Appendix H. LANDFIRE BpS Model Montane_Northern Red Oak-Chestnut Oak

LANDFIRE Biophysical Setting Model

Biophysical Setting **Southern and Central Appalachian Montane Northern Red Oak-Chestnut Oak Forest**

General Information

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Vegetation Type	Map Zone	Model Zone
Forest	57	√ S. Appalachians

Dominant Species	General Model Sources
QURU	√ Literature
QUPR2	√ Local Data
MAAC	√ Expert Opinion
CAAL27	
BELE	

Geographic Range

This system is known from the northern part of the Southern Appalachians and extreme southern part of the Central Appalachians in southwestern Virginia and adjacent parts of West Virginia, Tennessee, and North Carolina. Within the known range, it is a large-patch type that covers extensive areas on the Southern Blue Ridge. It is more localized in the Ridge and Valley and Cumberland Mountains, where it favors the higher ridges (Fleming 2010).

Biophysical Site Description

This system consists of mixed oak forests on predominantly submesic slopes at elevations from 600 to 1200 m (2000-4000 feet) in the northern part of the Southern Appalachians. It occurs on various topographic positions from lower to upper slopes and crests, in deep, infertile soils. Parent material at known sites includes Ordovician siltstones and shale, Devonian shale and sandstone, quartzite, conglomerate sandstone and shale, interbedded quartzite and dolomite, charnockite, layered pyroxene granulite, biotite gneiss, and feldspathic metagraywacke. Slope profiles are usually convex in at least one direction (Fleming 2010). In the north-zone of the Cherokee National Forest this type occurs in Ecological Zones with a median elevation from 600 to 1000 m (2000-3300 feet) and a range of 365 to 1650 m (1200-5400 feet). At the lower end of this elevational range it is confined to medium-width, cool-air drainages; at higher elevations it is confined to broader tertiary ridges and slopes, and at intermediate elevations it occurs on all landscape positions except the most exposed or the most protected, i.e. it occurs, on all submesic sites (Simon 2011).

Vegetation Description

Mature stands have a well-developed canopy of trees 30 m or more tall. *Quercus rubra* is the leading overstory dominant, with only slightly higher density and basal area than *Quercus prinus*. Most stands are mixed, although either species can dominate small areas. One or both of the magnolias, *Magnolia acuminata* or *Magnolia fraseri*, are usually important in the overstory or understory. Minor canopy associates vary and can include *Quercus alba, Betula lenta, Acer rubrum, Carya* spp., *Fagus grandifolia, Tsuga canadensis*, and *Liriodendron tulipifera*. Most of the preceding species may be present in the understory, along with *Acer pensylvanicum, Oxydendrum arboreum, Pinus strobus, Amelanchier arborea* and *Amelanchier laevis*, and sprouts of *Castanea dentata*. *Acer pensylvanicum* is consistently the most important small tree / shrub, attaining densities >500 stems/ha in some stands (under the current fire-suppressed condition). Other shrubs that are less constant but sometimes important include

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Hamamelis virginiana, Rhododendron maximum, Ilex montana, Viburnum acerifolium, and *Vaccinium pallidum*. The herb layer is often patchy to sparse, with *Medeola virginiana, Galax urceolata, Convallaria majuscula, Thelypteris noveboracensis*, and *Dennstaedtia punctilobula* occasionally attaining 5% cover in a plot. In the higher part of the elevational range, however, the latter two ferns may greatly dominate the herb layer and cover more substantial areas. Other relatively constant but low-cover herbs include *Dioscorea quaternata, Eurybia divaricata, Solidago curtisii, Polygonatum biflorum, Polystichum acrostichoides, Conopholis americana, Clintonia umbellulata, Viola hastata, Uvularia puberula, Chamaelirium luteum, Zizia trifoliata*, and *Carex appalachica (*Fleming 2010).

This system concept also includes many successional communities that have been impacted by logging or agriculture, such as types dominated by *Liriodendron tulipifera*, *Pinus* spp., and *Robinia pseudoacacia.* Bedrock may be of any type. Soils are usually deep residual soils, but are often rocky. Some shallow soils, colluvium, and other soils may be present locally within the group, but shallow soils tend to produce environments that are more extreme and have a larger component of various pine species (LANDFIRE 2009).

Disturbance Description

The frequency of *Castanea dentata* sprouts in this community type suggests that it was formerly an important tree in the overstory mix. Extensive logging during the late 19th and early 20th centuries, along with removal of *Castanea* by chestnut blight, no doubt favored the oaks in regenerated stands. Many mature, contemporary stands of this vegetation type are now exhibiting classic symptoms of oak decline, with very poor recruitment of the dominant oaks, along with abundant invasion of stand understories by shade-tolerant mesophytic trees. The latter vary from site to site but include *Acer rubrum, Fagus grandifolia, Tsuga canadensis, Pinus strobus*, and rarely, *Acer saccharum var. saccharum*. Exclusion of low-intensity fires and logging disturbances have contributed to these changes, which will likely continue barring the re-introduction of fire. A recently burned stand on Clinch Mountain in southwest Virginia exhibited atypically high cover by herbaceous species, suggesting that fires also benefit herbs by burning off litter/humus and increasing illumination though the elimination of shrubs (Fleming 2010).

These forests are naturally uneven-aged climax forests, with reproduction occurring in canopy gaps. The open slopes are exposed to a variety of natural disturbances such as fires, winds, and ice storms. Fires were probably of low to moderate intensity and confined to the surface. All of these forests are in a state of transition following the loss of chestnut as a canopy dominant. In most stands it appears that chestnut has been replaced initially by existing canopy and understory species. Species that have responded favorably (to this disturbance), such as *Liriodendron tulipifera*, *Acer rubrum*, *Robinia pseudoacacia*, and *Pinus* spp. have increased (Schafale and Weakley 1990).

Fire Regime Group I. Fire occurred fairly frequently in pre-European settlement times. Pre-settlement forests studies suggest fire return intervals of 7-26 yrs for drier oak sites (Schuler and McClain 2003) or similar sub-mesic oak sites in the northern portion of this BpS. These observations are consistent with previous research in the oak forests of Ohio, Maryland, and Missouri. Fires were usually low-intensity surface fires, with an occasional more intense fire that replaced patches of the overstory. The dominant species (oak and historically chestnut) are fairly fire-tolerant, making most fires non-catastrophic. If fires occurred during the spring “green up” under very dry to drought conditions then patches of overstory could be killed by basal injury depending on aspect and fire behavior (LANDFIRE 2009).

Adjacency or Identification Concerns

This system is similar in species composition to BpS 5713200 – Central and Southern Appalachian Montane Oak Forest and has a broad transition/ecotone with this more extreme environment, i.e., exposed ridges. It is most similar to BpS 5713150 – Southern Appalachian Oak Forest, also a matrix oak type, and can be considered its more mesic, higher elevation extension (or visa-versa). These oak-dominated systems are distinguished from xeric to dry oak types, that occur as patches within this matrix, by the lack of a dominant ericaceous species understory (evergreen or deciduous). Fire suppression and the time since the last fire can confuse the identification of these types in the field.

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Native Uncharacteristic Conditions

Now present and increasingly abundant red maple (*Acer rubrum*), white pine (*Pinus stobus*), and tulip poplar (Liriodendron tulipifera) could be typified as the "native invasive" in 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 and great rhododendron have likely increased in cover, however, to a less extent than in more xeric or more mesic types (LANDFIRE 2009, Simon 2011).

Scale Description

This is a matrix oak-dominated forest over large parts of its geographic range, covering millions of acres at mid to high elevations within the Southern and Central Appalachians, and may extend into the Northern Appalachians. It represents 30% of ecological zones in the Southern Appalachian Landscape, and nearly 25% of ecological zones in the north-zone of the Cherokee National Forest. This type represents sites that are the most productive for oaks except for northern red oak in rich coves (LANDFIRE 2009, Simon et. al. 2005, Simon 2011).

This matrix type, because of its wide range in elevation and extent across the landscape, can be adjacent to most all Ecological Systems in the Appalachians. From a perspective of proximity to 'fire prone types', its mean distance is less than ½ mile from Southern Appalachian Montane Pine Forest and Woodland but greater than 3 miles from more mesic to wet zones such as Central and Southern Appalachian Spruce-Fir Forest and Appalachian (Hemlock)-Northern Hardwood types. At the lower end of its range it can occur in mesic to sub-mesic drainages adjacent to Southern Appalachian Low-Elevation Pine (Simon 2011).

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Succession Classes

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

Class A 5%

Early Development 1 All Structure

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [√] Tree **Fuel Model** 9

Indicator Species* and Canopy Position

QURU Upper
QUPR2 Upper
MAAC Upper
CAAL27 Upper
BELE Upper

Structure Data (for upper layer lifeform)		
	Min	*Max*
Cover	0%	70%
Height	Tree 0m	Tree 10m
Tree Size Class	Sapling > 4.5ft; <9" DBH	

Description

(Class age 0-19 yrs): Treefall gaps and small to medium patches 0-19 yrs in age with saplings and small trees up to 20 cm (8 in) DBH. Potential canopy species (oaks) are typically mixed with subcanopy and shrub species and herbs. Most oaks are coppice grown from previously established and fire killed individuals with some as seedlings from animal-buried acorns.

With time and periodic surface fire, Class A succeeds to Class C. We estimate that periodic surface fires may occur in this class every 15-25 years but that stand replacement fires would only occur every 300+ years.

Class B 5%

Mid Development 1 Closed

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [√] Tree **Fuel Model** 9

Indicator Species* and Canopy Position

ACRU Upper,Middle
LITU Upper
QURU Upper
QUPR2 Upper
MAAC Upper
PIST Upper

Structure Data (for upper layer lifeform)		
	Min	*Max*
Cover	61%	100%
Height	Tree 10m	Tree 25m
Tree Size Class	Medium 9-21" DBH	

Description

(Class age 20-79yrs): Mid-seral closed forest (canopy closure > 60%) with old treefall gaps with a closed canopy. Midstory well-developed; shrub/herbaceous cover > 35%; shade tolerant species in the understory.

Periodic surface fires are less likely due to more shaded and mesic conditions and these very low intensity fires maintain this condition (25yr probability). With time and no mixed severity fires, class B will succeed to class E (late closed). Replacement fires (400yr probability) transition this class to A.

Class C 5%

Mid Development 1 Open

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [√] Tree **Fuel Model** 9

Indicator Species* and Canopy Position

QURU Upper
QUPR2 Upper
MAAC Upper
CAAL27 Upper
BELE Upper

Structure Data (for upper layer lifeform)		
	Min	*Max*
Cover	41%	65%
Height	Tree 10m	Tree 25m
Tree Size Class	Medium 9-21" DBH	

Description

(Class age 20-79yrs): Mid-seral fairly open forest (canopy closure < 60%) with an open midstory and patchy shrub/herbaceous cover.

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Periodic surface fires (18yr probability) and more rarely mixed-severity fires (150yr probability) that create openings, will both maintain this class. With time and fire the class would succeed to class D. Without fire for 25yrs the midcanopy would become more developed and would transition to class B. Replacement fires (300yr probability) transition this class to A.

Class D 80%

Late Development 1 Open

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [√] Tree **Fuel Model** 9

Indicator Species* and Canopy Position

QURU Upper
QUPR2 Upper
MAAC Upper
CAAL27 Upper
BELE Middle

Structure Data (for upper layer lifeform)		
	Min	*Max*
Cover	65%	80%
Height	Tree 25m	Tree 35m+
Tree Size Class	Large 33"+ DBH	

Description

(Class age 80+yrs): This is the late-seral stage with open canopy gaps. It is dominated by oaks, hickories, occasional ash, maple spp., and, birch spp. in all layers. This forest has an open midstory and canopy closure of 65-80%. Shrub/herbaceous cover is patchy and the lower midstory is predominantly emergent oaks and hickories with occasional striped maple and witchhazel (< 25% total cover). Shade intolerant species are more common than shade tolerant species.

The vegetation of this class is similar to class C except with more mature trees (over 80+ years in age). This class would be maintained by frequent low-severity surface fires with a 15-25 year fire return interval and mixed fires with a 150yr probability. A replacement fire may occur every 300+ years and would transition this class back to A as will insects and diseases, specifically initiated by Gypsy moth outbreaks (400yr probability). Rare catastrophic wind/weather events (1000yr probability) also transition this class back to A, however, periodic small scale blowdowns from other wind events such as microbursts (100yr probability) would maintain this class.

Class E 5%

Late Development 1 Closed

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [√] Tree **Fuel Model** 9

Indicator Species* and Canopy Position

ACRU Upper,Middle
LITU Upper
QUPR2 Upper
PIST Upper,Lower
QURU Upper

Structure Data (for upper layer lifeform)		
	Min	*Max*
Cover	80%	100%
Height	Tree 25m	Tree 35m+
Tree Size Class	Large 33"+ DBH	

Description

(Class age 80+yrs): Late-seral closed. Closed canopy forest with cover > 80% and few canopy gaps. Midstory and understory closed with dense cover and stocking of tree saplings dominated by red maple, tulip poplar, and occasional white pine. Red maple and white pine often dominate the understory and there is little to 'no' oak regeneration.

This closed-canopy mixed hardwood-pine forest results after prolonged periods of fire suppression (approximately 60yrs+). This class would be maintained by continued fire suppression. Class E could move to Class D (late open stage) with a mixed fire (200yr probability) or periodic small scale blowdowns from wind events such as microbursts (100yr probability). Rare catastrophic wind/weather events (1000yr probability) transition this class back to A as will insects and diseases, specifically initiated by Gypsy moth outbreaks (400yr probability)..

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Disturbances

Fire Regime Group:** I

Historical Fire Size (acres)

Avg
Min
Max

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement					
Mixed					
Surface					
All Fires					

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
√ Wind/Weather/Stress
Native Grazing
Competition

References

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