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):

R6OAHI **Oak Hickory**

General Information

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

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Vegetation Type

Forested

Dominant Species*

QUAL	QUCO2
QUVE	ACRU
QUPR4	ACSA3
QURU	CARYA

General Model Sources

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

LANDFIRE Mapping Zones

Rapid Assessment Model Zones

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

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. It also occurs from eastern Oklahoma to Massachusetts and from northern Mississippi to Pennsylvania. It continues west to the Ozark and Ouachita Highlands.

Biophysical Site Description

This system encompasses dry hardwood forests 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 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. 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 150 years) were needed for maple dominance to manifest.

Vegetation Description

Typically, the vegetation seen today consists of forests dominated by oaks, especially white oak (Quercus alba) and red oak (Quercus rubra), and, on drier sites, chestnut oak (Quercus prinus), black oak (Quercus velutina), and scarlet oak (Quercus coccinea). Along with oaks are varying amounts of hickory (Carya spp.), red maple (Acer rubrum), and other species such as white pine (Pinus strobus) and white ash (Fraxinus americana). American chestnut (Castanea dentata) was once dominant or codominant in many of these forests. Currently, subcanopies and shrub layers are usually well-developed. Some areas (usually on

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

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.). Others 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.

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 400 years. Scarlet and black oaks are shorter-lived with typical ages being approximately 50 to 100 years, while white oaks can live as long as 600 years. 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. Grassland prairies 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) occurred where fire frequency was a bit less, probably 3-9 yrs. Also, grub conditions would arise immediately after catastrophic burns that would top-kill tree-dominated communities. Savannas and woodlands developed within a moderate burning regime, with fire return times averaging every 5 to 15 yrs. Closed-canopy oak-hickory forests would develop where fire return intervals stretched beyond 15 years. 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 32 years from 1846 to 2002 with a median of approximately 16 years, and prior to the fire control era ranged from 7 to 15 years (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.

Adjacency or Identification Concerns

Though often contiguous, oak-hickory patches are virtually always convoluted and interfingered with other systems, especially Mesophytic Cove Forests and Dry-Xeric Oak-Pine Forests. At the highest elevations it may grade into Northern Hardwood Forests. Small patches of other communities, such as rock outcrops and mountain wetlands, are sometimes embedded within this group.

Scale Description

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

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

Issues/Problems

This type occurs across many coarse mapped PNVGs. Many FRCC models are redundant, overlap, or are similar.

Model Evolution and Comments

This model replaces the model R8OAKdm from the Southern Appalachians model zone.

This is a modification of the OKH4 FRCC model developed by Nowacki, Hutchinson, Iverson, and Van-Gundy. We added a pathway from Class B to Class E to represent a portion of the landscape that is too moist to burn. Possible reviewers: Todd Hutchinson, thutchinson@fs.fed.us; Thomas Schuler, tschuler@fs.fed.us; Richard Guyette, guyetter@missouri.edu; Greg Nowacki, gnowacki.

Succession Classes

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

Class A 1 %

Early1 All Structures

Description

Class A is grassland prairie maintained by frequently recurring fire (1-2 yrs) and age class of 0-1 years. These patches would typically be less than 100 acres, but may have been up to 500 acres. Native Americans used these lands for hunting, and agriculture/native plant gathering. If fire is absent for a few years, tree seedlings and sprouts will establish and move the community to the mid-seral, open stage.

Indicator Species* and Canopy Position

ANGE	Upper
SCHIZ4	Upper
SONU2	Upper

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model 3

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Herb Medium 0.5-0.9m	Herb Tall > 1m
Tree Size Class	no data	

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

Class B 5 %

Mid1 Open

Description

This is an early tree regeneration (root and stump sprouts) phase; fire frequency is about 3-9 years and age class is 2-19 years. Any area that does not burn frequently is probably too moist and will be populated by mixed-mesophytic tree species. These communities will move to the late-seral closed, mixed mesophytic 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 moving the community back to the early-seral class.

Indicator Species* and Canopy Position

QUAL	Upper
QURU	Upper
ANGE	Low-Mid
QUVE	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	10 %	25 %
Height	Shrub Short 0.5-0.9m	Shrub Medium 1.0-2.9m
Tree Size Class	Sapling >4.5ft; <5"DBH	

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

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

Class C 35 %

Mid2 Open

Description

This class is defined as oak-hickory savannas and woodlands with a fire return interval of 5-15 years and an age class of 10-299+ years. 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.
An occasional replacement fire will move this community back to a mid-seral, open stage.

Indicator Species* and Canopy Position

QUAL	Upper
QURU	Upper
QUVE	Upper
QUCO2	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 9

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	25 %	60 %
Height	Tree Short 5-9m	Tree Medium 10-24m
Tree Size Class	Large 21-33"DBH	

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

Class D 50 %

Late1 Open

Description

Class D is defined as oak-hickory forest. Open understories of oak seedlings exist. The age class is 50+ years. Stand replacement fires in late-succession open class types are rare (200-year interval) and will result in return to a mid-succession open class B. Mixed fire has a return interval of approximately 66 years 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 70 years 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.

Indicator Species* and Canopy Position

QUAL	Upper
QURU	Upper
QUCO2	Upper
QUVE	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 9

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	60 %	80 %
Height	Tree Short 5-9m	Tree Medium 10-24m
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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Class E 9 %

Late1 Closed

Description

Mixed (maple) forests develop during the absence of fire. Dense understories of shade-tolerant species develop. Age class equals 20+ years. Replacement fires are very rare, occurring every 700 years, and will revert the system to a mid-succession open class B. Wind and weather stress events (150-year interval) will result in gap formation and a decline to mid-succession open class B. Surface fire (20-year interval) will result in the system remaining in the current class type.

Indicator Species* and Canopy Position

ACRU	Upper
ACSA3	Upper
LIRIO	Upper
FAGR	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 8

Structure Data (for upper layer lifeform)

	Min	Max
Cover	80 %	100 %
Height	Tree Short 5-9m	Tree Medium 10-24m
Tree Size Class	Large 21-33"DBH	

☐ 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:

Fire Regime Group: 1

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

Historical Fire Size (acres)

Avg: 100
Min: 10
Max: 1000

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.

Sources of Fire Regime Data

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	66			0.01515	13
Mixed	77			0.01299	11
Surface	11	2	25	0.09091	76
All Fires	8			0.11905	

References

Braun, E.L., 1950. Deciduous forests of eastern North America. Hafner Publishing Company, New York, NY.

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Greller, A. M., 1988. Deciduous forest. Pages 288-316 in: M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. Cambridge University Press, New York.

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

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