

14130

Bluegrass Savanna and Woodland

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Vegetation Type

Herbaceous

Map Zone

47

Geographic Range

As defined here, this system is restricted to the Inner Bluegrass Basin of Kentucky, e.g. Ecoregion 711 and "S. Fork Licking River arm" of Ecoregion 71d of Woods et al. (2002). In contrast, the LANDFIRE (LF) Rapid Assessment (RA) model was a broad one that covered the limestone-based communities of the Cincinnati Arch, the Jessamine dome, as well as the Nashville dome. This broader geographic area included southern Ohio around Cincinnati and Maysville on the Ohio River south to Lexington, Kentucky and Nashville, Tennessee, and to the outer margins of all the areas dominated by limestones.

Biophysical Site Description

This Biophysical Setting (BpS) encompasses open oak/graminoid woodlands on the drier, gently rolling limestone upland of the Lexington Plain (Inner Bluegrass). The assumption is that this region was a mosaic of this woodland/savanna BpS with more 'ordinary' dry-mesic forests on more dissected terrain and mesic forests on steeper slopes. From historic accounts, it seems that grazing, drought, and fire all played roles in its maintenance.

Vegetation Description

The vegetation of this BpS is primarily a bur oak-chinquapin oak woodland with grass (*Elymus* and other species) or locally, cane understories maintained by grazing, drought, and occasional fire on the gently rolling limestone uplands of the Lexington Plain (Inner Bluegrass) of Kentucky.

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 muehlenbergii*) and bur oak (*Quercus macrocarpa*), but also with a variety of other species such as blue ash (*Fraxinus quadrangulata*), black locust (*Robinia pseudoacacia*), honey locust (*Gleditsia triacanthos*), Sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), bitternut hickory (*Carya cordiformis*), black walnut (*Juglans nigra*), and the rare Kentucky coffee tree (*Gymnocladus dioica*).

Understories were dominated by cane (*Arundinaria gigantea*) or by a calcareous flora of graminoids and forbs. The understory is composed of cool-season grasses, as far as known (e.g. *Elymus*, *Dichanthelium*) with *Arundinaria gigantea* (extensive canebrakes). Settlers referred to a "buffalo grass" of unknown identity (possibly *Dichanthelium clandestinum* or *Dichanthelium scoparium*).

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUMU	<i>Quercus muehlenbergii</i>	Chinkapin oak
QUMA2	<i>Quercus macrocarpa</i>	Bur oak
FRQU	<i>Fraxinus quadrangulata</i>	Blue ash
ROPS	<i>Robinia pseudoacacia</i>	Black locust
FRAM2	<i>Fraxinus americana</i>	White ash
FRPE	<i>Fraxinus pennsylvanica</i>	Green ash
JUNI	<i>Juglans nigra</i>	Black walnut
ARGI	<i>Arundinaria gigantea</i>	Giant cane

Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

Fire Regime Groups I or III. Central Kentucky grasslands were maintained by a combination of grazing, periodic drought, and fire but one would 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 4-12yrs 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 4-6yrs 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 personal communication). Some writers think that these cool-season grasses (e.g. *Elymus*) predominated in preference to warm-season grasses such as *Schizachyrium*. In contrast, a fire frequency of 7-12yrs could be expected in areas with broken topography such as the more rugged parts of the Outer Bluegrass and other limestone margin regions.

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. United States Weather Service lightning ground flash monitoring stations indicate a lightning strike density of four to eight 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 (Frost, personal communication). The likely influence of Native American burning would have been expansion of these savannas and woodlands into otherwise forested areas.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	80	34		

Moderate (Mixed)	131	21		
Low (Surface)	62	45		
All Fires	28	100		

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. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

None

Adjacency or Identification Concerns

This model covers the NatureServe Ecological System called Bluegrass Basin Savanna and Woodland; it formerly (Frost's version) covered all the more widespread limestone-based vegetation types of a much broader geographic range, including other limestone areas of the Interior Low Plateau. It does not include the cedar barrens of Tennessee which are covered in a model developed specifically for that BpS. Some descriptions of the central bluegrass have suggested that the original landscape was blue ash-oak savanna with large expanses of open grass (Bryant et al 1980; McInteer 1952). Recent examination of early surveys has 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, personal communication). There are several other related models for other Barrens of the Interior Low Plateau.

Issues or Problems

This is a contentious model whose pre-European existence is much debated. Many experts feel that this BpS was an artifact of European settlement based upon the ages of large, old trees. Much of the limestone region, especially the Inner Bluegrass of central Kentucky, was settled very early, beginning in the late 1700s, 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. Original modeler Cecil Frost says, "In my youth, 50yrs ago, 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 over by tractors, but every small farm in the Outer Bluegrass kept open pasture for one or more forlorn, aging horses. As the horses died off over the last 50yrs their pastures were abandoned and have undergone massive succession to eastern red-cedar." (Cecil Frost, personal communication).

Native Uncharacteristic Conditions

Many stands have been converted to pasture. Forested stands are typically secondary forest with a mixture of oaks etc. with successional and fire-intolerant taxa with closed understories. Even sites with open canopies may have European pasture grasses present instead of native ones.

Comments

This is a contentious model, where some experts believe it did not exist before European settlement. The RA model as adapted verbatim for LF National as the draft model. RA peer review resulted in the following changes: age ranges were made consistent and compatible, and Relative Age in class A was corrected. There was an important discussion about the true, historic

nature of this BpS from one reviewer (suggested by modeler). The 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 RA Fire Regime Condition Class estimate for this BpS. These changes increased the fire return intervals across the board. This BpS as currently defined (in contrast to RA model) is only located in one LF mapping zone.

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	UN	UN	UN	UN	UN	A	A	A	A	A
Herb	0.5-1.0	UN	UN	UN	UN	UN	A	A	A	A	A
Herb	>1.0	UN	UN	UN	UN	UN	A	A	A	A	A
Shrub	0-0.5	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	0.5-1.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	1.0-3.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	>3.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	0-5	C	C	C	C	C	C	B	B	B	B
Tree	5-10	C	C	C	C	C	C	B	B	B	B
Tree	10-25	D	D	D	D	D	D	D	D	D	D
Tree	25-50	D	D	D	D	D	D	D	E	E	E
Tree	>50	D	D	D	D	D	D	D	E	E	E

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A 13 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ELVI3	<i>Elymus virginicus</i>	Virginia wildrye	Upper
ARGI	<i>Arundinaria gigantea</i>	Giant cane	Upper
TRST4	<i>Trifolium stoloniferum</i>	Running buffalo clover	Upper

Description

This class represents open, treeless patches occurring as medium sized gaps to large patches intermixed with upland woodland types of the Inner Bluegrass (Lexington Plain). These

Maximum Tree Size Class
None

This class is used here to represent canebrakes and grasslands with young, scattered trees. Historical descriptions mention large canebrakes in bottomlands but also cane on limestone

This class represents mature and old-growth closed canopy forest and oak litter-shrub dominated woodlands. Older bur oak and chinquapin oaks remain co-dominant, with younger individuals of sugar maple, white ash, sugarberry filling in and closing up the understory, and eventually reaching the canopy and filling in the gaps between the older trees. These trees will ultimately dominate the canopy as the older trees senesce and die. Mature shrubs and seedlings of less fire

tolerant species comprise the shrub layer. Other shrub species include buckbrush (*Symphoricarpos orbiculatus*).

Maximum Tree Size Class

Very Large >33"DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	16
Mid1:OPN	17	Late1:OPN	59
Mid1:CLS	17	Late1:CLS	59
Late1:OPN	60	Late1:OPN	999
Late1:CLS	60	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Alternative Succession	Early1:ALL	Mid1:CLS	1	1	Yes	15
Replacement Fire	Early1:ALL	Early1:ALL	0.05	20	Yes	0
Native Grazing	Early1:ALL	Early1:ALL	0.1	10	Yes	0
Alternative Succession	Mid1:OPN	Mid1:CLS	1	1	Yes	40
Replacement Fire	Mid1:OPN	Early1:ALL	0.01	100	Yes	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.02	50	No	0
Native Grazing	Mid1:OPN	Mid1:OPN	0.05	20	No	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.01	100	Yes	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.02	50	Yes	0
Native Grazing	Mid1:CLS	Mid1:OPN	0.03	33	Yes	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	40
Mixed Fire	Late1:OPN	Mid1:OPN	0.003	333	Yes	0
Replacement Fire	Late1:OPN	Early1:ALL	0.003	333	Yes	0
Wind or Weather or Stress	Late1:OPN	Mid1:OPN	0.01	100	Yes	0
Surface Fire	Late1:OPN	Late1:OPN	0.04	25	No	0
Native Grazing	Late1:OPN	Late1:OPN	0.07	14	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.001	1000	Yes	0

Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.003	333	Yes	0
Insects or Disease	Late1:CLS	Late1:OPN	0.003	333	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.01	100	No	0
Mixed Fire	Late1:CLS	Late1:OPN	0.02	50	Yes	0
Native Grazing	Late1:CLS	Late1:OPN	0.05	20	Yes	0

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