
- (5) SIOUX CITY GATEWAY AP [USW00014943], Sioux City, IA
- (6) NEBRASKA CITY 2NW [USC00255810], Nebraska City, NE
- (7) RULO 2W [USC00257401], Falls City, NE
- (8) LEAVENWORTH [USC00144588], Fort Leavenworth, KS
- (9) ATCHISON [USC00140405], Atchison, KS

- (10) LEXINGTON 3E [USC00234904], Lexington, MO
- (11) BLAIR [USC00250930], Blair, NE

Influencing water features

Wet Floodplain Woodlands are classified as a RIVERINE wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as Palustrine, Forested, Broad-Leaved Deciduous, Temporarily Flooded under the National Wetlands Inventory (FGDC 2013). The site can experience irregular, shallow (less than two feet) flooding from the nearby stream. Infiltration is slow (Hydrologic Group C) for undrained soils, and surface runoff is low to high. When flooding does occur, surface water or soil saturation can persist for approximately two to fifteen percent of the growing season (Nelson 2010).

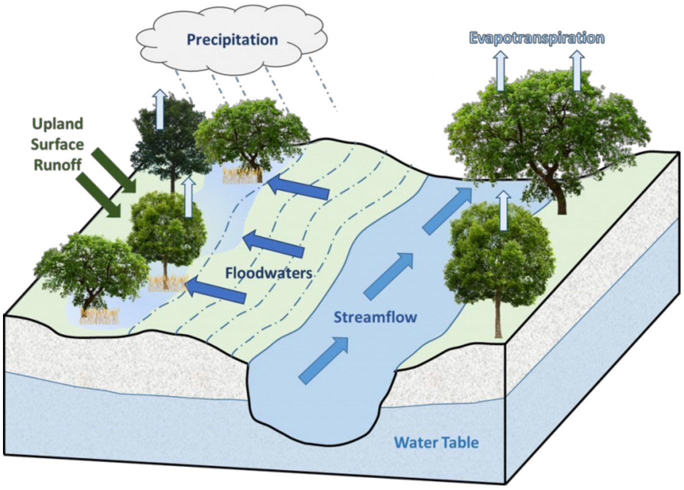


Figure 10. Figure 5. Hydrologic cycling in Wet Floodplain Woodland ecological site.

Soil features

Soils of Wet Floodplain Woodlands are in the Entisol and Mollisol orders, further classified as Aeric Fluvaquents, Aquic Udifluvents, and Fluvaquentic Hapludolls with slow infiltration and low to high runoff potential. The soil series associated with this site includes Dupo, Gilliam, Modale, and Paxico. The parent material is alluvium, and the soils are somewhat poorly-drained and very deep with seasonal high water tables. Soil pH classes are moderately acid to moderately alkaline. No rooting restrictions are noted for the soils of this ecological site.

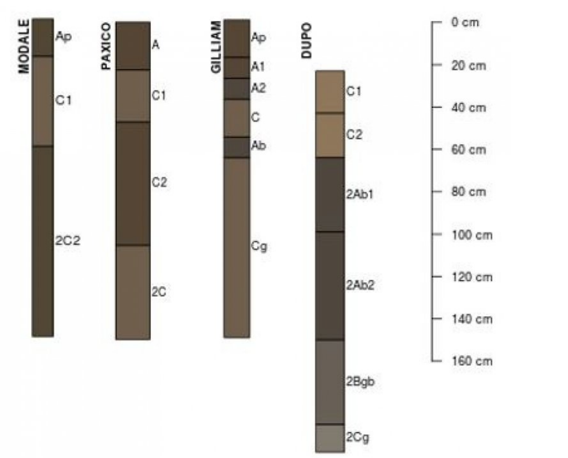


Figure 11. Figure 6. Profile sketches of soil series associated with Wet Floodplain Woodland.

Table 4. Representative soil features

Parent material	(1) Alluvium

Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Coarse-silty
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Slow to moderately slow
Soil depth	20–80 in
Available water capacity (0-40in)	4–8 in
Calcium carbonate equivalent (0-40in)	0–30%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.6–8.4

Ecological dynamics

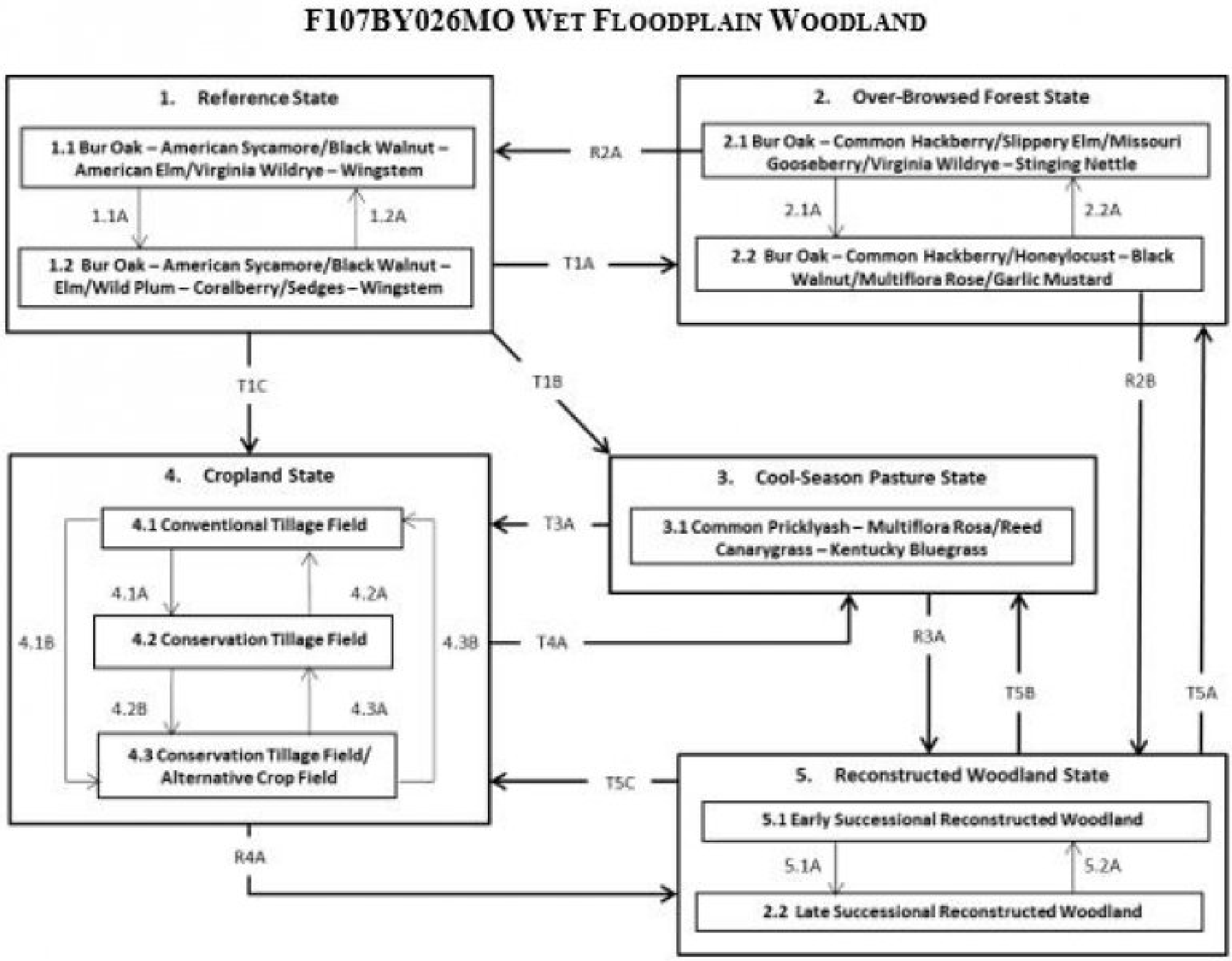
The Loess Hills region lies within the transition zone between the eastern deciduous forests and the Great Plains, with the Missouri River flowing through the middle. The heterogeneous topography of the area results in variable microclimates and fuel matrices that in turn are able to support prairies, savannas, woodlands, and forests (Nelson 2010). Wet Floodplain Woodlands form an aspect of this vegetative continuum. This ecological site occurs in floodplains less subject to flooding on somewhat poorly-drained alluvial soils. Species characteristic of this ecological site consist of upland and hydrophytic woody and herbaceous species (Nelson 2010; Steinauer and Rolfsmeier 2010).

Flooding is the dominant disturbance factor in Wet Floodplain Woodlands. Within MLRA 107B, seasonal flooding of shallow depths (less than 24 inches) occurs on an irregular basis, with surface water or soil saturation lasting for brief periods (two to fifteen percent) of the growing season. Sites are typically saturated in fall, winter, and spring (Nelson 2010).

Infrequent fires, windthrow events, and insect and disease outbreaks influence this site to a lesser, more localized extent (LANDFIRE 2009; Nelson 2010). Immediate responses to these events can alter forest structure and species richness or eveness, thereby impacting species diversity. Composition can also shift to one containing more early-successional species (Peterson 2000).

Today, many original Wet Floodplain Woodlands have been reduced as a result of drainage and clearing for agriculture, livestock, and urban development. Sites have also been degraded by stream channelization and levee construction which alters the hydrologic flood cycles and, ultimately, the reference plant community. Overgrazing by unnaturally high white-tailed deer populations also contributes to plant community changes, especially the reduction of ground flora and shrubs. Invasive species, such as garlic mustard (*Alliaria petiolata* L.), Japanese hops (*Humulus japonicus* Siebold & Zucc.), multiflora rose (*Rosa multiflora* Thunb.), common buckthorn (*Rhamnus cathartica* L.), and honeysuckle (*Lonicera maackii* (Rupr.) Herder, *Lonicera tatarica* L.) have been invading this site and reducing native species diversity (Nelson 2010; Steinauer and Rolfsmeier 2010).

State and transition model



Code	Process
T1A, T5A	Overabundant white-tailed deer populations, fire suppression, and altered hydrology
T1B, T4A, T5B	Woody species removal, interseeding cool-season grasses, and continuous grazing
T1C, T3A, T5C	Agricultural conversion via drain tile installation, tillage, seeding, and non-selective herbicide
1.1A	Recent flood or fire event
1.2A	Prolonged flood and/or fire-free period
R2A	Restore historic fire regime
R2B, R3A, R4A	Site preparation, tree planting/thinning, non-native species control
4.1A	Less tillage, residue management
4.1B	Less tillage, residue management, and implementation of cover cropping
4.2B	Implementation of cover cropping
4.2A, 4.3B	Intensive tillage, remove residue, and reinitiate monoculture row cropping
4.3A	Remove cover cropping

State 1
Reference State

The reference plant community is categorized as a wet-mesic bottomland oak woodland. The two community phases within the reference state are dependent on seasonal flooding regimes and infrequent fires. The amount of water occurring at flood stages and fire intensity affects species composition, cover, and extent. Windthrow events and pest outbreaks have more localized impacts in the reference phases, but do contribute to overall plant community composition, diversity, cover, and productivity.

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- American sycamore (*Platanus occidentalis*), tree
- sedge (*Carex*), grass
- Virginia wildrye (*Elymus submuticus*), grass

Community 1.1
Bur Oak – American Sycamore/Black Walnut – Elm/Virginia Wildrye – Wingstem

Sites in this reference community phase represent a bottomland oak woodland evolving out of shallow seasonal flooding (less than two feet) and infrequent fire (Nelson 2010). Bur oak and American sycamore are the dominant tree species for this reference community phase, while black walnut, common hackberry (*Celtis occidentalis* L.), slippery elm, and American elm are closely associated sub-canopy species (Rolfsmeier 2007; Nelson 2010; Steinauer and Rolfsmeier 2010). Tree heights range between 90 and 140 feet tall, tree size class is very large (>33-inches DBH), and the canopy coverage is between 40 and 67 percent (Rolfsmeier 2007; LANDFIRE 2009; Nelson 2010). The understory is dense and multilayered. The shrub layer is very scattered, populated with wild plum and coralberry. Numerous sedges and forbs form the herbaceous ground layer, including Virginia wildrye (*Elymus virginicus* L.) and wingstem (Nelson 2010; Steinauer and Rolfsmeier 2010).

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- American sycamore (*Platanus occidentalis*), tree
- elm (*Ulmus*), shrub
- black walnut (*Juglans nigra*), shrub
- Virginia wildrye (*Elymus submuticus*), grass
- wingstem (*Verbesina alternifolia*), other herbaceous

Community 1.2
Bur Oak – American Sycamore/Black Walnut – Elm/Wild Plum – Coralberry/Sedges – Wingstem

This reference community phase can occur following a prolonged disturbance-free period. The canopy and subcanopy are similar in composition but cover increases to greater than 67 percent (Rolfsmeier 2007). Wild plum and coralberry become a more significant component of the vegetative community due to lack of disturbances, and shade-tolerant species begin to become a more prominent component of the herbaceous layer (Rolfsmeier 2007; Steinauer and Rolfsmeier 2010).

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- American sycamore (*Platanus occidentalis*), tree
- elm (*Ulmus*), tree
- American plum (*Prunus americana*), shrub
- coralberry (*Symphoricarpos orbiculatus*), shrub
- sedge (*Carex*), grass
- wingstem (*Verbesina alternifolia*), other herbaceous

Pathway P1.1A
Community 1.1 to 1.2

Natural succession as a result of a prolonged, flood and/or fire-free period.

Pathway P1.2A
Community 1.2 to 1.1

Natural succession as a result of a recent flood or fire event.

State 2

Over-browsed Forest State

Overbrowsing by an unnaturally abundant white-tailed deer population (in addition to fire suppression and altered landscape hydrology) can transition the reference state into an over-browsed forest state. Continuous browsing has been reported to prevent the regeneration of the historic dominant canopy, which is replaced by mid-level and invasive species (Rolfsmeier 2007; Gubanyi et al. 2008; VerCauteren and Hygnstrom 2011). Common hackberry has a greater tolerance to deer browsing thus allowing it to dominate the tree canopy under high deer browse conditions. Similarly, as small woody shrubs and plants are continuously browsed, the gaps are replaced by less palatable herbaceous species (Gubanyi et al. 2008).

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- common hackberry (*Celtis occidentalis*), tree
- slippery elm (*Ulmus rubra*), shrub
- Virginia wildrye (*Elymus submuticus*), grass
- garlic mustard (*Alliaria petiolata*), other herbaceous

Community 2.1
Bur Oak – Common Hackberry/Slippery Elm/Missouri Gooseberry/Virginia Wildrye – Stinging Nettle

This community phase represents the initial impacts of browsing from an over-abundant deer population. The overstory component is out of browsing range from the deer and will persist. However, recruitment of these species becomes nonexistent as seedlings and small saplings are browsed. Common hackberry (*Celtis occidentalis* L.) is tolerant of deer browsing and can quickly become a co-dominant canopy species (Coladonato 1992; Rolsfmeier 2007; Gucker 2011). Wild plum and coralberry are preferred browse by deer and as they are reduced in the shrub canopy, Missouri gooseberry (*Ribes missouriense* Nutt.) becomes the dominant species (Rolfsmeier 2007; Steinauer and Rolfsmeier 2010). The herbaceous layer diversity is reduced, and disturbance-tolerant species, such as Virginia wildrye and stinging nettle remain (*Urtica dioica* L.).

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- common hackberry (*Celtis occidentalis*), tree
- slippery elm (*Ulmus rubra*), shrub
- Missouri gooseberry (*Ribes missouriense*), shrub
- Virginia wildrye (*Elymus submuticus*), grass
- stinging nettle (*Urtica dioica*), other herbaceous

Community 2.2
Bur Oak – Common Hackberry/Honeylocust – Black Walnut/Multiflora Rose/Garlic Mustard

As deer browsing continues unabated, the elms are replaced by honeylocust (*Gleditsia triacanthos* L.) and black walnut in the subcanopy (Rolfsmeier 2007). Non-native invasive species can become established and include multiflora rose and invasive garlic mustard (Gubanyi et al. 2008; Rawbinski 2008; Steinauer and Rolfsmeier 2010). In addition to continued disturbance from the overabundant deer, garlic mustard can also suppress the re-establishment of native species as it is known to produce an antifungal chemical that disrupts beneficial mychorrhizal fungi relationships (Stinson et al. 2006).

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- common hackberry (*Celtis occidentalis*), tree
- honeylocust (*Gleditsia triacanthos*), tree
- black walnut (*Juglans nigra*), tree
- multiflora rose (*Rosa multiflora*), shrub
- Virginia wildrye (*Elymus submuticus*), grass
- stinging nettle (*Urtica dioica*), other herbaceous
- garlic mustard (*Alliaria petiolata*), other herbaceous

Pathway P2.1A
Community 2.1 to 2.2

Deer populations continue to rise and browsing rates increase.

Pathway P2.2A
Community 2.2 to 2.1

Deer populations are reduced or browse protection around vegetation less than two meters in height is installed.

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 Kentucky bluegrass (*Poa pratensis* L.), converting the woodland to pasture (Smith 1998). 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

- multiflora rose (*Rosa multiflora*), shrub
- common pricklyash (*Zanthoxylum americanum*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

Community 3.1
Reed Canarygrass – Kentucky Bluegrass

Sites in this community phase arise from selective tree removal and seeding of non-native cool-season grasses (Steinauer and Rolfsmeier 2010). Oak, elm, sycamore, and hackberry all have some timber value and were harvested to supply the timber market for early settlers. Tree regeneration may occur for some time, but livestock can trample and eat tree seedlings thereby reducing the overstory. Unpalatable woody species, such as common pricklyash (*Zanthoxylum americanum* Mill.) and multiflora rose (*Rosa multiflora* Thunb.), can invade under excessive grazing (Randall and Herring 2012). Reed canarygrass (*Phalaris arundinacea* L.) and Kentucky bluegrass were common species used for pasture planting.

Dominant plant species

- common pricklyash (*Zanthoxylum americanum*), shrub
- multiflora rose (*Rosa multiflora*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

State 4
Cropland State

The Midwest is well-known for its highly-productive agricultural soils, and as a result, much of the MLRA has been converted to cropland, including portions of this ecological site. The continuous use of tillage, row-crop planting, and chemicals (i.e., herbicides, fertilizers, etc.) have effectively eliminated the reference community and many of its natural ecological functions in favor of crop production. Corn (*Zea mays* L.) and soybeans (*Glycine max* (L.) Merr.) are the dominant crops for the site. These areas are likely to remain in crop production for the foreseeable future.

Community 4.1
Conventional Tillage Field

Sites in this community phase typically consist of monoculture row-cropping maintained by conventional tillage practices. They are cropped in either continuous corn or corn-soybean rotations. The frequent use of deep tillage, low crop diversity, and bare soil conditions during the non-growing season negatively impact soil health. Under these practices, soil aggregation is reduced or destroyed, soil organic matter is reduced, erosion and runoff are increased, and infiltration is decreased, which can ultimately lead to undesirable changes in the hydrology of the watershed (Tomer et al. 2005).

Community 4.2
Conservation Tillage Field

This community phase is characterized by rotational crop production that utilizes various conservation tillage methods to promote soil health and reduce erosion. Conservation tillage methods include strip-till, ridge-till, vertical-till, or no-till planting systems. Strip-till keeps seedbed preparation to narrow bands less than one-third the width of the row where crop residue and soil consolidation are left undisturbed in-between seedbed areas. Strip-till planting may be completed in the fall and nutrient application either occurs simultaneously or at the time of planting. Ridge-till uses specialized equipment to create ridges in the seedbed and vegetative residue is left on the surface in between the ridges. Weeds are controlled with herbicides and/or cultivation, seedbed ridges are rebuilt during cultivation, and soils are left undisturbed from harvest to planting. Vertical-till systems employ machinery that lightly tills the soil and cuts up crop residue, mixing some of the residue into the top few inches of the soil while leaving a large portion on the surface. No-till management is the most conservative, disturbing soils only at the time of planting and fertilizer application. Compared to conventional tillage system, conservation tillage methods can reduce soil erosion, increase organic matter and water availability, improve water quality, and reduce soil compaction.

Community 4.3
Conservation Tillage Field/Alternative Crop Field

This condition applies conservation tillage methods as described above as well as adds cover crop practices. Cover crops typically include nitrogen-fixing species (e.g., legumes), small grains (e.g., rye, wheat, oats), or forage covers (e.g., turnips, radishes, rapeseed). The addition of cover crops not only adds plant diversity but also promotes soil health by reducing soil erosion, limiting nitrogen leaching, suppressing weeds, increasing soil organic matter, and improving the overall soil. In the case of small grain cover crops, surface cover and water infiltration are increased, while forage covers can be used to graze livestock or support local wildlife. Of the three community phases for this state, this phase promotes the greatest soil sustainability and improves ecological functioning within a cropland system.

Pathway P4.1A
Community 4.1 to 4.2

Tillage operations are greatly reduced, crop rotation occurs on a regular schedule, and crop residue is allowed to remain on the soil surface.

Pathway P4.1B
Community 4.1 to 4.3

Tillage operations are greatly reduced or eliminated, crop rotation is either reduced or eliminated, and crop residue is allowed to remain on the soil surface, and cover crops are implemented to prevent soil erosion.

Pathway P4.2A
Community 4.2 to 4.1

– Intensive tillage is utilized and monoculture row-cropping is established.

Pathway P4.2B
Community 4.2 to 4.3

Cover crops are implemented to prevent soil erosion.

Pathway P4.3B
Community 4.3 to 4.1

Intensive tillage is utilized, cover crops practices are abandoned, monoculture row-cropping is established, and crop rotation is reduced or eliminated.

Pathway P4.3A
Community 4.3 to 4.2

Cover crop practices are abandoned.

State 5
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 watershed hydrology, and overabundant deer populations on top of naturally-occurring disturbances (severe weather and native pests) (Flickinger 2010; Heitmeyer et al. 2015). However, these habitats provide multiple ecosystem services including carbon sequestration; clean air and water; soil conservation; biodiversity support; wildlife habitat; 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 Wet Floodplain 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 5.1
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 5.2
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 P5.1A
Community 5.1 to 5.2

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

Pathway P5.2A
Community 5.2 to 5.1

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

Transition T1A
State 1 to 2

Overbrowsing by white-tailed deer, fire-suppression, and altered hydrology transition this site to the over-browsed forest state (2).

Transition T1B
State 1 to 3

Woody species reduction, interseeding of non-native, cool-season grasses, and continuous grazing transition this site to the cool-season pasture state (3).

Transition T1C
State 1 to 4

Installation of drain tiles, tillage, seeding of agricultural crops, and non-selective herbicide transition this site to the cropland state (4).

Restoration pathway R2B
State 2 to 5

Site preparation, tree planting and/or thinning, and invasive species control transition this site to the reconstructed woodland state (5).

Transition T3A
State 3 to 4

Installation of drain tiles, tillage, seeding of agricultural crops, and non-selective herbicide transition this site to the cropland state (4).

Restoration pathway R3A
State 3 to 5

Site preparation, tree planting and/or thinning, and invasive species control transition this site to the reconstructed woodland state (5).

Restoration pathway T4A
State 4 to 3

Non-selective herbicide, seeding of non-native cool-season grasses, and continuous grazing transitions the site to the cool-season pasture state (3).

Restoration pathway R4A
State 4 to 5

Site preparation, tree planting and/or thinning, and invasive species control transition this site to the reconstructed woodland state (5).

Transition T5A
State 5 to 2

Over-browsing by unnaturally high populations of white-tailed deer transition this site to the over-browsed woodland state (2).

Restoration pathway T5B
State 5 to 3

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

Transition T5C
State 5 to 4

Tillage, seeding of agricultural crops, and non-selective herbicide transition this site to the cropland state (4).

Additional community tables

Animal community

Wildlife (MDC 2006)

Tall emergent trees along with an uneven canopy structure and canopy gaps associated with this ecological site are important for heron colonies, eagle nesting, Mississippi kites, and other bird species in additional to being important migratory songbird stopover sites.

Ephemeral pools provide important amphibian breeding habitat.

Bird species associated with these sites include Indigo Bunting, Willow Flycatcher, Yellow Warbler, Red-headed Woodpecker, Eastern Wood-Pewee, Great Crested Flycatcher, Tree Swallow, Orchard Oriole, and Baltimore Oriole.

Reptile and amphibian species associated with Floodplain Woodlands include tiger salamander, small-mouthed salamander, midland brown snake, gray treefrog, plains leopard frog, southern leopard frog, and western chorus frog.

Other information

Forestry

Management: Estimated site index values range from 50 to 90. On the wettest sites, timber management opportunities may be limited. Management of these groups is often difficult because of the great variation in species, age, stocking levels and seasonal wetness. Use seed-tree, group selection, or clear cutting regeneration methods. Harvest favoring reproduction of the less-shade tolerant species such as swamp white oak, pin oak, sycamore, and cottonwood. Maintain adequate riparian buffer areas.

Limitations: Wetness from flooding; high water table. Use of equipment may be restricted in spring and other excessively wet periods. Restrict activities to dry periods or surfaced areas. Equipment use when wet may compact soil and damage tree roots. Unsurfaced roads and traffic areas tend to be slippery and form ruts easily. Access to forests is easiest during periods in late summer or winter when soils are frozen or dry. Planting is extremely difficult during spring periods. Seedling mortality may be high due to excess wetness. Unsurfaced roads and skid trails may be impassable during rainy periods.

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

This project could not have been completed without the dedication and commitment from a variety of partners and staff (Table 6). Team members supported the project by serving on the technical team, assisting with the development of state and community phases of the state-and-transition model, providing peer review and technical editing, and conducting quality control and quality assurance reviews.

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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	02/08/2025
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:**

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):

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

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

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

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17. **Perennial plant reproductive capability:**
