

13050

Southern Interior Low Plateau Dry-Mesic Oak Forest

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
Brad Slaughter	slaughterb@michigan.gov	Jim Drake	jim_drake@natureserve.org
Jeff Sole	jsole@tnc.org	None	None
Dave Minney	dminney@tnc.org	None	None

Vegetation Type

Forest and Woodland

Map Zones

49

Geographic Range

Southern Interior Low Plateau Dry-Mesic Oak Forest occurs in the non-coastal plain portion of the Western Mesophytic Forest region of Braun (1950) (NatureServe 2007). This includes portions of OH, IN, IL, KY, TN, AL and MS. In MZ49, this BpS is of limited distribution, occurring in the Interior Plateau Level III Ecoregion in the Northern Shawnee Hills and Southern Shawnee Hills Level IV Ecoregions (Woods et al. 2006), also known as the Interior Low Plateau, Shawnee Hills Section of the Eastern Broadleaf Forest Ecological Subregion (222D). This area is sometimes referred to as the “Ozark Hills” region (Braun 1950).

Biophysical Site Description

Southern Interior Low Plateau Dry-Mesic Oak Forest occupies ridgetops and slopes in the Interior Low Plateau region of southern Illinois, which is split into two Level IV Ecoregions by Woods et al. (2006a): Northern Shawnee Hills and Southern Shawnee Hills. This region is characterized by a high east-west escarpment of Pennsylvanian sandstone cliffs (which constitute the “Greater Shawnee Hills”) and a series of lower hills underlain by Mississippian limestone and sandstone and, locally, siltstone and shale (known as the “Lesser Shawnee Hills”) (Schwegman 1973, Woods et al. 2006). Bedrock is covered by a thin to thick layer of Quaternary loess. Soils can be calcareous or acidic. Drier examples of this BpS are found on southerly to westerly aspects and broad ridges; submesic to dry-mesic examples are typically found on midslopes with northerly or easterly aspects (NatureServe 2007). This BpS transitions to BpS 1321 (South-Central Interior Mesophytic Forest) on lower slopes and protected coves. Annual precipitation in the Illinois range of BpS 1305 is 46 in; length of average growing season is 185-192 days (Woods et al. 2006).

Vegetation Description

In Illinois, this BpS is dominated by white oak (*Quercus alba*), black oak (*Q. velutina*) and shagbark hickory (*Carya ovata*), associated with post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), scarlet oak (*Q. coccinea*), chestnut oak (*Q. prinus*), pignut hickory (*Carya glabra*) and black hickory (*C. texana*) on the driest sites (Braun 1950, Schwegman 1973, White and Madany 1978, NatureServe 2007). Submesic to dry-mesic stands may include red oak (*Quercus rubra*) and mockernut hickory (*Carya tomentosa*) (White and Madany 1978). On extremely shallow soils over bedrock or gravel, canopy trees may be scattered and stunted. On better soils,

trees are larger, and a closed canopy develops. Characteristic shrubs on the driest sites include farkleberry (*Vaccinium arboreum*) and lowbush blueberry (*V. pallidum*). Flowering dogwood (*Cornus florida*), hop-hornbeam (*Ostrya virginiana*) and black haw (*Viburnum prunifolium*) are characteristic of dry-mesic sites. Ground layer species vary, but include Christmas fern (*Polystichum acrostichoides*), wild comfrey (*Cynoglossum virginianum* var. *virginianum*), ebony spleenwort (*Asplenium platyneuron*), tall hairy agrimony (*Agrimonia gryposepala*), hog-peanut (*Amphicarpaea bracteata*), sedges (*Carex blanda*, *C. pensylvanica*), tick-trefoil (*Desmodium* spp.) and poverty oat grass (*Danthonia spicata*) (NatureServe 2007).

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUAL	<i>Quercus alba</i>	White oak
QUVE	<i>Quercus velutina</i>	Black oak
CAOV2	<i>Carya ovata</i>	Shagbark hickory
QUST	<i>Quercus stellata</i>	Post oak
QUPR2	<i>Quercus prinus</i>	Chestnut oak
QUCO2	<i>Quercus coccinea</i>	Scarlet oak
CAGL8	<i>Carya glabra</i>	Pignut hickory
VAAR	<i>Vaccinium arboreum</i>	Farkleberry

Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

This system is impacted by disturbances at different scales and in different seral states (estimated historic frequencies for the various modeled disturbances are included in this description below). In the later, more persistent portions of the life cycle, small canopy gaps may be created across the landscape by the death of individual (or small numbers of) trees which topple. However, weather related events (ice, wind, etc.) could have created gaps in the mature canopy that range from individual tree size to larger areas depending on the specific incident. Fire also occurred, mostly at low and moderate intensities, and could create much larger openings or more open forest canopies when they occur in any seral stage.

The oak-hickory forest is predominantly Fire Regime I, characterized by low-severity surface fires. Historically, indigenous fires accounted for over 95% of the ignitions over these landscapes. Vegetation types varied based on fire frequency and intensity. Grasslands burned often (annually, biennially) and were probably associated with flat-to-slightly rolling terrain that effectively carried fire. These grasslands, deliberately maintained by Native Americans for hunting purposes, were probably scattered throughout the forest matrix. Oak-hickory grubs (tree-sprout and shrub thickets) and small areas of shortleaf pine occurred where fire frequency was a bit less, probably 3-9yrs. Grub conditions would also arise immediately after catastrophic burns that would top-kill tree-dominated communities.

Savannas and woodlands developed within a moderate burning regime, with fire return intervals also averaging every 3-9yrs. Closed-canopy oak-hickory forests would develop where fire return intervals stretched beyond 15yrs. Shade-tolerant, fire-sensitive maples (and associated late-successional trees) would regenerate and form understories beneath oak-hickory canopies when fire was excluded over several decades. With continued fire exclusion, maple and other late-successional species would gradually replace overstory oaks and hickories through gap capture

(Sutherland and Hutchinson 2003). A mosaic of vegetation types comprised oak-hickory landscapes contingent on fire history (Cutter and Guyette 1994). In a recent study on fire history of a red oak stand in West Virginia it was found that fire intervals ranged from 7-32yrs from 1846 to 2002 with a median of approximately 16yrs, and prior to the fire control era ranged from 7-15yrs (Schuler and McClain, 2003). Schuler and McClain stated that these observations did not deviate significantly from previous research in the oak forests of Ohio, Maryland, and Missouri. For fire references in MZ49, see Batek et al. (1999), Fralish (1988), and Fralish et al. (1991). Fire frequencies in southern IL are likely similar to those reported elsewhere for oak-hickory forests.

NatureServe (2007) notes that Native Americans played a critical role in the development and maintenance of oak-hickory landscapes through fire ignition, as lightning-strike ignitions were limited. Natives burned these landscapes for a variety of reasons. Fire encouraged open habitats which, in turn, increased food-producing plants (forbs, mast) and ungulate herbivores (meat). Mixed (maple-dominated) forests were relegated to those areas where fire was restricted, often associated with mesic coves, wetter depressions, and lee-sides of natural fire breaks (e.g., rivers and lakes). Prolonged lengths of time (100-150yrs) were needed for maple dominance to manifest.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	62	12	1	25
Moderate (Mixed)	119	6		
Low (Surface)	9	82	2	25
All Fires	8	100		

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Pre-European oak-hickory forests covered hundreds of thousands of contiguous acres.

Adjacency or Identification Concerns

Adjacent Ecological System Comments: The somewhat more mesic and/or more base-rich forests of the lower slopes of the Shawnee Hills are covered by South-Central Interior Mesophytic Forest (CES202.887 -- BpS 1321).

Issues or Problems

This type occurs across many coarse mapped Rapid Assessment PNVGs. Many FRCC models are redundant, overlap, or are similar.

Native Uncharacteristic Conditions

American Chestnut, characteristic of dry-mesic oak forests in the eastern United States prior to the introduction of Chestnut blight, was absent or local in MZ49 (see Russell 1987). Stump-sprouting following widespread anthropogenic disturbances in the 1800s and early 1900s (including cutting, fire, and farming/grazing) has resulted in oak colonization of sites previously supporting mesophytic forest (Fralish 1988).

Comments

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41 - 50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	A	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	B	B	B	B	UN	UN	UN	UN	UN	UN
Shrub	0.5-1.0	B	B	B	B	UN	UN	UN	UN	UN	UN
Shrub	1.0-3.0	B	B	B	B	UN	UN	UN	UN	UN	UN
Shrub	>3.0	B	B	B	B	UN	UN	UN	UN	UN	UN
Tree	0-5	B	B	B	B	UN	UN	UN	UN	UN	UN
Tree	5-10	UN	UN	C	C	C	C	D	D	UN	UN
Tree	10-25	UN	UN	C	C	C	C	D	D	UN	UN
Tree	25-50	UN	UN	UN	UN	UN	UN	D	D	E	E
Tree	>50	UN	UN	UN	UN	UN	UN	D	D	E	E

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A	3	Early Development 1 - All Structures
----------------	----------	---

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ANGE	Andropogon gerardii	Big bluestem	Upper
SCSC	Schizachyrium scoparium	Little bluestem	Upper
SONU2	Sorghastrum nutans	Indiangrass	Upper
QUAL	Quercus alba	White oak	Middle

Description

Class A is grasslands/savanna maintained by frequently recurring fire. These patches would typically be <100ac, but may have been up to 500ac. Native Americans used these lands for hunting, and agriculture/native plant gathering. If fire is absent for a few years, tree seedlings and sprouts will establish and move the community to the mid-seral, open stage (class C). Tallgrass species dominate, including big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and Indiangrass (*Sorghastrum nutans*), with scattered oaks (*Quercus* spp.).

Maximum Tree Size Class

None

Class B	10	Mid Development 1 - Open
----------------	-----------	---------------------------------

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
QUVE	Quercus velutina	Black oak	Low-Mid
ANGE	Andropogon gerardii	Big bluestem	Upper
CARYA	Carya	Hickory	Mid-Upper

Description

This is an early tree regeneration (root and stump sprouts) phase.

Areas that receive frequent surface fires will be populated by fire-adapted species such as oaks and hickories. These fires will top-kill seedlings and sprouts and a proportion of the saplings. These communities will develop into the mid-seral, open oak-hickory forest class. Occasional fires of high severity will top-kill all trees moving the community back to the early-seral class.

Maximum Tree Size Class

Sapling >4.5ft; <5"DBH

Class C	50	Late Development 1 - Open
----------------	-----------	----------------------------------

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
CARYA	Carya	Hickory	Upper
QUVE	Quercus velutina	Black oak	Upper
QUCO2	Quercus coccinea	Scarlet oak	Upper

Description

This class is defined as oak-hickory woodland. The canopy closure is less than 60%. This community quite commonly experiences frequent surface fires. If fire is absent from this community for an extended period, the canopy will become less open, moving the community into the late-seral, closed canopy (60-100%), oak-hickory forest.

An occasional replacement fire will move this community back to an early seral, open stage.

Maximum Tree Size Class

Large 21-33"DBH

Class D	35	Late Development 2 - Closed
----------------	-----------	------------------------------------

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper

Replacement Fire	Late1:OPN	Early1:ALL	0.004	250	Yes	0
Mixed Fire	Late1:OPN	Late1:OPN	0.01	100	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.15	7	No	0
Alternative Succession	Late2:CLS	Late3:CLS	1	1	Yes	50
Wind or Weather or Stress	Late2:CLS	Early1:ALL	0.001	1000	Yes	0
Replacement Fire	Late2:CLS	Early1:ALL	0.004	250	Yes	0
Mixed Fire	Late2:CLS	Late1:OPN	0.01	100	Yes	0
Surface Fire	Late2:CLS	Late2:CLS	0.1	10	No	0
Wind or Weather or Stress	Late3:CLS	Early1:ALL	0.001	1000	Yes	0
Replacement Fire	Late3:CLS	Early1:ALL	0.001	1000	Yes	0
Mixed Fire	Late3:CLS	Late2:CLS	0.005	200	Yes	0
Surface Fire	Late3:CLS	Late3:CLS	0.025	40	No	0

References

Batek, J.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.

Blake, J.G. and B. Schuette. 2000. Restoration of an oak forest in east-central Missouri: Early effects of prescribed burning on woody vegetation. *Forest Ecology and Management* 139: 109-126.

Braun, E.L., 1950. *Deciduous forests of eastern North America*. Hafner Publishing Company, New York, NY.

Chapman, R.A., E. Heitzman, and M.G. Shelton. 2006. Long-term changes in forest structure and species composition of an upland oak forest in Arkansas. *Forest Ecology and Management* 236: 85-92.

Cutter, B.E. and R.P. Guyette. 1994. Fire frequency on an oak-hickory ridgetop in the Missouri Ozarks. *American Midland Naturalist* 132: 393-398.

Dey, D.C. and G. Hartman. 2005. Returning fire to Ozark Highland forest ecosystems: Effects on advance regeneration. *Forest Ecology and Management* 217: 37-53.

Fralish, J.S. 1988. Predicting potential stand composition from site characteristics in the Shawnee Hills forest of Illinois. *American Midland Naturalist* 120: 79-101.

Fralish, J.S., F.B. Crooks, J.L. Chambers, and F.M. Harty. 1991. Comparison of presettlement, second-growth, and old-growth forest on six site types in the Illinois Shawnee Hills. *American Midland Naturalist* 125: 294-309.

Heikens, A.L. and P.A. Robertson. 1995. Classification of barrens and other natural xeric forest openings in southern Illinois. *Bulletin of the Torrey Botanical Club* 122: 203-214.

Huddle, J.A. and S.G. Pallardy. 1996. Effects of long-term annual and periodic burning on tree survival and growth in a Missouri Ozark oak-hickory forest. *Forest Ecology and Management* 82: 1-9.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.7. NatureServe, Arlington, VA. 28 November 2007 <http://www.natureserve.org/explorer>.

Ozier, T.B., J.W. Groninger, and C.M. Ruffner. 2006. Community composition and structural changes in a managed Illinois Ozark Hills forest. *American Midland Naturalist* 155: 253-269.

Ruffner, C.M. and J.W. Groninger. 2006. Making the case for fire in southern Illinois forests. *Journal of Forestry* 104: 78-83.

Russell, E.W.B. 1987. Pre-blight distribution of *Castanea dentata* (Marsh.) Borkh. *Bulletin of the Torrey Botanical Club* 114: 183-190.

Schwegman, J.E. 1973. Comprehensive plan for the Illinois nature preserves system- Part II: The natural divisions of Illinois. Illinois Nature Preserves Commission, Springfield, IL. 32 pp.

Shang, Z., H.S. He, D.E. Lytle, S.R. Shifley, and T.R. Crow. 2007. Modeling the long-term effects of fire suppression on central hardwood forests in Missouri Ozarks, using LANDIS. *Forest Ecology and Management* 242: 776-790.

White, J. and M.H. Madany. 1978. Classification of natural communities in Illinois. Appendix 30 in: Illinois Natural Areas Inventory- Technical report by The Department of Landscape Architecture, University of Illinois at Urbana-Champaign & The Natural Land Institute, Rockford, IL.

Woods, A.J., J.M. Omernik, C.L. Pederson, and B.C. Moran. 2006. Ecoregions of Illinois (2-sided color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey, scale 1: 500,000.

Yang, J., H.S. He, S.R. Shifley, and E.J. Gustafson. 2007. Spatial patterns of modern period human-caused fire occurrence in the Missouri Ozark Highlands. *Forest Science* 53: 1-15.