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):

R8OKAW **Oak - Ash - Woodland**

General Information

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

Modelers		Reviewers	
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Vegetation Type

Woodland

Dominant Species*

QUMU	FRAM2
QUMA2	FRPE
FRQU	JUNI
ROPS	ARGI

General Model Sources

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

LANDFIRE Mapping Zones

47
53
48

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

For purposes of the LANDFIRE Rapid Assessment this broad model covers the limestone-based communities of the Cincinnati Arch, the Jessamine dome and the Nashville dome. The geographic area includes southern Ohio around Cincinnati and Maysville on the Ohio River south to Lexington, Kentucky and Nashville, Tennessee, and to the outer margins of all of the areas dominated by limestones.

Biophysical Site Description

Fire-maintained oak/graminoid woodlands on the drier, gently rolling limestone upland of the Lexington Plain (Inner Bluegrass) with many additional tree species on more mesic areas and the more dissected lands of the Outer Bluegrass, the limestone palisades, and calcareous areas transitional to younger and more acidic soils on the margins of limestone areas in Kentucky and Tennessee.

Vegetation Description

Burr oak-chinquapin oak woodland with grass (Elymus and other species) or locally, cane understories maintained by occasional fire on the gently rolling limestone uplands of the Lexington Plain (Inner Bluegrass) of Kentucky. Cane was more abundant on more mesic sites within the same landscape and the tree canopy included many more species. Streams and seepage areas on slopes were outlined with sycamore.

The original woodland-savanna aspect, especially on drier uplands of the Inner Bluegrass is believed to have been dominated by fire-resistant oaks, especially chinquapin oak (Quercus muhlenbergia) and burr oak (Quercus macrocarpa), but also with a variety of other species such as blue ash (Fraxinus quadrangulata), black locust (Robinnia pseudo-acacia), honey locust (Gleditsia triacanthos, Sugar maple (Acer saccharum), white ash (Fraxinus americana, green ash (Fraxinus pensylvanica), bitternut hickory (Carya cordiformis), black walnut (Juglans nigra), and the rare Kentucky coffee tree (Gymnocladus diocus).

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

Understories were dominated by cane (Arundunaria gigantea) or by a calcareous flora of graminoids and forbs. Plant communities listed by NatureServe for the Inner Bluegrass Basin include:

CEGL004411 Acer (nigrum, saccharum) - Carya cordiformis Forest
CEGL004436 Fraxinus quadrangulata - Quercus macrocarpa - Quercus muehlenbergii / Arundinaria gigantea ssp. gigantea / Elymus spp. Woodland
CEGL004437 Juglans nigra - Aesculus glabra var. glabra - Gymnocladus dioicus / Arundinaria gigantea ssp. gigantea - (Asimina triloba) Forest
CEGL004693 Juglans nigra - Celtis occidentalis Forest

Disturbance Description

Fire Regime Groups I or III. Central Kentucky grasslands were maintained by fire but we could expect that woody succession was also retarded by the heavy, clayey soils originating from the limestone substrate. The first approximation map of presettlement fire regimes of the U.S. (Frost 1998) indicated fire regimes of 4-6 and 7-12 years in the model area.

In the gently rolling limestone regions, large expanses of land without significant firebreaks lie between the major firebreak streams. The large size of fire compartments in these areas suggests that fire frequency should have been high, perhaps 4-6 years where understory species were conducive to fire spread. Areas dominated by Elymus species may have experienced lower fire frequency because of the reduced capacity of this fuel type to carry fire (Campbell pers. comm.). A fire frequency of 7-12 years could be expected in areas with broken topography such as the more rugged parts of the Outer Bluegrass and other limestone margin regions. In the vicinity of limestone palisades, more fire sheltered areas could be found and in the most sheltered bottoms, there were essentially fire-free habitats for fire refugia species such as beech

Lightning and Native Americans likely provided roughly equal influence as ignition sources in presettlement Kentucky, with Indian influence being the dominant factor locally near population concentrations and around fall and winter hunting camps. US Weather Service lightning ground flash monitoring stations indicate a lightning strike density of 4-8 strikes per square kilometer per year in the limestone regions. While only a tiny fraction of strikes result in ignitions this rate would have produced a fire regime sufficient to support canebrakes and woodlands even in the absence of man. The likely influence of Indians would have been expansion of these fire types into previously forested areas.

Adjacency or Identification Concerns

This very broad model includes the entirety of the NatureServe Ecological System called Bluegrass Basin Savanna and Woodland, as well as all of the more widespread limestone-based vegetation types of the geographic range described above. It does not include the cedar barrens of Tennessee which are covered in a model developed specifically for that vegetation type.

Some descriptions of the central bluegrass have suggested that the original landscape was blue ash-oak savanna with large expanses of open grass. Recent examination of early surveys have suggested that the landscape might more appropriately be described as oak or oak-ash woodland, having an open, fire-maintained understory and perhaps with a lower fire frequency than that previously suggested (Campbell, pers. Comm.) .

Related models include the NatureServe type CES202-334 Nashville Basin Limestone Glade which is represented in such natural areas as the Big Barrens of Kentucky, Penny Royal and the Jackson Purchase Barrens of Kentucky. Post oak/little bluestem savanna is an important type. Another related community is CES202-887 Southern Interior Mesophytic Forest (see models by Carl Nordman).

For information elsewhere on mesic barrens/woodlands in the Interior Highlands, see description for Quercus stellata - Quercus alba - (Quercus falcata) / Schizachyrium scoparium Woodland NatureServe (CEGL004217).

Scale Description

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

Scale of vegetation patches and fires: In the gently rolling limestone areas patch size of dominant vegetation is large, covering most of the upland landscape. Average fire size in such areas in presettlement times might have ranged from a few acres to more than 100,000 acres under severe wildfire conditions during the spring fire season. Fall fires set by native Americans would likely have been smaller, ranging from a few acres to perhaps 1000 acres.

Issues/Problems

Much of the limestone region, especially the Inner Bluegrass of central Kentucky was settled very early, beginning in the late 1700's, and has long been grazed. Complete alteration of the original ground cover is likely and species composition of the presettlement graminoid and forb cover is still uncertain. In the Outer Bluegrass and in more rugged areas around the limestone periphery and to the south in Tennessee, succession to red cedar in the absence of fire is dramatic. In my youth, 50 years ago (Frost), red cedar was confined to fencerows and woodlands where it could be seen filling in the gaps. The areas now occupied by dense red cedar were old pastures for horses and cattle. Up until shortly before the Second World War, horses were still used for many farm tasks. By 1950 their chores had been taken by the tractor but every small farm in the Outer Bluegrass had one or more forlorn, aging horses and pasture for them was still kept open. As they died off in the past 50 years their pastures were abandoned and have undergone massive succession to red cedar.

Model Evolution and Comments

Peer Review resulted in the following changes: Made age ranges consistent and compatible, and correct Relative Age in Class A. There was an important discussion about the true, historic nature of this BpS from one reviewer (suggested by modeler). Basically, the peer reviewer indicated that this was not a "savannah-dominated" BpS, and had more, less-flammable forest cover that previously thought. Basically, this was interpreted as a reduction in the fire probabilities that maintain open, savannah-like areas. Surface fire was reduced in Class A (to p = 0.05), and Class D (to p = 0.033). This created a compromise landscape that had less Open and Early stages, and will likely create a more conservative Rapid Assessment FRCC estimate for this BpS. These changes increased the fire return intervals across the board. This BpS is only located in two LANDFIRE mapping zones, and the discrepancies between these two descriptions will need to be resolved during those workshops.

Succession Classes

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

Class A 10 %

Early1 All Structures

Description

Open, treeless patches occurring as single tree or medium sized gaps in upland woodland types. Openings had patches of cane (mesic sites) or calciphilic prairie graminoids and forbs such as wild rye (Elymus species, including E. virginicus, E. riparius and E. macgregorum), and possibly other prairie grasses that have been extirpated by grazing and elimination of fire. Little bluestem and a variety of other prairie grasses do well on high pH soils elsewhere and could be candidates for inclusion in the original herb layer. Historical descriptions mention "pea vine", two or three species of nettles, ironweed (Vernonia species), Eupatorium rugosum and running buffalo clover (Trifolium stoloniferum). This last species, once common, is now a federal endangered species (Julian Campbell, pers. comm.).

Indicator Species* and Canopy Position

ELVI3	Upper
ARGI	Upper
TRST4	Upper

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	75 %	100 %
Height	Herb Short <0.5m	Herb Tall > 1m
Tree Size Class	no data	

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

Class B 15 %

Mid1 Closed

Description

Hardwood seedlings, saplings and pole-sized trees in areas transitional to fire sheltered habitats for forest in class E. Such sheltered areas are found on steeper mid and lower slopes and in bottoms protected by such slopes. This situation is more prevalent in the Outer Bluegrass and in marginal areas transitional to other types. This class would also represent the primary presettlement habitat of red cedar (Juniperus virginiana). Most of the other dominant trees of the model can be

Indicator Species* and Canopy Position

ROPS	Upper
JUVI	Middle
CELA	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	50 %	100 %
Height	Tree Regen <5m	Tree Short 5-9m
Tree Size Class	Pole 5-9" DBH	

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

found as saplings or small trees.

Class C 25 %

Mid1 Open

Description

This class is used here to represent canebrakes. Historical descriptions mention large canebrakes in bottomlands but also cane on limestone uplands. cane can occur in all densities in terms of stems per acre and with highly variable canopy species composition and closure. Remnant examples through out the South can be found with no trees, trees as scattered individuals or clumps, and stands with >50% tree cover with a continuous cane understory.

Indicator Species* and Canopy Position

ARGI	Low-Mid
FRQU	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	25 %	100 %
Height	Shrub Medium 1.0-2.9m	Shrub Tall >3.0 m
Tree Size Class	Large 21-33"DBH	

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

The dominant life form can be either hardwoods or cane. Tree cover varies widely. Cane minimum cover is about 25% and maximum is 100%, varying inversely with tree canopy cover. Minimum height of cane is ~1/2 meter, up to about 2.5 meters, occasionally much taller in riparian areas.

Class D 25 %

Late1 Open

Description

Class D represents the classic old-growth burr oak-chinquapin oak woodland of the gently rolling limestone areas. Before settlement, this fire-maintained type would have had an open, grassy two layered structure with a canopy of variable density over a species-rich grass-forb layer. The understory would have been kept open by fire in the cane and herbaceous layers. Replacement would have occurred as a tree by tree model with most regeneration killed by fire, but the canopy would have been maintained by the rare stem that escaped into the canopy and built bark thick enough to resist the light surface fires.

Indicator Species* and Canopy Position

QUMA2	Upper
QUMU	Upper
ROPS	Mid-Upper
TRST4	Lower

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	10 %	75 %
Height	Tree Medium 10-24m	Tree Tall 25-49m
Tree Size Class	Very Large >33"DBH	

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

Class E **25 %**

Late1 Closed

Description

This includes mature and old-growth forest in partially fire-sheltered situations as described in Class B above.

Indicator Species* and Canopy Position

PLOC	Upper
CELA	Upper
FRAM2	Upper
ACSA	Upper

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	75 %	100 %
Height	Tree Medium 10-24m	Tree Tall 25-49m
Tree Size Class	Very Large >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:
Min:
Max:

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	119			0.00840	23
Mixed	95			0.01053	28
Surface	55			0.01818	49
All Fires	27			0.03711	

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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.

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