Rapid Assessment Reference Condition Model

The Rapid Assessment is a component of the LANDFIRE project. Reference condition models for the Rapid Assessment were created through a series of expert workshops and a peer-review process in 2004-2005. For more information, please visit www.landfire.gov. Please direct questions to helpdesk@landfire.gov.

Potential Natural Vegetation Group (PNVG):

R8MMHW **Mixed Mesophytic Hardwood**

General Information

Contributors *(additional contributors may be listed under "Model Evolution and Comments")*

Modelers		Reviewers	
April Moore	amoore02@fs.fed.us	Carl Nordman	Carl_Nordman@natureserve.org
Greg Nowacki	gnowacki@fs.fed.us		
Aaron Burk	aburk@fs.fed.us		

Vegetation Type

Forested

Dominant Species*

FAGR	TIAMH
LITU	CADE12
ACSA3	BEAL2
TSCA	AEFL

General Model Sources

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

LANDFIRE Mapping Zones

61	53	48
62	57	
63	47	

Rapid Assessment Model Zones

- [ ] California
- [ ] Great Basin
- [ ] Great Lakes
- [ ] Northeast
- [ ] Northern Plains
- [ ] N-Cent.Rockies
- [ ] Pacific Northwest
- [ ] South Central
- [ ] Southeast
- [x] S. Appalachians
- [ ] Southwest

Geographic Range

The mixed-mesophytic forest region (Küchler 1964) is located in two of Bailey's ecoregion sections (McNab and Avers 1994). It includes the southern portion of the Southern Unglaciated Allegheny Plateau Section (southeastern Ohio, western West Virginia, northeastern Kentucky). It also covers the Northern Cumberland Plateau Section (eastern Kentucky and east-central Tennessee; and southern Blue Ridge ecoregion, and a very small portion in northeast Alabama and northwest Georgia). There are also scattered occurrences in northwestern and central Pennsylvania (C.E. Williams, G. Nowacki personal communication).

Biophysical Site Description

Mixed mesophytic forests occur on moist, topographically protected areas (e.g. coves, v-shaped valleys, N and E facing toe slopes) within highly dissected hills and mountains. On slopes it forms a mosaic with pyrogenic oak-hickory forests, whereby mixed mesophytic forests are restricted to the most protected coves and oak-hickory occurs on the interfluves. These Plateaus are mature and dissected, most of the landscape consisting of high hills and narrow valleys. Elevations range from 650 to 1,300 ft. in the Allegheny Plateau and from 1,270 to 2,000 ft. in the Cumberland Plateau (McNab and Avers 1994). The dissected topography creates strong gradients in microclimate and soil moisture and fertility at the local (watershed) scale (Hutchins et al. 1976, Iverson et al. 1997, Morris and Boerner 1998). In the absence of frequent or catastrophic disturbance, these environmental gradients determine forest composition (Hutchins et al. 1976, Muller 1982, Iverson et al. 1997, Dyer 2001). These forests occupy the transition zone from the oak-hickory forest to the northern hardwood forest. They are among the most diverse in the United States containing more than 30 canopy tree species. This type lies west of the Appalachians and transitions from the more northern sugar maple-beech-birch forest in northern West Virginia, southwestern Pennsylvania (lesser extent in northwestern and central PA), and southern Ohio southward down the Allegheny

*Dominant and Indicator Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.

Mountains, across the Allegheny Plateau including all of the Cumberland Plateau, and into northern Alabama where it transitions to the oak-hickory-pine type of the Southern Mixed Hardwood Forest (Brown et al. 2000). Two major and distinct forest types within this PNVG are typically recognized: mixed-oak and mixed-mesophytic. This model focuses on the mixed-mesophytic type. This model crosswalks to NatureServe Terrestrial Ecological Classification, under the heading Deciduous Forest Woodland.

CES 202.596 Central and Southern Appalachian Montane Forest
CES 203.477 East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest
CES 202.887 South-Central Interior Mesophytic Forest
CES 202.373 Southern and Central Appalachian Cove Forest
CES 202.886 Southern Appalachian Oak Forest
CES 202.342 Southern Piedmont Mesic Forest

Vegetation Description

A diverse closed-canopy forest with dominant species including beech (Fagus grandifolia) yellow-poplar (Liriodendron tulipifera), American basswood (Tilia americana var. heterophylla), sugar maple (Acer saccharum), yellow buckeye (Aesculus flava), red oak (Quercus rubra), white oak (Q. alba) and formerly American chestnut (Castanea dentata) (Braun 1950, Muller 1982). This forest type developed primarily on mesic, sheltered landscapes positions (e.g., lower slopes, coves, ravines) but also occurred on some dry-mesic slopes, where presumably fire was infrequent (Wade et al. 2000).

Disturbance Description

The mixed-mesophytic forest type is fire regime class III, surface fires with return rn intervals 30 - 100+ years (Wade et al. 2000). Mixed severity fires will occur approximately every 500 years opening the canopy with increased mortality. This effect may also be achieved by recurrent, severe insect defoliations or droughts. Straight-line winds or microbursts may cause blow-downs on a scale of 1 to 100 acres. Stand replacement fires happen very infrequently. This PNVG is susceptible to Gypsy Moth, but its effects are not included in this model since it is a recent invasive. Another prominent current issue is Oak Decline, but its impact on reference conditions is not known.

Adjacency or Identification Concerns

Mapping mixed mesophytic forests would likely focus on specific topographic positions, such as coves, valley bottoms typically v-shaped (excluding broad u-shaped floodplains), lower north and east facing slopes; sometimes west and south facing lower slopes where moisture permits; wet-mesic to mesic conditions on the landscape; rich fertile conditions/sites; shaded topographic positions (Nowacki personal communication). On side slopes, mixed mesophytic forest interbrain with oak-hickory forests, with mixed-mesophytic occurring in v-notches and coves (drainages) and oak-hickory on interfluves.

Due to the transitioning nature of this PNVG from the oak-hickory forest to the northern hardwood forest, finer scale mapping may likely break this PNVG into those types based on local data. However, this PNVG model is appropriate for the Rapid Assessment northeast model zone.

Uncharacteristic types (structure/composition/etc.) that may frequently occur today in this PNVG include: non-native invasive species (plants, animals, insects, pathogens, etc.), deer herbivory (limiting species composition and structure), absence of fire.

Scale Description

Sources of Scale Data ☑ Literature ☐ Local Data ☑ Expert Estimate

Mixed-mesophytic forest occur more continuously on north and east facing toe slopes, and interfinger with oak-hickory on side slopes up to the northern hardwood zone and higher elevations.

Issues/Problems

Though Küchler (1964) mapped and described this region as mixed-mesophytic, witness tree data (from early land surveys) and studies of old-growth forests suggest that mixed-oak forests were more abundant than mixed-mesophytic forests in many areas prior to European settlement (Beatley 1959, McCarthy et al. 1987, Abrams et al. 1995, Dyer 2001, McCarthy et al. 2001, Rentch et al. 2003). Delineating the 'mixed-mesophytic' forest type today is influenced by the absence of fire, deer herbivory, and non-native invasive species (plants, animals, insects and disease). The absence of fire is causing an expansion out of coves and replacing previous oak sites.

This model was developed to represent the 'true' mixed-mesophytic forest types within Kuchler's original mapping. There are several oak models that may be used for the mixed oak forest type.

Due to the transitioning nature of this PNVG from the oak-hickory forest to the northern hardwood forest, finer scale mapping may likely change this PNVG.

Model Evolution and Comments

This model replaces the model R7MMHW from the Northeast model zone.

Additional modeler was Dan Yaussy (Dyaussy@fs.fed.us). This model is essentially identical to the model R7MMHW (Mixed Mesophytic Hardwood Forest) created for the Northeast region, with descriptive changes.

R8MMHW Model incorporates both the MMHF and MMPH FRCC models with additional description information and references. Further review is needed by the original modelers and others; particularly age class and species composition within those classes. Bruce Davenport developed the first mixed mesophytic hardwood forest model MMHF (4/23/05) which encompasses the range of Kuchler's mapping; the model focuses on the mixed mesophytic forest type where as the MMPH model incorporates both the mixed-oak and mixed-mesophytic forest types of this transitional PNVG.

No changes were made to the model during QA/QC, but additional information on was provided by modelers and added, including brief mentions of Gypsy Moth and Oak Decline in the Disturbance Description, but these are assumed to be more modern phenomena and are not specifically included in the model. Reviewer also suggested that these tree do not reach 600 years in a single life span, but the implication of the model is that a late seral stage may maintain itself for 600 years even though individual trees do not live that long. The reviewer also suggested that southern pine beetle could be a factor in the pine component in the early seral stages. However, pine species are not listed as dominants in any of the seral stages, so southern pine beetle should not have significant impact (nothing was added to the model).

Succession Classes

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

Class A 5 %

Early1 All Structures

Description

Regenerating stands (age = 0-9 years) established after catastrophic disturbance, primarily wind and ice storms and less frequently by fire. Tree regeneration unfolds from a combination of stump and root sprouts and the seedbank. This short-lived stage exists until canopy closure occurs and resource competition for growing space begins.

Indicator Species* and Canopy Position

FAGR	Upper
LITU	Upper
ACSA3	Upper
BEAL2	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 5

Structure Data (for upper layer lifeform)

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

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class B 30 %

Mid1 Closed

Description

Mid-seral closed overstory; stem exclusion stage. Intense competition begins after canopy closure (ca. 20 yrs.) and lasts until trees are large enough to form, upon their death, canopy gaps that are not captured by lateral growth of neighboring trees. This "released" growing space that is captured by tree and shrub regeneration.

Indicator Species* and Canopy Position

LITU	Upper
BEAL2	Upper
ACSA3	Mid-Upper
FAGR	Mid-Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 8

Structure Data (for upper layer lifeform)

	Min	Max
Cover	75 %	100 %
Height	Tree Short 5-9m	Tree Medium 10-24m
Tree Size Class	Pole 5-9" DBH	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class C 10 %

Late1 Open

Description

Mature forest with gaps created by wind, ice storms, insect and disease, and to a lesser extent by fire leading to "open" overstory conditions. Partial canopy disturbances from moderate-level wind events and ice storms are common and lead to multi-cohort stands. These events generally remove 25-50% of the canopy. Canopy would typically close after approximately 20 years and revert

Indicator Species* and Canopy Position

FAGR	Upper
ACSA3	Upper
LITU	Middle
BEAL2	Middle

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 10

Structure Data (for upper layer lifeform)

	Min	Max
Cover	25 %	50 %
Height	Tree Medium 10-24m	Tree Tall 25-49m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

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back to class E.

Class D 55 %

Late1 Closed

Description

Closed-canopy mixed-mesophytic forests that develop on mesic landscape positions and have dominant trees that are 100+ years of age. Dominant species include Fagus grandifolia, Acer saccharum, Liriodendron tulipifera, Castanea denatata; also Tilia americana va. Heterophylla, Aesculus flava, Tsuga canadensis, Quercus alba, and Quercus rubra.

Indicator Species* and Canopy Position

FAGR	Upper
ACSA3	Upper
LITU	Upper
BEAL2	Middle

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 8

Structure Data (for upper layer lifeform)

	Min	Max
Cover	50 %	100 %
Height	Tree Medium 10-24m	Tree Tall 25-49m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class E 0 %

Late1 Closed

Description

Indicator Species* and Canopy Position

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Disturbances

Non-Fire Disturbances Modeled

- ☑ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other:
- ☐ Other:

Historical Fire Size (acres)

Avg: 20
Min: 1
Max: 1000

Fire Regime Group: 3

I: 0-35 year frequency, low and mixed severity
II: 0-35 year frequency, replacement severity
III: 35-200 year frequency, low and mixed severity
IV: 35-200 year frequency, replacement severity
V: 200+ year frequency, replacement severity

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 the 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. All values are estimates and not precise.

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Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	665			0.00150	11
Mixed	715			0.0014	10
Surface	90			0.01111	79
All Fires	71			0.01401	

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