Appendix H. LANDFIRE BpS Model Allegheny-Cumberland Dry Oak Forest And Woodland

LANDFIRE Biophysical Setting Model

Biophysical Setting **5712170 Allegheny-Cumberland Dry Oak Forest and Woodland**

General Information

Contributors	**Date 8/15/2007**	**Date 1/10/2011**	
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Vegetation Type
Forest

Map Zone
57

Model Zone
√ S. Appalachians

Dominant Species

QUAL	ACRU
QUFA	CAGL8
QUPR2	CAAL27
QUCO2	CADE12

General Model Sources
√ Literature
√ Local Data
√ Expert Opinion

Geographic Range

This system occurs on the Allegheny, Piedmont, and Cumberland plateaus, and may be applicable to other forests in the Central Hardwoods Region dominated by oak species, predominantly Quercus alba (and Quercus Montana). This system can also be found as small (to large) isolated patches in the Southern Blue Ridge (NatureServe 2007).

Biophysical Site Description

This system encompasses dry (to xeric) hardwood forests (and oak-pine woodlands) on predominantly acidic substrates in the Allegheny and Cumberland plateaus, and ridges in the Ridge and Valley. This system can also be found as small isolated (to large) patches in the Southern Blue Ridge. Its range is more or less consistent with the "Mixed Mesophytic Forest Region" of Braun (1950) and Greller (1988), although it is not a mesic forest type (NatureServe 2007).

Vegetation Description

These forests were typically dominated by Quercus alba, Quercus falcata, Quercus prinus, Quercus coccinea, with lesser amounts of Acer rubrum, Carya glabra and Carya alba. These occur in a variety of situations, most likely on nutrient-poor or acidic soils and, to a much lesser extent, on circumneutral soils. American chestnut (Castanea dentata) was once dominant or codominant in many of these forests and sprouts of C. dentata can often be found where it was formerly a common tree. Small inclusions of Pinus echinata and/or Pinus virginiana may occur, particularly adjacent to escarpments or following fire. In the absence of fire, Pinus strobus may invade some stands (NatureServe 2007).

Today, subcanopies and shrub layers are usually well-developed. Some areas (usually on drier sites) now have dense evergreen ericaceous shrub layers of mountain laurel (Kalmia latifolia), fetterbush (Pieris floribunda), or on more mesic sites rhododendron (Rhododendron spp.). Other areas have more open shrub layers, sometimes consisting of blueberries (Vaccinium spp.) or huckleberries (Gaylussacia spp.). Herbs, forbs and ferns are usually sparse to moderate in density.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement .

Disturbance Description

This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration. Most oaks are long-lived with typical age of mortality ranging from 200 to 400yrs. Scarlet and black oaks are shorter-lived with typical ages being approximately 50 to 100yrs, while white oaks can live as long as 600yrs. A mixed pine component would exist on poor soils on ridgetops. 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 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 yellow pine occurred where fire frequency was a bit less, probably 3 to 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 to 9 yrs. Closed-canopy oak-hickory forests would develop where fire return intervals stretched beyond 18 yrs. 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 to 32yrs from 1846 to 2002 with a median of approximately 16yrs, and prior to the fire control era ranged from 7 to 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 RA model R6OAHI -- 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. 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 to 150yrs) were needed for maple dominance to manifest.

Adjacency or Identification Concerns

Adjacent Ecological System Comments: The somewhat more mesic and/or more base-rich forests of the lower slopes of the Cumberlands and the lower slopes and valleys in the Ridge and Valley are covered by South-Central Interior Mesophytic Forest (CES202.887 -- BpS 1321). Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457 -- BpS 1376)--is found in some similar landscapes as BpS 1317 -- Allegheny-Cumberland Dry Oak Forest and Woodland, but on more base-rich substrates, which usually correspond to different landform positions (NatureServe 2007).

Native Uncharacteristic Conditions

American Chestnut was once a dominant species in this type, but was reduced dramatically in the 1930s. Sprouts of Castanea dentata can often be found where it was formerly a common tree. Now present and increasingly abundant white pine (*Pinus strobus*), and tulip poplar (Liriodendron tulipifera) could be typified as the “native invasive” in these oak-dominated forests. Their abundance in these systems measured in both stem density and basal area has grown considerably due to fire suppression and the marked increase in fire return interval. In some stands, mountain laurel has likely increased in cover (LANDFIRE 2009, Simon 2011).

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

Issues/Problems
This type occurs across many coarse mapped Rapid Assessment PNVGs. Many FRCC models are redundant, verlap, or are similar

Comments
NOTE: 2/26/09: As a result of final QC for LANDFIRE National by Jennifer Long the user-defined min and max fire return intervals for replacement and mixed severity fire were deleted because they were not consistent with the modeled fire return intervals for these fire severity types.

A majority of the descriptive information for this BpS came from the R6OAHI (Oak Hickory) model of the Rapid Assessment. C. Szell developed a VDDT model based on the Rapid Assessment R6OAHI (Oak Hickory) model which is where the modelers pulled most of their descriptive information. C. Szell updated the R6OAHI model since it violated some LANDFIRE rules.

Possible reviewers: Todd Hutchinson, thutchinson@fs.fed.us; Thomas Schuler, tschuler@fs.fed.us; Richard Guyette, guyetter@missouri.edu; Greg Nowacki, gnowacki.

NOTE: 1/10/2011: Disturbance intervals, especially those for fire and wind/weather events, were adjusted by Steve Simon and Steve Croy to better reflect the local environmental and landscape continuum between Southern Appalachian Montane Pine Forest and Woodland (BpS 5713520) and Southern Appalachian Oak (BpS 5713150) which the Allegheny-Cumberland Dry Oak Forest and Woodland represents. These changes were reviewed by members of the "Oak Panel" (Cherokee National Forest Landscape Restoration Initiative, TNC 2011). Some changes were also made to species composition, age classes, and canopy cover breaks within vegetation classes to better reflect local ecological conditions (also reviewed by the "Oak Panel"). All changes / additions to the original LANDFIRE Biophysical Setting Model are highlighted in yellow in this document.

Succession Classes
Succession classes are the equivalent of Vegetation Fuel Classes" as defined in the Interagency FRCC Guidebook (www.frcc.gov).

Class A 1%
Early Development 1 All Structure

Upper Layer Lifeform

√	Herbaceous
	Shrub
√	Tree

Fuel Model 3

Indicator Species* and Canopy Position

QUPR2	Upper
KALA	Mid
GABA	Mid
VAPA4	Mid
SCSC	Lower
ANGE	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	35%	100%
Height	Tree 0m	Tree 8m
Tree Size Class	Sapling > 4.5ft; <5" DBH	

Description
(Class age 0-19yrs); Class A is mixed oak reproduction with patches of grasslands/savanna maintained by frequently recurring fire (1-10yrs). These patches would typically be less than 100ac, but may have been up to 500 acres. Native Americans used these lands for hunting, and agriculture/native plant gathering. If fire is absent deterministic transition in this case), tree seedlings and sprouts will establish and move the community to the mid-seral, closed stage (class B), i.e., if no fire in 18 years, goes to B. Replacement fire interval = 350 years.

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Class B 13%
Mid Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree **Fuel Model** 1

Indicator Species* and Canopy Position

QUPR2	Upper
QUVE	Upper
PIST	Upper
ACRU	Upper
KALA	Mid
GABA	Mid
VAPA4	Mid

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	60%	85%
Height	Tree 5m	Tree 10m
Tree Size Class	Medium 9-21" DBH	

Description

(Class age = 20-69 yrs); this is an early tree regeneration (root and stump sprouts) phase; fire frequency is about 8-12 yrs. Any area that does not burn frequently is probably too moist and will be populated by mixed mesophytic tree species. Class B needs to have some surface fire to remove the more mesic (ACRU, ACSA, LITU, FAGR) seedlings and saplings from the understory and remove some of the oaks and hickories as well. Otherwise, you can not get to the open woodland / savanna stages (class C). Change after review: These communities will move to the late-seral closed, mixed mesophytic class (class E).

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 (class C) oak-hickory forest class. Occasional fires of high severity will topkill all trees moving the community back to the early-seral class (class A). Review Changes: Surface Fire in class B retains pixels in class B-no change in probability. Succession for class B is to class C (which means surface fire did occur). If no Surface Fire occurs, the AltSuccession is to class E (late seral closed) for 1% of the landscape. Impact of these changes on the landscape are minor: Original Model: 1,5,35,50,9; New Model: 2,10,35,45,8.

Surface fire return interval = 10 years and maintains class; mixed fire return interval = 100 years and moves to class C; replacement fire interval = 200 years and moves to class A; Wind/Weather interval = 250 years and moves to class C.

Class C 32%
Mid Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree **Fuel Model** 9

Indicator Species* and Canopy Position

QUVE	Upper
QUPR2	Upper
KALA	Mid
SCSC	Lower
VAPA4	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	30%	60%
Height	Tree 5.1	Tree 10m
Tree Size Class	Medium 9-21" DBH	

Description

(Class age = 70yrs+); this class is defined as the mid-seral open oak-hickory savannas and woodlands with a fire return interval of 5-15yrs. 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 (class D). An occasional replacement fire will move this community back to a mid-seral, closed early tree regeneration phase (class B). Surface fire return interval = 10 years and maintains class; mixed fire return interval = 75 years and maintains class; replacement fire interval = 175 years and moves to class A; Wind/Weather interval = 250 and maintains class C; if no fire in 20 years moves to class B.

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Class D 47%
Late Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree **Fuel Model** 9

Indicator Species* and Canopy Position

QUPR2	Upper
QUVE	Upper
OXAR	Upper
KALA	Mid
SCSC	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	35%	65%
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21" DBH	

Description
(Class age = 70yrs+); Class D is defined as a late seral open canopy oak-hickory forest. Open understories of oak seedlings exist; mixed with shrubs and grass. Stand replacement fires in late-succession open class types are rare (200-year interval)and will result in return to a mid-succession closed class B. Mixed fire has a return interval of approximately 66yrs and will send the system to a mid-succession open class C. Surfaces fires occur every ten years and result in maintaining the late-succession open 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.

Surface fire return interval = 10 years and maintains class; mixed fire return interval = 75 years and moves to class C; replacement fire interval = 200 years and moves to class A; Wind/Weather interval = 500 years and moves to class A; if no fire in 25 years moves to class E.

Class E 7%
Late Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree **Fuel Model** 9

Indicator Species* and Canopy Position

ACRU	Upper
NYSY	Upper
QUPR2	Upper
PIST	Upper
KALA	Mid

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	66%	90%
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21" DBH	

Description
Class age = 70yrs+; Mixed (maple) forests develop during the absence of fire. Dense understories of shade tolerant species develop. Age class equals 20yrs+. Replacement fires are very rare, occurring every 700yrs, and will revert the system to a mid-succession closed class B. Wind and weather stress events (150-year interval) will result in gap formation and a decline to mid-succession closed class B. Surface fire (20-year interval) will result in the system remaining in the current class type. Surface fire return interval = 25 years and maintains class; mixed fire return interval = 100 years and moves to class D; replacement fire interval = 250 years and moves to class A; Wind/Weather interval = 1000 and moves to class A.

Disturbances

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Fire Regime Group:** I

Historical Fire Size (acres)

Avg 100
Min 10
Max 1000

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	55.53			0.01801	15
Mixed	129.6			0.00772	6
Surface	10.62	2	25	0.09414	79
All Fires	8			0.11987	

Sources of Fire Regime Data

√ Literature
Local Data
√ Expert Estimate

Fire Intervals (FI):
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

Additional Disturbances Modeled

Insects/Disease	Native Grazing
√ Wind/Weather/Stress	Competition

References

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