USDA Natural Resources Conservation Service

Ecological site F116AY034MO
Loamy Terrace Forest

Last updated: 9/24/2020
Accessed: 05/02/2024

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): 116A–Ozark Highland

The Ozark Highland constitutes the Salem Plateau of the Ozark Uplift. Elevation ranges from about 300 feet on the southeast edge of the Ozark escarpment, to about 1,600 feet in the west, adjacent to the Burlington Escarpment of the Springfield Plateau. The underlying bedrock is mainly horizontally bedded Ordovician-aged dolomites and sandstones that dip gently away from the uplift apex in southeast Missouri. Cambrian dolomites are exposed on deeply dissected hillslopes. In some places, Pennsylvanian and Mississipian sediments overlie the plateau. Relief varies, from the gently rolling central plateau areas to deeply dissected hillslopes associated with drainageways such as the Buffalo, Current, Eleven Point and White Rivers.

Classification relationships

Terrestrial Natural Community Type in Missouri (Nelson, 2010):
The reference state for this ecological site is most similar to a Mesic Bottomland Forest.

Missouri Department of Conservation Forest and Woodland Communities (MDC, 2006):
The reference state for this ecological site is most similar to a Mixed Hardwood Mesic Bottomland Forest.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):

The reference state for this ecological site is most similar to a Acer saccharum - Quercus rubra - Carya cordiformis / Asimina triloba Forest (CEGL002060).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site is widespread across the Ozark Highlands Section.

Ecological site concept

NOTE: This is a “provisional” Ecological Site Description (ESD) that is under development. It contains basic ecological information that can be used for conservation planning, application and land management. After additional information is collected, analyzed and reviewed, this ESD will be refined and published as “Approved”.

Loamy Terrace Forests are widely distributed throughout the Ozark Highland. Soils are very deep and loamy, and are subject to flooding. The reference plant community is forest with an overstory dominated by a variety of trees including sugar maple, northern red oak, bitternut hickory, bur oak, American elm, black walnut and Kentucky coffeetree, an understory dominated by pawpaw, northern spicebush, Ohio buckeye and eastern leatherwood and a rich herbaceous ground flora.

Associated sites

F116AY011MO	**Chert Upland Woodland** Chert Upland Woodlands, and other upland and backslope ecological sites, are upslope.
F116AY031MO	**Dry Footslope Forest** Dry Footslope Forests are upslope.
F116AY032MO	**Loamy Footslope Forest** Loamy Footslope Forests are upslope.
F116AY039MO	**Loamy Floodplain Step Forest** Loamy Floodplain Step Forests are adjacent and downslope.
F116AY042MO	**Sandy/Gravelly Floodplain Forest** Sandy/Gravelly Floodplain Forests and other floodplain ecological sites are downslope.

Similar sites

F116AY032MO	**Loamy Footslope Forest** Loamy Footslope Forests are upslope.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Quercus rubra*
Shrub	(1) *Asimina triloba*
Herbaceous	(1) *Asarum canadense*

Physiographic features

This site is on low stream terraces and high floodplains (floodplain steps), with slopes of 0 to 8 percent. The site generates some runoff to adjacent lower floodplain sites, and receives some runoff from higher stream terraces and uplands. This site is subject to rare to occasional flooding. Scour is uncommon in these flood events, and deposition is minimal, so ecological processes more closely resemble those of stream terrace systems.

The following figure (adapted from Simmons et al, 2006) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. It is within the area labeled “3” on the figure. Loamy Terrace Forest sites are typically above Floodplain Step Forest sites, labeled “4”, or may be directly above Floodplain Forest sites that are adjacent to the stream, labeled “5”.

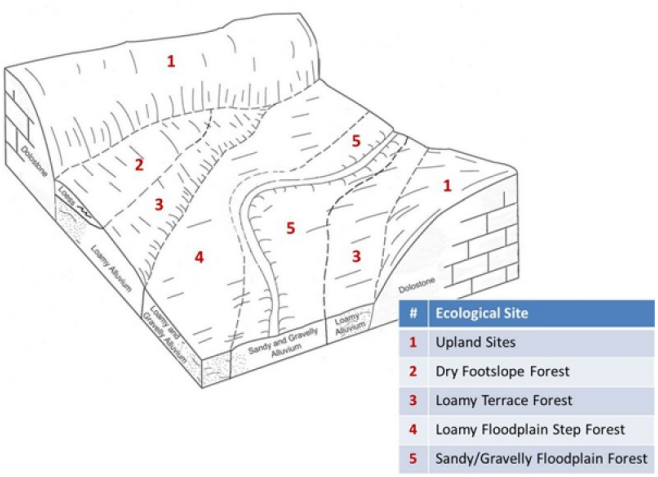


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Flood-plain step
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding frequency	None
Slope	0–8%
Water table depth	43–152 cm
Aspect	Aspect is not a significant factor

Climatic features

The Ozark Highland has a continental type of climate marked by strong seasonality. In winter, dry-cold air masses, unchallenged by any topographic barriers, periodically swing south from the northern plains and Canada. If they invade reasonably humid air, snowfall and rainfall result. In summer, moist, warm air masses, equally unchallenged by topographic barriers, swing north from the Gulf of Mexico and can produce abundant amounts of rain, either by fronts or by convectional processes. In some summers, high pressure stagnates over the region, creating extended droughty periods. Spring and fall are transitional seasons when abrupt changes in temperature and precipitation may occur due to successive, fast-moving fronts separating contrasting air masses.

The Ozark Highland experiences regional differences in climates, but these differences do not have obvious geographic boundaries. Regional climates grade inconspicuously into each other. The basic gradient for most climatic characteristics is along a line crossing the MLRA from northwest to southeast.
The average annual precipitation in almost all of this area is 38 to 45 inches. Snow falls nearly every winter, but the snow cover lasts for only a few days. The average annual temperature is about 53 to 60 degrees F. The lower temperatures occur at the higher elevations in the western part of the MLRA. Mean January minimum temperature follows a stronger north-to-south gradient. However, mean July maximum temperature shows hardly any geographic variation in the MLRA. Mean July maximum temperatures have a range of only two or three degrees across the area.

Mean annual precipitation varies along a northwest to southeast gradient. Seasonal climatic variations are more complex. Seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages three to four times greater than January precipitation. Most of the rainfall occurs as high-intensity, convective thunderstorms in summer.

During years when precipitation comes in a fairly normal manner, moisture is stored in the top layers of the soil during the winter and early spring, when evaporation and transpiration are low. During the summer months the loss of water by evaporation and transpiration is high, and if rainfall fails to occur at frequent intervals, drought will result.

Drought directly affects plant and animal life by limiting water supplies, especially at times of high temperatures and high evaporation rates.

Superimposed upon the basic MLRA climatic patterns are local topographic influences that create topoclimatic, or microclimatic variations. In regions of appreciable relief, for example, air drainage at nighttime may produce temperatures several degrees lower in valley bottoms than on side slopes. At critical times during the year, this phenomenon may produce later spring or earlier fall freezes in valley bottoms. Deep sinkholes often have a microclimate significantly cooler, moister, and shadier than surrounding surfaces, a phenomenon that may result in a strikingly different ecology. Higher daytime temperatures of bare rock surfaces and higher reflectivity of these unvegetated surfaces may create distinctive environmental niches such as glades and cliffs.

Slope orientation is an important topographic influence on climate. Summits and south-and-west-facing slopes are regularly warmer and drier than adjacent north- and-east-facing slopes. Finally, the climate within a canopied forest is measurably different from the climate of a more open grassland or savanna areas.

Source: University of Missouri Climate Center - http://climate.missouri.edu/climate.php; Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, United States Department of Agriculture Handbook 296 - http://soils.usda.gov/survey/geography/mlra/

Table 3. Representative climatic features

Frost-free period (characteristic range)	162-176 days
Freeze-free period (characteristic range)	188-196 days
Precipitation total (characteristic range)	1,118-1,270 mm
Frost-free period (actual range)	157-184 days
Freeze-free period (actual range)	181-204 days
Precipitation total (actual range)	1,092-1,270 mm
Frost-free period (average)	169 days
Freeze-free period (average)	192 days
Precipitation total (average)	1,194 mm

Climate stations used

- (1) ELDON [USC00232503], Eldon, MO
- (2) FESTUS [USC00232850], Crystal City, MO
- (3) TAHLEQUAH [USC00348677], Tahlequah, OK
- (4) DONIPHAN [USC00232289], Doniphan, MO
- (5) EUREKA SPRINGS 3 WNW [USC00032356], Eureka Springs, AR

Influencing water features

This ecological site is typically associated with, but not adjacent to, a perennial stream. Stream levels typically respond quickly to storm events, especially in watersheds where surface runoff is dominant. This site is subject to rare to occasional flooding, particularly during spring and early summer storm events. However, scour and deposition are uncommon. The site generates some runoff to adjacent lower floodplain sites, and receives some runoff from higher stream terraces and uplands.

Soil features

These soils have no rooting restriction. They were formed under forest vegetation, and have thin, light-colored surface horizons. Parent material is alluvium. They have silt loam, sandy loam or loam surface horizons, and loamy subsoils with argillic horizons that may be skeletal with depth. They are not affected by seasonal wetness. Soil series associated with this site include Bearthicket, Britwater, Hootentown, Horsecreek, Jemerson, Raftville, Razort, Secesh, and Zanoni.

The accompanying picture of the Britwater series shows a thin, light-colored gravelly silt loam surface horizon over a reddish gravelly silty clay loam subsoil. Coarse fragment content increases with depth in this soil. Picture courtesy of John Preston, NRCS.

Figure 9. Britwater series

Table 4. Representative soil features

Surface texture	(1) Gravelly silt loam (2) Sandy loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderate
Soil depth	183 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.16–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–45%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

Information contained in this section was developed using historical data, professional experience, field reviews, and scientific studies. The information presented is representative of very complex vegetation communities. Key indicator plants, animals and ecological processes are described to help inform land management decisions. Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal. The species lists are representative and

are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Loamy Terrace Forests are on relatively stable former floodplain positions. These rarely flooded terraces are often associated with more poorly drained Wet Terrace Forests, and occur above high floodplain forests or riverfront forests that are the on lower, more frequently flooded areas. The reference plant community is dominated by a wide variety of deciduous hardwood tree species including sugar maple, northern red oak, bitternut hickory, bur oak, American elm, black walnut and Kentucky coffeetree. Trees are generally large and tall forming a dense, closed canopy.

Both historically and today, these forests are structurally and compositionally diverse, with occasional tree-fall gaps and natural mortality providing opportunities for regeneration of overstory species. The understory is also complex, with multiple layers of shade tolerant species such as pawpaw, northern spicebush, Ohio buckeye and eastern leatherwood. Grape vine, greenbrier, and Virginia creeper are also present along with a diverse array of ground flora species that carpets the forest floor.

Loamy Terrace Forests were also subjected to occasional disturbances from flooding, wind and ice. Wind, flooding, and ice would have periodically opened the canopy up by knocking over trees or breaking substantial branches off canopy trees.

Today, the rich, Loamy Terrace Forests are largely converted to pasture and cropland. Where they do still occur, they often occur as a rather narrow band of forest traversing the riverfront forest. These bands of forest play an important role as a source of food and shelter for migrating birds.

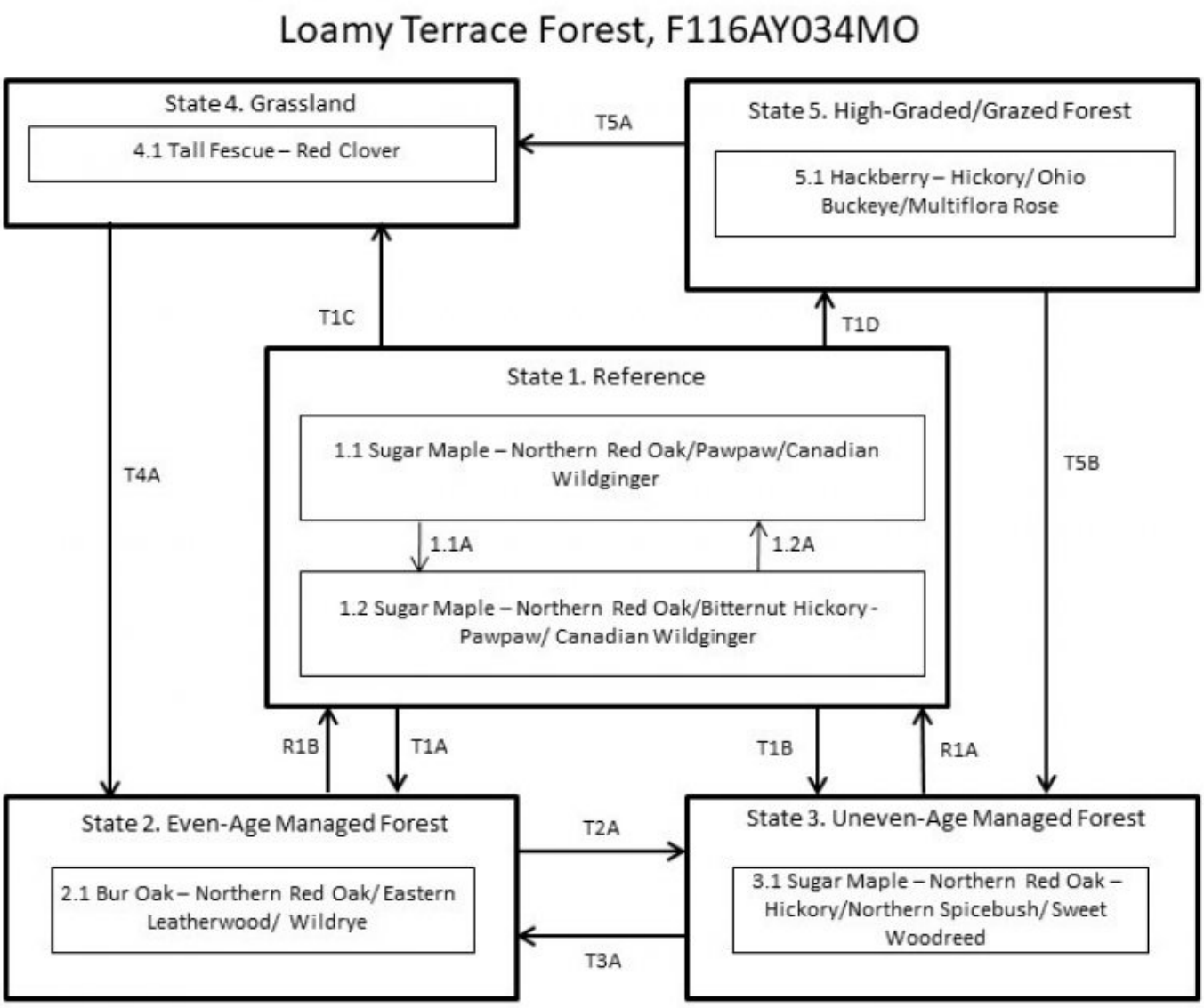
Uncontrolled grazing by domestic livestock in these remaining areas of forest damages and kills smaller trees and removes the ground cover. Carefully planned timber harvests can be tolerated on these sites, but high grading of the timber will ultimately degrade the sites.

Re-establishment of these productive forests is important for stream quality and stream health, and as critical habitat for migratory birds. Woody planting on the appropriate landscape position and soils has proven to be an effective means for restoration.

These ecological sites are productive. Oak regeneration is typically problematic. Maintenance of the oak component will require disturbances that will encourage more sun adapted species and reduce shading effects. Single tree selection timber harvests are common in this region and often results in removal of the most productive trees (high grading) in the stand leading to poorer quality timber and a shift in species composition away from more valuable oak species. Better planned single tree selection or the creation of group openings can help regenerate and maintain more desirable oak species and increase vigor on the residual trees.

A State and Transition Diagram follows. Detailed descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.

State and transition model



Code	Activity/Event/Process
T1A	Harvesting; even-aged management
T1B	Harvesting; uneven-age management
T1C, T5A	Clearing; pasture planting
T1D	High-grade harvesting; uncontrolled grazing
T2A	Uneven-age management
T3A	Even-age management; thinning
T4A, T5A	Tree planting; long-term succession; no grazing
T5B	Uneven-age management; tree planting; no grazing

Code	Activity/Event/Process
1.1A	No disturbance (10+ years)
1.2A	Disturbance (fire, wind, ice) 3-5 years

Code	Activity/Event/Process
R1A	Extended rotations; forest stand improvement
R1B	Uneven-age mgt, extended rotations; forest stand improvement

Figure 10. State and transition diagram for this ecological site

State 1

Reference

The reference state was dominated by northern red oak and sugar maple including a wide variety of other deciduous hardwood tree species. Periodic disturbances from fire, wind or occurred along with infrequent flooding. Long disturbance-free periods allowed an increase in more shade tolerant species such as bitternut hickory and sugar maple. Two community phases are recognized in this state, with shifts between phases based on disturbance frequency. The reference state is rare today. Some sites have been converted to grassland (State 4). Others have been subject to repeated, high-graded timber harvest coupled with uncontrolled domestic livestock grazing (State 5). Many reference sites have been managed for timber harvest, resulting in either even-age (State 2) or uneven-age (State 3) forests.

Community 1.1
Sugar Maple – Northern Red Oak/Pawpaw/Canadian Wildginger

Figure 11. Reference state along Current River, Ozark National Scenic Riverways, Missouri; photo credit MDC.

Two community phases are recognized in this state, with shifts between phases based on disturbance frequency.

Forest overstory. The Overstory Species list is based on field reconnaissance as well as commonly occurring species listed in Nelson 2010; names and symbols are from USDA PLANTS database.

Forest understory. The Understory Species list is based on field reconnaissance as well as commonly occurring species listed in Nelson 2010; names and symbols are from USDA PLANTS database.

Community 1.2
Sugar Maple – Northern Red Oak/Bitternut Hickory - Pawpaw/ Canadian Wildginger

Two community phases are recognized in this state, with shifts between phases based on disturbance frequency.

State 2

Even-Age Managed Forest

These former forests are now rather dense, with an under developed understory and ground flora. Thinning can increase overall tree vigor and improve understory diversity. Continual timber management, depending on the practices used, will either maintain this state, or convert the site to uneven-age (State 3) forests.

Community 2.1
Bur Oak – Northern Red Oak/ Eastern Leatherwood/ Wildrye

State 3
Uneven-Age Managed Forest

Uneven-Age Managed forests can resemble the reference state but are denser. The biggest differences are tree age, most being only 50 to 90 years old, and canopy closure. Composition is also likely altered from the reference state depending on tree selection during harvest. In addition, without a regular 15 to 20 year harvest re-entry into these stands, they will slowly increase in more shade tolerant species such as bitternut hickory and sugar maple and northern red oak will become less dominant.

Community 3.1
Sugar Maple – Northern Red Oak – Hickory/Northern Spicebush/ Sweet Woodreed

State 4
Grassland

Conversion of forests to planted, non-native pasture species such as tall fescue has been common in this MLRA. If grazing and active pasture management is discontinued, the site will eventually transition, over time, to State 2 (Even-Age).

Community 4.1
Tall Fescue - Red Clover

State 5
High-Graded/Grazed Woodland

Forested sites subjected to repeated, high-graded timber harvests and uncontrolled domestic grazing transition to this state. This state exhibits an over-abundance of hickory and other less desirable tree species, and weedy understory species such as coralberry, gooseberry, poison ivy and Virginia creeper. The vegetation offers little nutritional value for cattle, and excessive stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff. Exclusion of livestock from sites in this state coupled with uneven-age management techniques will cause a transition to State 3 (Uneven-Age).

Community 5.1
Hackberry – Hickory/ Ohio Buckeye/Multiflora Rose

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
sugar maple	ACSA3	*Acer saccharum*	Native	–	–	–	–
bitternut hickory	CACO15	*Carya cordiformis*	Native	–	–	–	–
bur oak	QUMA2	*Quercus macrocarpa*	Native	–	–	–	–
Shumard's oak	QUSH	*Quercus shumardii*	Native	–	–	–	–
white oak	QUAL	*Quercus alba*	Native	–	–	–	–
slippery elm	ULRU	*Ulmus rubra*	Native	–	–	–	–
green ash	FRPE	*Fraxinus pennsylvanica*	Native	–	–	–	–
blackgum	NYSY	*Nyssa sylvatica*	Native	–	–	–	–
American basswood	TIAM	*Tilia americana*	Native	–	–	–	–
northern red oak	QURU	*Quercus rubra*	Native	–	–	–	–
Kentucky coffeetree	GYDI	*Gymnocladus dioicus*	Native	–	–	–	–
American elm	ULAM	*Ulmus americana*	Native	–	–	–	–
American sycamore	PLOC	*Platanus occidentalis*	Native	–	–	–	–
Tree Fern							
black walnut	JUNI	*Juglans nigra*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
eastern woodland sedge	CABL	*Carex blanda*	Native	–	–
eastern star sedge	CARA8	*Carex radiata*	Native	–	–
sweet woodreed	CIAR2	*Cinna arundinacea*	Native	–	–
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	–
eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	–
Bosc's panicgrass	DIBO2	*Dichanthelium boscii*	Native	–	–
whitegrass	LEVI2	*Leersia virginica*	Native	–	–
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	–
white bear sedge	CAAL11	*Carex albursina*	Native	–	–
Forb/Herb					
cutleaf coneflower	RULA3	*Rudbeckia laciniata*	Native	–	–
feathery false lily of the valley	MARA7	*Maianthemum racemosum*	Native	–	–
Carolina elephantsfoot	ELCA3	*Elephantopus carolinianus*	Native	–	–
yellow passionflower	PALU2	*Passiflora lutea*	Native	–	–
Indian-tobacco	LOIN	*Lobelia inflata*	Native	–	–
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	–	–
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	–
fragrant bedstraw	GATR3	*Galium triflorum*	Native	–	–
fewflower ticktrefoil	DEPA7	*Desmodium pauciflorum*	Native	–	–

bottomland aster	SYON2	*Symphyotrichum ontarionis*	Native	–	–
Canadian wildginger	ASCA	*Asarum canadense*	Native	–	–
feathery false lily of the valley	MARA7	*Maianthemum racemosum*	Native	–	–
green dragon	ARDR3	*Arisaema dracontium*	Native	–	–
spring blue eyed Mary	COVE2	*Collinsia verna*	Native	–	–
white fawnlily	ERAL9	*Erythronium albidum*	Native	–	–
zigzag iris	IRBR2	*Iris brevicaulis*	Native	–	–
Virginia bluebells	MEVI3	*Mertensia virginica*	Native	–	–
Missouri violet	VIMI3	*Viola missouriensis*	Native	–	–
pale touch-me-not	IMPA	*Impatiens pallida*	Native	–	–
Canadian clearweed	PIPU2	*Pilea pumila*	Native	–	–
Fern/fern ally					
rattlesnake fern	BOVI	*Botrychium virginianum*	Native	–	–
Christmas fern	POAC4	*Polystichum acrostichoides*	Native	–	–
Christmas fern	POAC4	*Polystichum acrostichoides*	Native	–	–
Shrub/Subshrub					
eastern leatherwood	DIPA9	*Dirca palustris*	Native	–	–
burningbush	EUAT5	*Euonymus atropurpureus*	Native	–	–
northern spicebush	LIBE3	*Lindera benzoin*	Native	–	–
Tree					
Ohio buckeye	AEGL	*Aesculus glabra*	Native	–	–
pawpaw	ASTR	*Asimina triloba*	Native	–	–
American hornbeam	CACA18	*Carpinus caroliniana*	Native	–	–

Animal community

Wildlife (MDC 2006)

Moist conditions with abundant coarse woody debris make this type of ecological site important for many herptiles.

These forests can provide good “old-growth” conditions with large diameter trees and snags and downed, dead wood.

Bird species associated with late-successional forests include Great Blue Heron (colonies especially in large sycamores and cottonwoods), Bald Eagle, Belted Kingfisher, Red-shouldered Hawk, Northern Parula, Louisiana Waterthrush, Wood Duck, Hooded Merganser, Kentucky Warbler, Hooded Warbler, Acadian Flycatcher, Barred Owl, Pileated Woodpecker, Cerulean Warbler, Yellow-throated Warbler, and Swainson’s Warbler (sites with giant cane or sapling/brambles dominated understory).

Reptiles and amphibians associated with these forests include marbled salamander, small-mouthed salamander, central newt, midland brown snake, and gray treefrog.

Other information

Forestry (NRCS 2002, 2014):

Management: Estimated site index values range from 60 to 70. 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 small group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Maintain adequate riparian buffer

areas.

Limitations: No major limitations or restrictions. Occasional periods of seasonal wetness; Use of equipment may be restricted in spring and other excessively wet periods. Equipment use when wet may compact soil and damage tree roots. Tree planting may be difficult during spring flooding periods.

Inventory data references

Potential Reference Sites: Loamy Terrace Forest

Plot CURINP07 - Britwater soil
Located along the Current River, Ozark National Scenic Riverways, National Park Service, Carter County, MO
Latitude: 37.084952
Longitude: -91.059151

Plot MERASP07 – Britwater soil
Located in Meramec State Park, Franklin County, MO
Latitude: 38.232768
Longitude: -91.093462

Other references

Anderson, R.C. 1990. The historic role of fire in North American grasslands. Pp. 8-18 in S.L. Collins and L.L. Wallace (eds.). Fire in North American tallgrass prairies. University of Oklahoma Press, Norman.

Batek, M.J., A.J. Rebertus, W.A. Schroeder, T.L. Haithcoat, E. Compas, and R.P. Guyette. 1999. Reconstruction of early nineteenth-century vegetation and fire regimes in the Missouri Ozarks. Journal of Biogeography 26:397-412.

Harlan, J.D., T.A. Nigh and W.A. Schroeder. 2001. The Missouri original General Land Office survey notes project. University of Missouri, Columbia.

Ladd, D. 1991. Reexamination of the role of fire in Missouri oak woodlands. Pp. 67-80 in G.V. Brown, James K.; Smith, Jane Kapler, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 257 p.

Missouri Department of Conservation. 2010. Missouri Forest and Woodland Community Profiles. Missouri Department of Conservation, Jefferson City, Missouri.

NatureServe, 2010. Vegetation Associations of Missouri (revised). NatureServe, St. Paul, Minnesota.

Nelson, Paul W. 2010. The Terrestrial Natural Communities of Missouri. Missouri Department of Conservation, Jefferson City, Missouri. 550p.

Nigh, Timothy A., and Walter A. Schroeder. 2002. Atlas of Missouri Ecoregions. Missouri Department of Conservation, Jefferson City, Missouri. 212p.

Schoolcraft, H.R. 1821. Journal of a tour into the interior of Missouri and Arkansas from Potosi, or Mine a Burton, in Missouri territory, in a southwest direction, toward the Rocky Mountains: performed in the years 1818 and 1819. Richard Phillips and Company, London.

Simmons, Melvin, J. Daniel Childress, Kevin Godsey, and Rod Taylor. 2006. Soil Survey of Reynolds County, Missouri. U.S. Dept. of Agric. Natural Resources Conservation Service.

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. 682 pgs.

Contributors

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Approval

Nels Barrett, 9/24/2020

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/02/2024
Approved by	Nels Barrett
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):**

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

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

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

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

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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

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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:**