

13690

Central Appalachian Dry Oak-Pine Forest

BpS Model/Description Version: Aug. 2020

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Modelers		Reviewers	
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None	None	None	None
None	None	None	None

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Vegetation Type

Forest and Woodland

Map Zones

60, 61, 63, 64, 65, 66

Geographic Range

This system is found from central New England through Pennsylvania and south to central Virginia.

The southern range limit in Virginia, where this system overlaps with Southern Piedmont Dry Oak-Pine Forest or Woodland (Biophysical Setting [BpS] 1368; CES202.339) needs to be determined (NatureServe 2007). This model should be reviewed outside the stated mapzones.

Biophysical Site Description

These oak and oak-pine forests cover large areas in the low- to mid-elevation central Appalachians and middle Piedmont (NatureServe 2007).

The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. The soils are coarse and infertile; they may be deep (on glacial deposits in the northern part of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock) (NatureServe 2007).

The well-drained soils and exposure create dry conditions. The well-drained soils and exposure create dry conditions.

Embedded submesic ravines and concave landforms support slightly more diverse forests characterized by mixtures of oaks, several hickories, *Cornus florida*, and sometimes *Liriodendron tulipifera*. Small hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic (NatureServe 2007).

This system occurs in drier settings than the other matrix oak forest system of the division, i.e., Northeastern Interior Dry-Mesic Oak Forest (BpS 1303; CES202.592). It includes the system formerly segregated as Southern Piedmont Dry Oak-Heath Forest (CES202.023). Its analog from central VA south is the Southern Piedmont Dry Oak-(Pine) Forest (BpS 1368; CES202.339),

which has somewhat more southern floristics, for example, the typical presence of *Pinus taeda* (NatureServe 2007).

Vegetation Description

The forest is mostly closed-canopy but can include more open woodlands. It is dominated by a variable mixture of dry-site oak and pine species, most typically *Quercus prinus*, *Pinus virginiana*, and *Pinus strobus*, but sometimes *Quercus alba* and/or *Quercus coccinea*. The system may include areas of oak forest, pine forest (usually small), and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum*, *Gaylussacia baccata*, and *Kalmia latifolia* are common in the understory and often form a dense layer (NatureServe 2007). In the southern part of this ecosystem *Pinus echinate*, *Quercus stellata* and *Quercus marlinadica* would have been present. *Pinus virginiana* is absent from the system at the northern edge of its range.

There is debate over whether much of this oak-pine system was in more of a woodland condition, rather than closed canopy, with lots of grass and forbs in the understory. Particularly within the pine stands.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUPR2	<i>Quercus prinus</i>	Chestnut oak
PIVI2	<i>Pinus virginiana</i>	Virginia pine
PIST	<i>Pinus strobus</i>	Eastern white pine
VAPA4	<i>Vaccinium pallidum</i>	Blue ridge blueberry
GABA	<i>Gaylussacia baccata</i>	Black huckleberry
KALA	<i>Kalmia latifolia</i>	Mountain laurel
ACRU	<i>Acer rubrum</i>	Red maple
NYSY	<i>Nyssa sylvatica</i>	Blackgum

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

Disturbance Description

Disturbance agents include fire, windthrow, and ice damage. Increased site disturbance generally leads to secondary forest vegetation with a greater proportion of *Pinus virginiana* and weedy hardwoods such as *Acer rubrum* (NatureServe 2007). In Vermont, the absence of periodic fire typically leads to encroachment of *Acer rubrum*. Also, increased site disturbance leads to oaks being more dominant. The greater the disturbance, the more oaks and pine will outcompete others.

There is an ongoing debate about the role of fire in the development of oak and pine forests in the eastern US. One viewpoint is that frequent surface fires (return interval of 2-15yrs) occurred across much of the landscape in the eastern US promoting fire tolerant oak and pine species. See Nowacki and Abrams 2008 or Brose et al. 2001 for a broad explanation of this view. Site specific fire histories have been reconstructed for sites in the dry oak-pine forests types in Virginia, Tennessee, and North Carolina with short fire return intervals from 3-10yrs. The place to start with this information is the Lafon review and synthesis of fire history work that has been done in the region. This contains references to journal articles and dissertations that provide evidence of frequent fire in these stands across many sites (~ 8 in Virginia). This synthesis also

provides a discussion of literature on age structure in these stands and what this likely indicates about the role of fire in the development of oak-pine stands.

One limitation of these fire histories is that they have primarily been reconstructed in the pine stands because hardwood (oak) species tend to rot after scarring and do not preserve the scars. This limitation brings up the question of whether it is appropriate to apply these frequent fire intervals to the broader oak matrix. However, the table mountain pine stands in which we collect fire history are small (~2-10 ha) on upper ridges and southwest facing noses and therefore it is unlikely that they would have experienced small localized fires due to lightning at this high frequency. It is much more likely that large fires were burning through the broader oak-pine matrix. Some evidence of this has been developed by reconstructing return intervals for area wide fires, which are fires that burned multiple pine stands at a site in a single year, suggesting that the fires had to burn through the intervening oak forests in order to scar trees in two separate pine stands (see Flately et al. 2013 and Aldrich et al. 2014).

The alternate view on the role of fire in these stands posits that oak-pine stands are primarily a product of anomalous, stand replacing anthropogenic disturbance during the late 1800s to early 1900s, with the stands currently proceeding through natural succession towards a hardwood condition that was typical of these sites prior to industrial disturbance (Williams 1998 or Hessl et al. 2011). Or that multiple interacting disturbances (drought, fire, land use, passenger pigeons) promoted oaks over many centuries (McEwan et al. 2011).

The other consideration is whether the fire histories that we have reconstructed are an anthropogenic fire regime. The prevailing opinion is that most of these fires were probably lit by humans, because there is not enough lightning initiated fire in the contemporary period to produce the frequent fire that we have found (Lafon 2005). However, our fire history records predate Euro-American settlement and show no change in frequency or seasonality with their arrival. So frequent fire would have been prevalent, possibly due to Native Americans. This may have varied according the population levels and spatial patterns of settlement, but something was promoting oaks, hickories, and pines in this region for the last 6-8,000yrs since climate warmed following the last glaciation.

Most ecologists agree that some relatively frequent disturbance process was required to maintain oak and pine dominance in the canopy. The succession of contemporary stands towards mesophytic species during the last 70-90yrs indicates the disturbance return interval of 80 years listed here is not sufficient to maintain pine oak dominance and certainly not frequent enough to maintain an open condition. Canopy disturbance in contemporary stands (80yrs into successional change following fire suppression) tends to accelerate successional change towards dominance of red maples and other mesophytic species, not promote oaks and pines because there is not any advanced regeneration in the mid-story. See some of the literature about the success of individual prescribed fires in contemporary fire suppressed oak and pine stands. Recent studies of prescribed burns have shown that a single fire will not necessarily promote pine and oak regeneration (Waldrop and Brose 1999, Welch et al. 2000, Elliott and Vose 2005, Albrecht and McCarthy 2006). In contrast, a single prescribed fire can actually increase the density of undesirable hardwoods (non oak-pine species) due to aggressive post-fire sprouting. Successful regeneration of pine and oak may require multiple burns over several years to eliminate competing hardwood sprouts, reduce duff and litter layers, and open the canopy (Elliott et al. 1999, Welch et al. 2000). Therefore, I think that the long

disturbance intervals that you have modeled in LANDFIRE would likely promote mesophytic hardwoods stands dominated by red maple and blackgum, rather than oak and pine-dominated stands.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	178	8		
Moderate (Mixed)	451	3		
Low (Surface)	15	89		
All Fires	13	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

Large-patch (at outer range) to matrix (in center of range) system that may cover extensive hillslopes and low ridges (NatureServe 2007). Mostly small patch forests at the northern edge of its range, although, prior to European settlement this system was widespread in the sandplains of the Champlain Valley.

Adjacency or Identification Concerns

This system occurs in drier settings than the other matrix oak forest system of the division, i.e., Northeastern Interior Dry-Mesic Oak Forest (CES202.592). It includes the system formerly segregated as Southern Piedmont Dry Oak-Heath Forest (CES202.023). Its analog from central VA south is Southern Piedmont Dry Oak-(Pine) Forest (BpS 1368; CES202.339), which has somewhat more southern floristics, for example, the typical presence of *Pinus taeda* (NatureServe 2007).

Similar Ecological Systems noted by NatureServe (2007) include:

- Southern Appalachian Oak Forest (BpS 1315; CES202.886), found south of Roanoke River in central Virginia (Blue Ridge/southern Appalachians only).
- Southern Piedmont Dry Oak-(Pine) Forest (BpS 1368; CES202.339)

Issues or Problems

Native Uncharacteristic Conditions

Comments

The forest is mostly closed-canopy but can include more open woodlands with disturbance, such as active management (e.g., prescribed fire and/or timber harvest) in these ecosystems today. Clark mentions that historically there could have been the rare drought followed by fire, but that she has not seen evidence of this in the literature.

Also, currently insect outbreaks from non-natives (gypsy moth) and natives (forest tent caterpillar, cicada) and from disease (*Armillaria*, *Phytophthora* in southern range). Non-fire disturbances are probably the most common type today.

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	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Herb	0.5-1.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Herb	>1.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	0-0.5	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	0.5-1.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	1.0-3.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	>3.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	0-5	A	A	A	A	A	A	A	A	A	A
Tree	5-10	A	A	A	A	A	A	A	A	A	A
Tree	10-25	UN	UN	UN	C	C	C	C	C	B	B
Tree	25-50	UN	UN	UN	D	D	D	D	D	E	E
Tree	>50	UN	UN	UN	D	D	D	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 11 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUPR2	Quercus prinus	Chestnut oak	Upper
QUAL	Quercus alba	White oak	Upper
QUVE	Quercus velutina	Black oak	Upper
CADE12	Castanea dentata	American chestnut	Upper

Description

Treefall gaps and small to medium patches with saplings and small trees up to 20cm (8in) DBH. Potential canopy species (oaks) are typically mixed with subcanopy and shrub species and herbs.

This class would have also included *Pinus virginiana* and *Pinus echinata*.

Maximum Tree Size Class

Sapling >4.5ft; <5"DBH

Class B 15 Mid Development 1 - Closed

Indicator Species

Maximum Tree Size Class

Large 21-33"DBH

Class E 20 Late Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUPR2	Quercus prinus	Chestnut oak	Upper
CADE12	Castanea dentata	American chestnut	Upper
PIST	Pinus strobus	Eastern white pine	Middle
QURU	Quercus rubra	Northern red oak	Upper
QUVE	Quercus velutina	Black oak	Upper

Description

Late- seral closed. Would be more diverse than indicated in Indicator Species table alone. Midstory and understory closed with dense cover and stocking of shrubs and saplings.

Maximum Tree Size Class

Large 21-33"DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	19
Mid1:OPN	20	Late1:OPN	69
Mid1:CLS	20	Late1:CLS	69
Late1:CLS	69	Late1:CLS	999
Late1:OPN	70	Late1:OPN	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
Alternative Succession	Early1:ALL	Mid1:CLS	1	1	Yes	19
Replacement Fire	Early1:ALL	Early1:ALL	0.0067	149	Yes	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.003	333	Yes	0
Wind or Weather or Stress	Mid1:OPN	Mid1:OPN	0.1	10	No	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.1	10	No	0
Wind or Weather or Stress	Mid1:CLS	Mid1:OPN	0.003	333	Yes	0

Replacement Fire	Mid1:CLS	Early1:ALL	0.0067	149	Yes	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.01	100	Yes	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.03	33	No	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	100
Replacement Fire	Late1:OPN	Early1:ALL	0.0067	149	Yes	0
Wind or Weather or Stress	Late1:OPN	Late1:OPN	0.025	40	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.1	10	No	0
Mixed Fire	Late1:CLS	Mid1:OPN	0.003	333	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.003	333	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.003	333	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.03	33	No	0

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