USDA Natural Resources Conservation Service

Ecological site F114XB805IL
Post Oak Flatwoods

Last updated: 11/16/2023
Accessed: 04/26/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 114X–Southern Illinois and Indiana Thin Loess and Till Plain

This MLRA is a loess-covered till plain with broad, nearly level summits and steeper slopes in areas. dissected by tributaries of the Ohio and Mississippi Rivers. It is used to produce cash crops, feed grain, and livestock. This MLRA is in Indiana (47 percent), Illinois (38 percent), and Ohio (15 percent) in four separate areas. It makes up about 10,388 square miles (26,904 square kilometers).

This area is in the Till Plains section of the Central Lowland province of the Interior Plains. Well defined valleys with broad flood plains and numerous stream terraces are along the major streams and rivers. The flood plains along the smaller streams are narrow. Broad summits are nearly level or gently sloping. Steep slopes are along rivers and streams. Elevation ranges from 310 feet (90 meters) on the southernmost flood plains to 1,340 feet (410 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters) but can be 50 to 100 feet (15 to 30 meters) along drainageways and streams.
The Little Miami River flows through the part of this MLRA in Ohio. The Ohio River flows along the southernmost boundary in some parts of this area in Ohio. The Kaskaskia River flows through the part of this area in Illinois. Tributaries to the Mississippi and Ohio Rivers drain this MLRA.

This area is covered dominantly by loess and Illinoian-age till or outwash. Most of the loess is Late Wisconsin-age Peoria Loess. In some places the Peoria Loess in underlain by Early Wisconsin-age Roxana Silt or by sandier or grittier loess. The loess ranges from 3 to 7 feet (1 or 2 meters) in thickness on stable summits and does not occur on some of the steeper slopes. The underlying Illinoian-age till and outwash commonly contain a paleosol. Meltwater outwash and lacustrine and alluvial deposits are on some of the stream terraces along the major tributaries. The till and outwash are underlain by several bedrock systems. Mississippian and Pennsylvanian bedrock occurs mostly in the western part of the MLRA. Ordovician, Silurian, and Devonian bedrock occurs mostly in the central part. Bedrock outcrops are common on the bluffs along the large rivers and their major tributaries. They also are evident at the base of steep slopes along minor streams and drainageways.

The average annual precipitation ranges from 39 to 47 inches (990 to 1,190 millimeters) with a mean of 42 inches (1,060 millimeters). The annual temperature ranges from 53 to 56 degrees F (11.8 to 13.6 degrees C) with a mean of 55 degrees F (13 degrees C). The freeze-free period ranges from 185 to 215 days with a mean of 200 days.

The dominant soil orders are Alfisols and Entisols. The soils in the area have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed or smectitic mineralogy. They are deep or very deep, poorly drained to well drained, and loamy, silty, or clayey. Although limited in extent, some soils have a natric horizon in the part of the MLRA in Illinois. The main soils and their series: Albaqualfs that formed in loess or loess over pedisediment on till plains (Marine series); Endoaqualfs that formed in loess or loess over pedisedimenton till plains (Oconee series); Fluvaquents that formed in alluvium on flood plains (Wakeland series); Fragiudalfs that formed in loess over pedisediment over till (Cincinnati series) and loess over till (Rossmoyne series) on till plains; Glossaqualfs that formed in loess over till on till plains (Avonburg, Clermont, and Cobbsfork series) Hapludalfs that formed in till (Hickory series) and loess over pedisediment (Homen series) on till plains.

The soils on uplands support natural hardwoods. Oak, hickory, beech, and sugar maple are the dominant species. Native grasses grow in some scattered areas between the trees. The soils in low-lying areas support mixed forest vegetation. Pin oak, shingle oak, sweetgum, and black oak are the dominant species on the wetter sites. White oak, black oak, northern red oak, hickory, yellow-poplar, ash, sugar maple, and black walnut grow on the better drained sites. Honey locust is dominant on soils that formed in shaly limestone residuum. Silver maple, eastern cottonwood, American sycamore, pin oak, elm, and sweetgum grow along rivers and streams. Black walnut is abundant on very deep, well drained soils on some small flood plains. Sedge and grass meadows and scattered trees are on some low-lying sites.

Most of this MLRA is in farms and used to produce corn, soybeans, and livestock. Some small grains, including winter wheat, oats, and grain sorghum, also are grown. A small acreage is used for specialty crops, such as popcorn and apple orchards. The grassland supports introduced and native grasses. The forested areas are mainly on steep valley sides and in low-lying parts of flood plains. Surface coal mines make up a small acreage. (USDA, Natural Resources Conservation Service. 2022)

LRU notes

LRU 114XB is in two separate areas in Illinois (66 percent) and Indiana (34 percent). It makes up about 7,005 square miles (18,150 square kilometers). It includes the towns of Brazil, Bloomfield, Cloverdale, and Spencer, Indiana, and Carlyle, Nashville, Hillsboro, Greenville, Vandalia, and Pinckneyville, Illinois. Interstates 55, 64, and 70 cross the part of the MLRA in Illinois. They converge in St. Louis, which is just west of this MLRA. The east edge of the Scott Air Force Base is on the western edge of the area in Illinois.

This area is in the Till Plains Section of the Central Lowland Province of the Interior Plains. Both large and small tributaries of the West Fork of the White River, the Eel River, the Kaskaskia River, and the Little Muddy River dissect the nearly level to very steep uplands. Well defined valleys with broad flood plains and numerous stream terraces are along the major streams and rivers. The flood plains along the smaller streams are narrow. Broad summits are nearly level to gently sloping. Elevation ranges from 350 feet (105 meters) on the southernmost flood plains along the Ohio and Wabash Rivers to 1,190 feet (365 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters), but it can be 50 to 100 feet (15 to 30 meters) along drainageways and streams. It generally is low on broad, flat till plains and flood plains and high on the dissected hills bordering rivers or drainage systems.

Classification relationships

Major Land Resource Area (MLRA) (USDA-NRCS, 2022):
114X–Southern Illinois and Indiana Thin Loess and Till Plain

U.S. Forest Service Ecoregions (Cleland et al. 2007):
Domain: Humid Temperate Domain
Division: Hot Continental Division
Province: Eastern Broadleaf Forest (Continental)
Province Code: 222

Ecological site concept

The historic reference plant community was a woodland dominated by fire and drought-tolerant oaks (Quercus spp.) and hickory (Carya spp.) species. Ground flora will vary in species composition and overall density depending on frequency and severity of disturbances. Trees on sites are often stunted in height due to the challenging soil conditions and periods of drought.

Fire was the primary disturbance factor that maintained this ecological site, while drought, windthrow, and grazing were secondary factors. Fire maintained a more open woodland and kept brush and woody species from dominating. (LANDFIRE 2009).

Widely scattered post oak (*Quercus stellata*), blackjack oak (Q. Marilandica), and hickories (Carya spp.) were the primary overstory species. Hickory species included shagbark (Carya ovata), mockernut (Carya tomentosa), and

black (C. texana). Shagbark and black hickories where scattered through the community while mockernut was usually on the site margins and associated with white oak (Coates 1992). Other species present may include shingle oak (Q. imbricaria), pin oak (Q. palustris), white oak (Q. alba), sassafras (Sassafras albidum), black cherry (Prunus serotina) and swamp white oak (Q. bicolor Willd.).

The shrub and woody vine strata common for these sites are Virginia creeper (Parthenocissus quinquefolia), Carolina rose (Rosa carolina), berries (Rubus spp.) and poison ivy (Toxicodendron radicans). (Taft et al. 1995).

Depending on fire regime, grazing, and drought, the canopy density and resulting understory composition was highly variable. Sites with short fire return intervals exhibited a open woodland structure and included prairie species - including native grasses.

On sites that have a longer return fire interval, and therefore a denser canopy cover, prairie grasses will not be as common and forest forbs will dominate.

These sites may have micro-depressional zones where standing water may occur in the spring. Species restricted to these depressions are Isoetes melanopoda (black quillwort), Eleocharis compressa (flat-stemmed spikerush), and Eleocharis verrucose (warty spikerush).

Associated sites

F114XB503IN	**Till Upland Forest** Till Upland Forest ecological site is typically adjacent to the Post Oak Flatwood ecological site, but the Till Upland Forest sites occur on soils that contain higher percentages of clay, formed in till.
F114XB804IN	**Silty Eolian Forest** Silty Eolian Forest ecological site is adjacent to the Post Oak Flatwood ecological site, but the Silty Eolian Forest site occurs in more unique landscapes such as eskers with soils that contain higher percentages of clay.
R114XB901IN	**Sodium Affected Uplands** The Sodium Affected Upland ecological site and the Post Oak Flatwood ecological site occur on similar landscape positions and are often intermixed. Both have silt loam soils with a restrictive layer, however the Sodium Affected Upland does have locations with sodium soils.

Similar sites

R114XB901IN	**Sodium Affected Uplands** The Sodium Affected Upland ecological site and the Post Oak Flatwood ecological site are found on similar landscape positions such as till plains and depressions with little to no slope. Both have silt loam soils with a restrictive layer, however the Sodium Affected Upland does have locations with sodium soils.

Table 1. Dominant plant species

Tree	(1) *Quercus stellata* (2) *Quercus marilandica*
Shrub	(1) *Rosa carolina* (2) *Rubus*
Herbaceous	(1) *Carex* (2) *Helianthus divaricatus*

Physiographic features

These soils are very deep, somewhat poorly to poorly drained and have seasonally high-water tables. Sites are located on loess capped till plains of Wisconsinan age and on nearly level to gently sloping interfluves and nearly level to slightly convex summits on the Illinoian till plain. Unique landform positions include depression, flat, ground moraine, and till plain.

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Depression
Runoff class	Negligible to low
Flooding frequency	None
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to frequent
Elevation	400–1,200 ft
Slope	0–2%
Ponding depth	0–15 in
Water table depth	6–18 in
Aspect	Aspect is not a significant factor

Climatic features

About 60 percent of the precipitation falls during the freeze-free period. Most of the rainfall occurs as high-intensity, convective thunderstorms during summer. Snowfall is common in winter. The freeze-free period averages about 190 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	157-169 days
Freeze-free period (characteristic range)	186-192 days
Precipitation total (characteristic range)	42-44 in
Frost-free period (actual range)	151-169 days
Freeze-free period (actual range)	185-194 days
Precipitation total (actual range)	41-45 in
Frost-free period (average)	162 days
Freeze-free period (average)	189 days
Precipitation total (average)	43 in

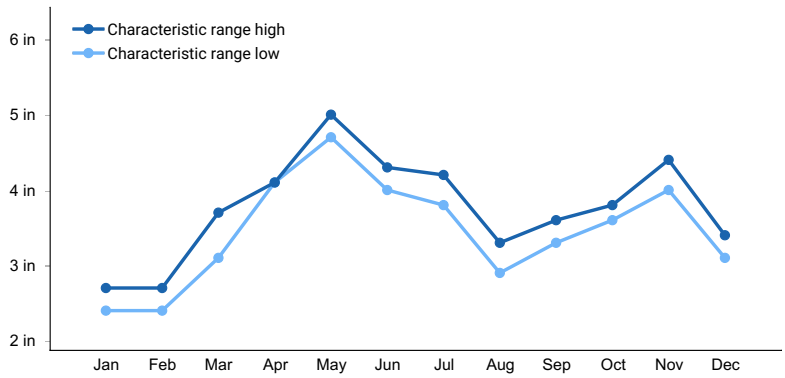


Figure 1. Monthly precipitation range

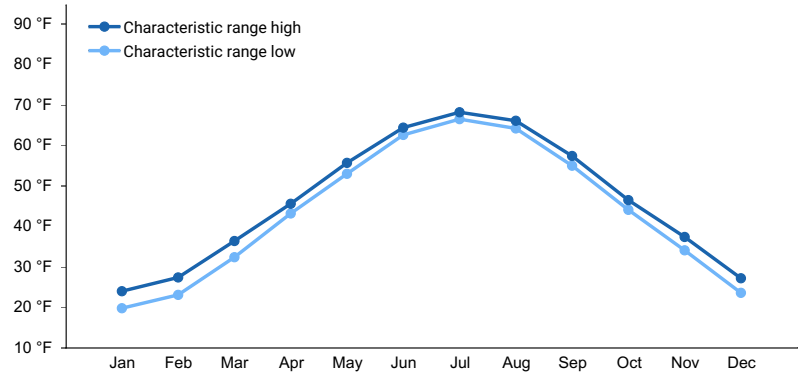


Figure 2. Monthly minimum temperature range

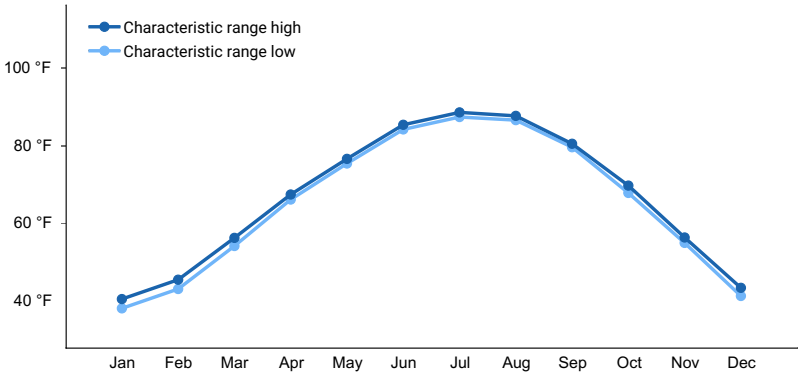


Figure 3. Monthly maximum temperature range

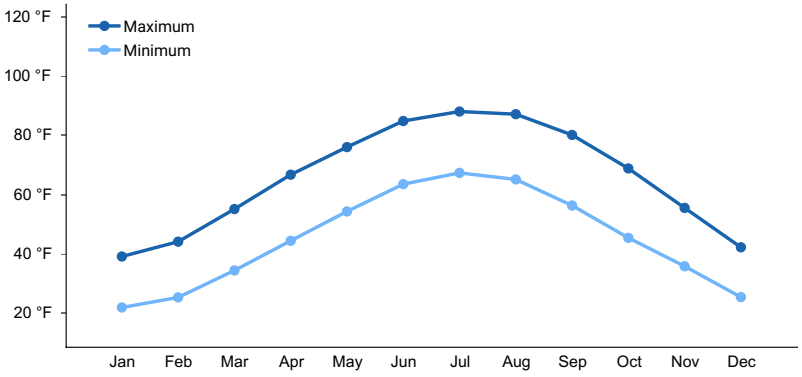


Figure 4. Monthly average minimum and maximum temperature

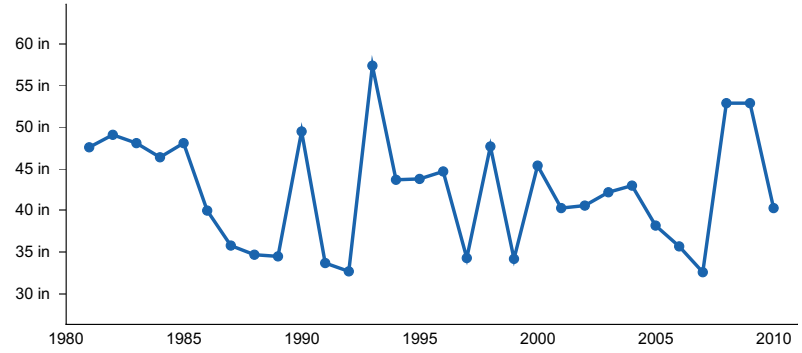


Figure 5. Annual precipitation pattern

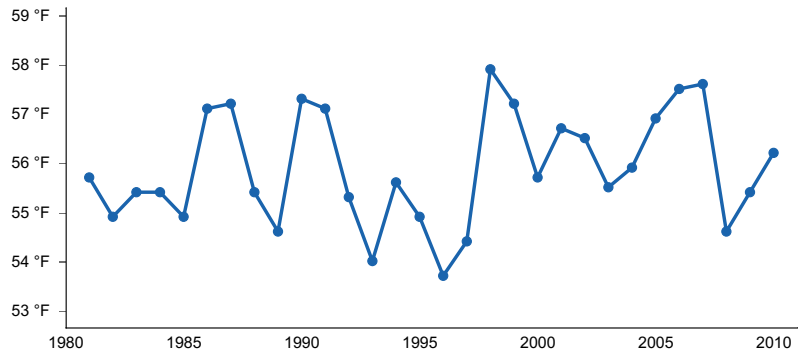


Figure 6. Annual average temperature pattern

Climate stations used

- (1) PANA 3E [USC00116579], Pana, IL
- (2) WATERLOO [USC00119002], Waterloo, IL
- (3) CARBONDALE SOUTHERN IL AP [USW00093810], De Soto, IL
- (4) LEBANON [USC00114991], Lebanon, IL

Influencing water features

These sites are not influenced by wetland or riparian water features; however, sites are influenced by clay layer in the subsoil. Precipitation is the main source of water for this ecological site. Infiltration is slow, and surface runoff ranges from negligible to low. Surface runoff contributes water to downslope ecological sites. These areas a slow rate of water transmission through the subsurface clay layer. Most sites would have a perched, seasonal water table.

Soil features

Soils in this group are deep to very deep and somewhat poorly to poorly drained with a restrictive layer. Series currently no soil series are signed this site.

Table 4. Representative soil features

Parent material	(1) Loess (2) Drift (3) Pedisediment
Surface texture	(1) Silt loam
Drainage class	Poorly drained to somewhat excessively drained
Permeability class	Very slow to moderate
Depth to restrictive layer	13–20 in
Soil depth	60–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6.3–7.2 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–1 mmhos/cm
Soil reaction (1:1 water) (0-40in)	4.5–7

Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

MLRA 114X in Illinois is within an ecological transition zone between the eastern deciduous forests and the tallgrass prairies. Upland woodlands in this region were often open in structure depending on disturbance regimes. Fire and grazing perpetuated this open mosaic of ecological communities throughout the landscape. Various levels of disturbance resulted in differing stages of successional plant communities. It is well documented that by the time of European settlement, wooded uplands had a repetitive fire regime (McClain and Elzinga 1994).

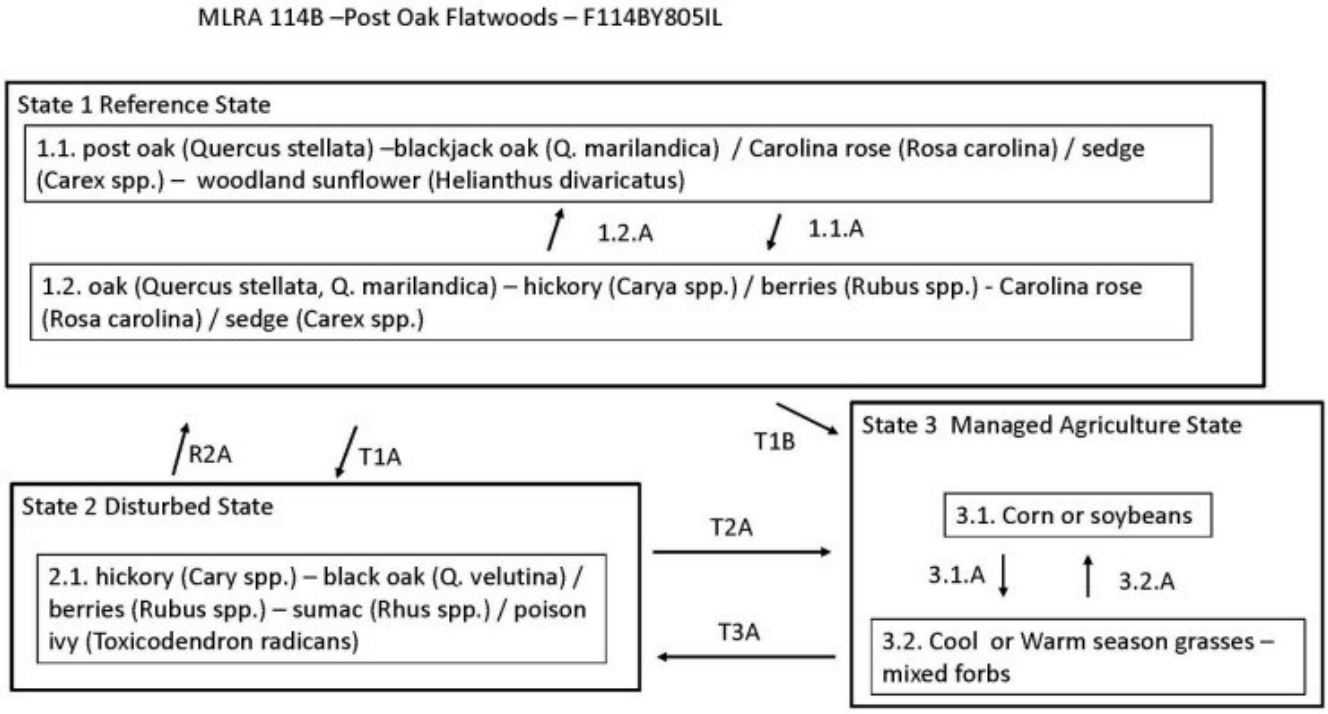
Flatwood forest were historically common in the Midwest. Dominated by *Quercus stellata* (post oak), these communities were found on the till plain of Illinois glaciation. These sites are characterized by poor drainage, slow permeability and a clay layer in the subsurface.
which restricts the movement of water as well as plant roots. Plants must be tolerant of seasonally perched water tables, shallow root zones, and xeric conditions during the summer. Because of these extremes, the canopy usually is dominated by drought tolerant upland species but the ground layers may be a mix of xeric and bottomland species.
Drought, fire, and grazing were the major influences of these sites.

The probable historic fire frequency for these sites was every five years or less (Anderson, 1982; McClain et al., 1999). Fire constitutes the main natural process for these sites and were the key disturbance that maintained an open canopy structure. Dense thickets tree seedlings and saplings would exist in the absence of fires, but shorter fire return intervals would reduce brush and tree density.

Today, sites are extensively utilized for agricultural production and few, if any, high-quality reference sites remain in MLRA 114X. Remaining woodland have generally been altered through long-term disturbance including unmanaged grazing, clearing, selective harvest, lack of fire, modification of hydrology (ditching/tiling) and non-native vegetation. Many of the heavily grazed wooded areas are typified by coralberry (*Symphoricarpos orbiculatus*), gooseberry (Ribes spp.), and rose (Rosa spp.)

A provisional state and transition diagram is depicted in this document. Detailed descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available data, agency field observations, professional opinion, and individual interpretations. It will change as additional field verifications occurs and ecological knowledge of these sites increases.

State and transition model



State 1
Reference - Post Oak Flatwoods

Widely scattered post oak (*Quercus stellata*), blackjack oak (Q. Marilandica), black oak (*Q. velutina*) and hickories (Carya spp.) were the primary tree species. These species are often stunted in height due to the challenging soil conditions and periods of drought. Ground flora is varied in composition and overall density. Numerous native grasses and herbaceous species were present and species vary depending on the timing and severity of disturbances .

Dominant plant species

- post oak (*Quercus stellata*), tree
- black oak (*Quercus velutina*), tree
- blackjack oak (*Quercus marilandica*), tree
- Carolina rose (*Rosa carolina*), shrub
- blackberry (*Rubus*), shrub
- sedge (*Carex*), grass
- woodland sunflower (*Helianthus divaricatus*), other herbaceous

Community 1.1
post oak -blackjack oak /Carolina rose /sedge -woodland sunflower

A post oak dominated flatwood community with many species of native grasses and forbs.

Dominant plant species

- post oak (*Quercus stellata*), tree
- blackjack oak (*Quercus marilandica*), tree
- black oak (*Quercus velutina*), tree
- Carolina rose (*Rosa carolina*), shrub
- blackberry (*Rubus*), shrub
- sedge (*Carex*), grass
- woodland sunflower (*Helianthus divaricatus*), other herbaceous

Community 1.2
oak - hickory / berries - Carolina rose / sedge

With longer fire return intervals, woody species number and density will increase on the site. Successional changes to the community will continue toward a woodland until disturbances, such as fire or grazing, reduce the tree and shrub density.

Dominant plant species

- post oak (*Quercus stellata*), tree
- hybrid hickory (*Carya*), tree
- Carolina rose (*Rosa carolina*), shrub
- blackberry (*Rubus*), shrub
- sedge (*Carex*), grass

Pathway 1.1A
Community 1.1 to 1.2

The historic reference plant community was a woodland dominated by fire and drought-tolerant oaks (Quercus spp.) and hickory (Carya spp.) species. Ground flora will vary in species composition and overall density depending on frequency and severity of disturbances. Trees on sites are often stunted in height due to the challenging soil conditions and periods of drought. Fire was the primary disturbance factor that maintained this ecological site and maintained an open woodland and kept brush and woody species from dominating.

Pathway 1.2A
Community 1.2 to 1.1

Oak, hickory and woody vegetation will increase on these sites with a reduction of fire disturbance.

State 2
Disturbed State

This state is typified by a variety of oak and hickory species and other woody species. Ground cover density and composition will vary depending on disturbances and seed sources.

Dominant plant species

- hybrid hickory (*Carya*), tree
- black oak (*Quercus velutina*), tree
- post oak (*Quercus stellata*), tree
- blackjack oak (*Quercus marilandica*), tree
- sumac (*Rhus*), shrub
- blackberry (*Rubus*), shrub
- Carolina rose (*Rosa carolina*), shrub
- multiflora rose (*Rosa multiflora*), shrub
- sedge (*Carex*), grass
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

Community 2.1
Disturbed Community

These sites have undergone substantial disturbances (cleared, oak removal) followed by no natural fire regime and no management inputs. Tree species will depend on seed sources. The shrub layer is often substantial and often includes berries, roses, and possumhaw. The understory composition will be dependent upon the severity of disturbance and seed sources. Sites may be impacted by non-native vegetation.

Dominant plant species

- hybrid hickory (*Carya*), tree
- black oak (*Quercus velutina*), tree
- post oak (*Quercus stellata*), tree
- blackjack oak (*Quercus marilandica*), tree
- blackberry (*Rubus*), shrub
- Carolina rose (*Rosa carolina*), shrub
- possumhaw (*Ilex decidua*), shrub
- sumac (*Rhus*), shrub
- sedge (*Carex*), grass
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous

State 3
Agriculture State

Numerous crops can be grown on these sites depending on landowner goals and objectives. Sites often have had hydrological modifications installed such as ditches and tiling.

Dominant plant species

- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

Community 3.1
Corn - soybean

Row crop production with corn and soybeans being the commonly planted crops.

Dominant plant species

- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

Community 3.2
Forage - Pasture

Sites are utilized for grazing or hay production. Many different grasses and forbs may be planted.

Dominant plant species

- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- timothy (*Phleum pratense*), grass
- orchardgrass (*Dactylis glomerata*), grass
- clover (*Trifolium*), other herbaceous
- alfalfa (*Medicago*), other herbaceous

Pathway 3.1A
Community 3.1 to 3.2

Site is transitioned from row crop production to forage/pasture production. Management inputs would include seeding desired species, weed control, and continual grassland management inputs.

Pathway 3.2A
Community 3.2 to 3.1

Production of row crops. Corn and soybean rotations are common; however many different crops may be grown.

Transition T1A
State 1 to 2

Many different disturbance can transition the reference state to a mixed oak - hickory community. Many different species may be present depending on the type and severity of disturbance(s). Non-native plants may also be brought on to the site thereby altering the understory species composition.

Transition T1B
State 1 to 3

Site is cleared and utilized for agriculture production

Restoration pathway R2A
State 2 to 1

Restoration inputs include woody species control, weed control and planting of desired species followed by continued management.

Transition T2A
State 2 to 3

Transition T3A
State 3 to 2

Site abandonment results in a number of native and non-native plant species invading the site. Species will be determined by a number of factors including the type/length of disturbance and the available seed sources. The community will naturally continue toward a return to a mixed woodland disturbed state

Additional community tables

Inventory data references

No field monitoring was conducted as part of this PES development. Future ESD development may result in plant community edits, soil mapunits being added or removed from this grouping, and/or additions or modifications to the narratives, tables, vegetation descriptions and state and transition model.

Other references

Anderson, R. C., and M. R. Anderson. 1975. The presettlement vegetation of Williamson County, Illinois. Castanea 40:345-363.

Anderson, R. C. 1982. An evolutionary model summarizing the roles of fire, climate, and grazing animals in the origin and maintenance of grasslands: In J.R. Estes, R.J. Tyrl, and J.N. Brunken eds., Grasses and grasslands: systematics and ecology. University of Oklahoma, p. 297-308.

Anderson, R. C., J. S. Fralish, Jerry M. Baskin. 2007. Presettlement forests of Illinois. In Proceedings of the Oak Woods Management Workshop, ed. G. V. Burger, J. E. Ebinger, and G. S. Wilhelm, pp. 9-19. Charleston, Ill.: Eastern Illinois University.

Barrett, S.W. 1980. Indians and fire. Western Wildlands Spring: 17-20.

Briggs, J.M., A.K. Knapp, and B.L. Brock. 2002. Expansion of woody plants in tallgrass prairie: a fifteen- year study of fire and fire-grazing interactions. The American Midland Naturalist 147: 287-294.

Brinson, M.M. 1993. A hydrogeomorphic classification for wetlands. Technical Report WRP-DE-4, U.S. Army Corps of Engineers, Engineer Waterways Experiment Station, Vicksburg, MS.

Brugam, RB, Kilburn PD and Luecking, LL. 2016. Pre-settlement Vegetation of Greene, Jersey and Macoupin Counties along the Prairie/Forest Border in Illinois. Transactions of the Illinois State Academy of Science 109:9-17

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Coterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC. 92 pp.

Coates D. T., K.J. Lyman, and J. E. Ebinger. 1992. Woody vegetation structure of a post oak flatwoods in Illinois Castanea 57:196-201.

Comer P.J., Faber-Langendoen D, Evans R, Gawler SC, Josse C, Kittel G, Menard S, Pyne M, Reid M, Schulz K, Snow K, and Teague J. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, Virginia.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Dept. of Interior, Fish & Wildlife Service, Office of Biological Services, Washington DC.

Dey, D.C. and J.M. Kabrick. 2015. Restoration of midwestern oak woodlands and savannas. In: J.A. Stanturf (ed.). Restoration of Boreal and Temperate Forests, Second Edition. CRC Press, Boca Raton, Florida, USA. 561 pp.

Edgin, B., W.E. McClain, R. Gillespie, and J.E. Ebinger 2003, Vegetation composition and structure of Eversgerd Post Oak Flatwoods, Clinton County, Illinois. Northeast Naturalist 10:111 - 118.

Ebinger, John E. 2008. Illinois woodlands 101. Illinois Department of Natural Resources, Springfield, Illinois. (https://www2.illinois.gov/dnr/education/Pages/IllinoisNaturalHistory.aspx) Accessed July 20

Illinois Department of Natural Resources (IDNR). 2018. Natural Divisions - Southern Till Plain. Accessed; March 2018.
https://www.dnr.illinois.gov/conservation/IWAP/Documents/NaturalDivisions/SouthernTillPlain

Illinois Depatment of Natural Resource (IDNR). Flatwood Forest –Online Woodland-Chapter 6.
(.pdf) Accessed July 2020.

Irland, L.C. 2000. Ice storms and forest impacts. The Science of the Total Environment 262: 231-242.

Landfire (Landfire National Vegetation Dynamics Database). 2009. Landfire National Vegetation Dynamics Models. Landfire Project, USDA Forest Service, U.S. Department of Interior. (http://www.LANDFIRE.gov/index.php: accessed 22 February 2018).

Mohlenbrock, R. H. and D. M. Ladd. 1978. Distribution of Illinois Vascular Plants. Southern Illinois Univ. Press, Carbondale and Edwardsville, Ill. 282 pp.

Mohlenbrock, R. H. 2003. Vascular Flora of Illinois, 3rd edition. Carbondale, Illinois: Southern Illinois University Press. 736 pp.

National Cooperative Soil Survey (NCSS). National Cooperative Soil Characterization Database. Available online: https://ncsslabdatamart.sc.egov.usda.gov/. Accessed: February 2018.

National Oceanic and Atmospheric Administration (NOAA). 1980-2010. https://www.ncdc.noaa.gov/data-access/land-based-station-data/find-station.

NatureServe. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Association Detail Report: CEGL002427) (Accessed: May 22, 2018).

Nelson, P. 2010. The Terrestrial Natural Communities of Missouri. Revised edition. Missouri Natural Areas Committee, Department of Natural Resources and the Department of Conservation, Jefferson City. 550 pp.

Pyne, S.J., P.L. Andrews, and R.D. Laven. 1996. Introduction to Wildland Fire, Second Edition. John Wiley and Sons, Inc. New York, New York. 808 pp.

Schwegman, J. E., G. B. Fell, M. D. Hutchinson, G. Paulson, W. M. Shephard, and J. White. 1973. Comprehensive plan for the Illinois Nature Preserve system. Part 2. The natural divisions of Illinois. Illinois Nature Preserves Commission, Rockford, IL. 32 pp.

Schwegman, J. 1997. Illinois' natural divisions. The Illinois Steward, Urbana, Illinois. 12 pp.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey (SSS NRCS WSS). Available online at the following link: https://websoilsurvey.sc.egov.usda.gov/. Accessed February 2018.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions (SSS NRCS OSD). Available online. Accessed March 2018.

Taft, J. B, M. W. Schwartz and L. R. Phillippe. 1994. Vegetational Ecology of Southern Flatwoods on the Illinoian Tillplain (Illinois). In J.S. Fralish, R. C. Anderson, J.E. Ebinger and R. Szafoni, eds., Proceedings of the North American Conference on Barrens and Savannas, Illinois State University, Normal Illinois.

USDA, Natural Resources Conservation Service. 2022. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture, Agriculture Handbook 296.

USDA, NRCS. 2018. The PLANTS Database (http://plants.usda.gov, 1 March 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

Voigt, J. W., and R. H. Mohlenbrock. 1964. Plant communities of southern Illinois. Southern Illinois University Press, Carbondale. 202 pp.

White, J. 1994. How the terms savanna, barrens, and oak openings were used in early Illinois. In J.S. Fralish, R. C. Anderson, J.E. Ebinger and R. Szafoni, eds., Proceedings of the North American Conference on Barrens and Savannas, Illinois State University, Normal Illinois. .

White, J. 1978. Classification of natural communities in Illinois. Natural Areas Inventory Technical Report: Volume I, Survey Methods and Results. Illinois Natural Areas Inventory, Department of Landscape Architecture, University of Illinois at Urbana/Champaign. 426 pp.

White, J and M. Madany. 1978. Classification of natural communities in Illinois. Pages 310-405 (Appendix 30) in J. White, Illinois Natural Areas Inventory Technical Report. Volume 1: Survey Methods and Results. Illinois Natural Areas Inventory, Department of Landscape Architecture, University of Illinois at Urbana/Champaign.

Contributors

John Allen, Acting Soil Survey Office Leader, USDA-NRCS, Indiana
Dena Anderson, Resource Soil Scientist, USDA-NRCS, Indiana
Ralph Tucker, Soil Survey Office Leader, USDA-NRCS, Missouri
Anita Arends, Ecological Site Specialist, USDA-NRCS, Illinois

Approval

Suzanne Mayne-Kinney, 11/16/2023

Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	04/26/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

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

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

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

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

17. **Perennial plant reproductive capability:**