

13050

Southern Interior Low Plateau Dry-Mesic Oak Forest

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
Jim McCoy	jrmccoy@fs.fed.us	None	None
Michele Morris	mmorris@tnc.org	None	None
None	None	None	None

Reviewed by: Roger Williams

Vegetation Type

Forest and Woodland

Map Zones

47, 48

Geographic Range

This system occurs in the southeastern Interior Highlands of the Interior Low Plateau region, including southern Indiana and a small part of southeastern Ohio. This system of upland hardwood-dominated forests occurs in the Interior Low Plateau region of the southeastern United States along ridgetops and slopes of various aspects. The system includes essentially all upland hardwood stands of the region except for mesic hardwood forests (which are accommodated by South-Central Interior Mesophytic Forest [CES202.887]).

Biophysical Site Description

This system encompasses dry hardwood forests on predominantly acidic substrates. Included here are a variety of associations ranging along a moisture gradient from submesic to drier ones. The submesic to dry-mesic expressions tend to be found on midslopes with northerly to easterly aspects, and the drier ones occur on southerly to westerly aspects and on broad ridges. Parent material can range from calcareous to acidic with very shallow, well- to excessively well-drained soils in the drier expressions and moderately well-drained soils in the submesic to dry-mesic ones. The canopy closure of this system ranges from closed to somewhat open in the drier examples. Historically, these examples may have been more open under conditions of more frequent fire.

Vegetation Description

The floristic expression of different stands included in this system varies considerably with aspect and soil type. A number of different *Quercus* species may dominate stands of this system, with *Carya* species also prominent. In the drier examples, *Quercus prinus* is typical over most of the range, reflecting relations with other Appalachian systems to the east. In addition, *Quercus stellata*, *Quercus marilandica*, and *Quercus coccinea* will also share dominance or be prominent in many of the drier examples. *Quercus shumardii* may appear in drier examples with high base status. *Quercus alba* may also be present but not typically dominant. In the submesic to dry-mesic examples, *Quercus alba* will typically exhibit dominance, possibly with *Quercus rubra* or *Quercus falcata*. The understories are typically shrub- and small tree-dominated, with the typical species varying with aspect, soil, and moisture relations.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUAL	<i>Quercus alba</i>	White oak
QUVE	<i>Quercus velutina</i>	Black oak
QUPR2	<i>Quercus prinus</i>	Chestnut oak
QUCO2	<i>Quercus coccinea</i>	Scarlet oak
ACRU	<i>Acer rubrum</i>	Red maple
CAGL8	<i>Carya glabra</i>	Pignut hickory
CAAL27	<i>Carya alba</i>	Mockernut hickory
QUST	<i>Quercus stellata</i>	Post oak

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.

Most oaks are long-lived with typical age of mortality ranging from 200-400yrs. Scarlet and black oaks are shorter-lived with typical ages being ~50-100yrs, while white oaks can live as long as 600yrs. Extreme wind or ice storms occasionally create larger canopy openings. The oak-hickory forest is predominantly Fire Regime I, characterized by low-severity surface fires. Historically, indigenous fires accounted for >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. In turn, large herbivores (elk, bison) played a role in maintaining the openness of this system. Oak-hickory grubs (tree-sprout and shrub thickets) and small areas of yellow 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 (FRIs) also averaging every 3-9yrs. Closed-canopy oak-hickory forests would develop where FRIs stretched beyond 15yrs. Shade-tolerant, fire-sensitive maples (and associated mesophytic species) would regenerate and form understories beneath oak-hickory canopies when fire was excluded over several decades. With continued fire exclusion, maple and other mesophytic 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 FRIs ranged from 7-32yrs from 1846-2002 with a median of ~16yrs, and prior to the fire control era, the FRI 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. The above description was taken from Rapid Assessment (RA) model R6OAH1 -- Oak Hickory.

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. Native Americans 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 (40-70yrs) were needed for maple dominance to manifest.

There is no doubt that prior to European settlement oak-hickory forests were a dominant forest type in Ohio if not *the* dominant forest. But how much of that is due to natural fires is unknown and subject to conjecture. A reviewer suggests that it was a result of unnatural causes, that is, the result of Native Americans burning the landscape. Samuel Hildreth in 1848 noted the annual burning in the fall by the Native Americans in Ohio. Hildreth was a physician, scientist, and historian, authoring numerous scientific and historical works and had spent time in Marietta, Ohio. Lewis and Clark in their journal entries of 29 October 1804 and 30 March 1805 write about how the Native Americans would set vast areas on fire. William Dunbar, a land surveyor, in 1804 wrote about how common it was for Native Americans to set forests and plains on fire in November and December; the fires would go for 100s of miles before being extinguished. So when restoring oak forests to pre-settlement conditions is the purpose, it means restoring to the conditions when Native Americans dominated the landscape.

Lightning strike fires are relatively rare in Ohio, accounting for typically one or two fires a year, and do not burn substantial acreages. Oak forest fuels are typically not highly flammable, and most lightning strikes occur during the growing season when fuels are much less available. When referencing fire frequencies, it means how often Native Americans set fires.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	6	78	1	25
Moderate (Mixed)	198	2		
Low (Surface)	21	20	2	25
All Fires	4	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/woodlands/savannas covered 100s of 1,000s of contiguous acres and may not have been structurally distinguishable across many millions of acres.

Adjacency or Identification Concerns

This system is anthropogenically created and historically would have been structurally indistinguishable from similar woodland systems in adjacent states (Arkansas, Missouri, Tennessee). Adjacent Ecological System Comments: The somewhat more mesic and/or more

Issues or Problems

Native Uncharacteristic Conditions

Comments

Another problematic species is yellow poplar. While it is fire-intolerant, it also responds to fire, but in a different way than red maple. Yellow poplar is very easily top-killed by fire and sprouts less because of total kill. However, it responds prolifically by high seed dispersal into good fire-created seed beds; seeds stored in the soil respond likewise. It puts out a high number of new germinants immediately after fire, and because of their fast growth, it can overtake oak very easily. Again, frequent FRIs of 10-20yrs may not be sufficient to create an oak-dominated reproduction layer.

Mapping Rules

[illegible]

Description

Type can be classified as thicket, very similar to old field succession (class age = 4-19yrs); this is an early tree regeneration (root and stump sprouts) phase; fire frequency is about 3-9yrs. Any area that does not burn frequently is probably too moist and will be populated by mixed-mesophytic tree species. Species such as eastern red cedar, elms, and in some cases Virginia pine often begin the transition from Class A to Class B. Oak, hickory, and mesophytic species may all be present in this class. 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 but will not move the community back to the early-seral class.

Maximum Tree Size Class

Sapling >4.5ft; <5" DBH

Class C	36	Mid Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
SCHIZ4	Schizachyrium	Little bluestem	Lower
QUVE	Quercus velutina	Black oak	Upper
DANTH	Danthonia	Oatgrass	Lower

Description

Type can be classified as open woodland. This class is defined as the mid-seral open oak-hickory woodland (which gradiates to Class A). This community quite commonly experiences frequent surface fires, and the FRI is typically 5-15yrs. The canopy closure is <60%. Mesophytic species may be present, but oak-hickory is dominant in the regeneration layer. If fire is absent from this community for an extended period (~25-30yrs), the canopy will become less open, moving the community into the late-seral, closed canopy (60-100%), oak-hickory forest. An occasional canopy removal event from fire or weather followed by fire exclusion will move this community back to a mid-seral, closed early tree regeneration phase. This type can move back to Early1:All after a canopy removal event, provided that fire is not excluded.

Maximum Tree Size Class

Medium 9-21" DBH

Class D	20	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
QURU	Quercus rubra	Northern red oak	Upper
QUCO2	Quercus coccinea	Scarlet oak	Upper

QUVE	Quercus velutina	Black oak	Upper
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Description

Type can be classified as closed-canopy oak-hickory forest. This class is defined as a late seral closed-canopy oak-hickory forest. Open understories of oak seedlings dominate on dry, xeric sites, while mesophytic species dominate on more mesic sites. Stand-replacement fires in late-succession closed class types are rare (200-yr interval) and will result in return to a mid-succession closed class. Widespread, high-severity fire is restricted to drought years due to the mosaic of fuel models. Mixed fire has a FRI of ~66yrs and will send the system to a mid-succession patchwork of Mid1:OPN. Low-severity surface fires occur on average every 10yrs and result in maintaining the late-succession closed forest type. If the late-succession open forest type persists for 70yrs without any type of fire, it will convert to a late-succession mixed mesophytic closed forest type. This conversion is a result of species shift from dominant oaks to dominant maple, tulip tree, and beech, which do not support fire as readily.

Maximum Tree Size Class

Medium 9-21" DBH

Class E 3 Late Development 2 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ACRU	Acer rubrum	Red maple	Upper
ACSA3	Acer saccharum	Sugar maple	Upper
LIRIO	Liriodendron	Tuliptree	Upper
FAGR	Fagus grandifolia	American beech	Upper

Description

Type can be classified as closed mesophytic forests. Mixed (maple) forests develop during the absence of fire. Dense understories of shade-tolerant species develop, causing oak-hickory dominance to fade.

Maximum Tree Size Class

Medium 9-21" DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:CLS	10
Mid1:CLS	11	Mid1:OPN	19
Mid1:OPN	20	Mid1:OPN	999
Late1:CLS	20	Late1:CLS	999
Late2:CLS	20	Late2:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Native Grazing	Early1:ALL	Early1:ALL	0.17	6	No	0
Replacement Fire	Early1:ALL	Early1:ALL	0.45	2	Yes	0
Alternative Succession	Mid1:OPN	Late1:CLS	1	1	Yes	20
Wind or Weather or Stress	Mid1:OPN	Early1:ALL	0.001	1000	Yes	0
Replacement Fire	Mid1:OPN	Mid1:CLS	0.005	200	Yes	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.1	10	No	0
Alternative Succession	Mid1:CLS	Late2:CLS	0.01	100	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.01	100	Yes	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.05	20	No	0
Alternative Succession	Late1:CLS	Late2:CLS	1	1	Yes	70
Replacement Fire	Late1:CLS	Mid1:CLS	0.0025	400	Yes	0
Mixed Fire	Late1:CLS	Mid1:OPN	0.025	40	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.05	20	No	0
Replacement Fire	Late2:CLS	Mid1:CLS	0.0007	1429	Yes	0
Mixed Fire	Late2:CLS	Mid1:OPN	0.005	200	Yes	0
Wind or Weather or Stress	Late2:CLS	Mid1:CLS	0.007	143	Yes	0
Surface Fire	Late2:CLS	Late2:CLS	0.025	40	No	0

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