

13430

Atlantic Coastal Plain Mesic Hardwood Forest

BpS Model/Description Version: Aug. 2020

Updated: 4/25/2018

Modelers		Reviewers	
Milo Pyne	milo_pyne@natureserve.org	Chris Szell	cszell@tnc.org
Alexa McKerrow	alexa_mckerrow@ncsu.edu		

Vegetation Type

Forest and Woodland

Map Zones

54, 55

Geographic Range

This upland system of the Atlantic Coastal Plain is found in suitable conditions from southern New Jersey south to Georgia, generally north of the natural range of *Pinus glabra* and *Magnolia grandiflora*. There is a broad gradient in climate and species composition from north to south and west. The boundary at the northern edge of its range (into New Jersey, north of the Chesapeake Bay Lowlands TNC ecoregion) may need clarification.

Biophysical Site Description

This model is specific to the mesic deciduous forests of the Atlantic Coastal Plain, north of the natural range of *Pinus glabra* and *Magnolia grandiflora*. The distribution of these forests is determined by the interaction of local topography and soil texture. Within the type, local variability in topography and moisture, as well as regional floristic variation, determine the canopy dominants. Richer and more mesic stands occur in more strongly concave and finer textured areas. This system occurs in a variety of moist non-wetland sites that are naturally sheltered from frequent fire. Most common are lower slope and bluff examples along streams and rivers in dissected terrain, but some examples occur on mesic flats between drier pine-dominated uplands and floodplains or on local high areas within bottomland terraces or nonriverine wet flats. Soils cover the full range of mineral soil textures, except the coarsest sands. Soils are not saturated for any significant time during the growing season, and seldom, if ever, are they extremely dry. Soils developed from calcareous materials or rich alluvium may be basic; others are strongly acidic. Sites are protected from most natural fires by steep topography or by surrounding extensive areas of non-flammable vegetation (NatureServe 2006).

Vegetation Description

Most stands of vegetation in this Biophysical Setting (BpS) are co-dominated by American beech (*Fagus grandifolia*) with or without white oak (*Quercus alba*). The more mesic end of the gradient may not include oaks at all, but instead show dominance by *Fagus grandifolia*, tuliptree (*Liriodendron tulipifera*), southern sugar maple (*Acer barbatum*), and/or sweetgum (*Liquidambar styraciflua*). In some sites, cherrybark oak (*Quercus pagodaefolia*) or Shumard oak (*Quercus shumardii*) are important canopy components. Swamp chestnut oak (*Quercus michauxii*) and/or water oak (*Quercus nigra*) may also be present, as well as bitternut hickory (*Carya cordiformis*), blackgum (*Nyssa sylvatica*) and umbrella magnolia (*Magnolia tripetala*).

Pinus taeda is sometimes present, but it is unclear if it is a natural component or has entered only as a result of past removal of the hardwood canopy and subsequent invasion. Analogous systems on the Gulf Coastal Plain have pine as a natural component, and this may be true for some examples of this system. Understories are usually well-developed. Shrub and herb layers may be sparse or moderately dense, with the herb layer being forb-dominated. Some typical smaller trees and shrubs include *Cornus florida*, *Symplocos tinctoria*, *Oxydendrum arboreum*, *Hamamelis virginiana*, *Morus rubra*, and *Stewartia malacodendron*. Within its range, *Sabal minor* may be a prominent shrub. Some stands may contain *Arundinaria gigantea*. Some typical herbs include *Mitchella repens* and *Hexastylis arifolia* (NatureServe 2006).

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUAL	<i>Quercus alba</i>	White oak
FAGR	<i>Fagus grandifolia</i>	American beech
QUPA5	<i>Quercus pagoda</i>	Cherrybark oak
LITU	<i>Liriodendron tulipifera</i>	Tuliptree
LIST2	<i>Liquidambar styraciflua</i>	Sweetgum
QUSH	<i>Quercus shumardii</i>	Shumard's oak

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

Disturbance Description

The fire regime is characterized by infrequent, low intensity surface fires and rare mosaic or replacement fires. The mean fire return interval (MFRI) is about 35yrs with wide year-to-year and within-type variation related to moisture cycles, degree of sheltering, and proximity to more fire-prone vegetation types. Anthropogenic fire was considered and it contributes to within-type MFRI variation.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	392	9		
Moderate (Mixed)	159	22		
Low (Surface)	52	69		
All Fires	35	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

Stands of this type may be essentially linear features on the landscape, occupying slopes associated with concave drainage features. Under closed conditions, fire may only partially penetrate these systems from adjacent uplands.

NatureServe 2006 notes the corresponding Ecological System (CES203.242) as a large-patch system, occurring in mosaics with other small-patch systems, or as small isolated patches surrounded by wetlands. Generally occurs as small to large patches, of a few to dozens of acres. Mosaics may contain up to several hundred acres in close proximity.

Adjacency or Identification Concerns

Stands of this type may be essentially linear features on the landscape, occupying slopes associated with concave drainage features. There may be larger patches where side-drains join

larger streams. Under closed canopy conditions, fire may only partially penetrate these systems from adjacent uplands.

Most commonly associated with Atlantic Coastal Plain Dry and Dry-Mesic Oak Forest (CES203.241) and various floodplain systems. Less commonly associated with Atlantic Coastal Plain Nonriverine Swamp and Wet Hardwood Forest (CES203.304). Floodplain systems often occur below this system (NatureServe 2006).

Issues or Problems

There is an issue with respect to recognizing canopy closure of just the overstory of this forest type. In this model, the sub-canopy closure really makes the difference between what an open and closed stand represent. The keep relative age was used in the model to keep it realistic.

Native Uncharacteristic Conditions

Comments

This BpS is based on a revision of the descriptive material for R9OADM of the Rapid Assessment process. (Notes from R9OADM: We have included the use of keep relative age in this model, realizing that in the long term, modeling this will either have to be accommodated in the software or reworked. The inclusion makes more ecological sense. Without it, the proportion of forests shift to the mid-successional forest class, which is not expected on the ground.)

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	A	A	A	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	A	A	A	A	A	A	A	A	A	A
Shrub	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Shrub	1.0-3.0	A	A	A	A	A	A	A	A	A	A
Shrub	>3.0	A	A	A	A	A	A	A	A	A	A
Tree	0-5	A	A	A	A	A	A	A	A	A	A
Tree	5-10	C	C	C	C	C	C	C	C	B	B
Tree	10-25	C	C	C	C	C	C	C	C	B	B
Tree	25-50	D	D	D	D	D	D	D	D	E	E
Tree	>50	D	D	D	D	D	D	D	D	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	8	Early Development 1 - All Structures
----------------	----------	---

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
FAGR	Fagus grandifolia	American beech	Upper
QUPA5	Quercus pagoda	Cherrybark oak	Upper
LITU	Liriodendron tulipifera	Tuliptree	Upper

Description

This class is characterized by sprouts, seedlings and saplings, primarily of major overstory species, occurring in gaps created by wind, lightning, insect/disease and, less frequently, fire. Shade intolerant species (e.g., *Liriodendron tulipifera*, LITU) are confined to multiple-tree gaps. This is not a fire-driven system; therefore, most of early succession would result from other disturbances, including tree fall.

Maximum Tree Size Class

Sapling >4.5ft; <5"DBH

Class B	30	Mid Development 1 - Closed
----------------	-----------	-----------------------------------

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
FAGR	Fagus grandifolia	American beech	Upper
QUPA5	Quercus pagoda	Cherrybark oak	Upper
LITU	Liriodendron tulipifera	Tuliptree	Upper

Description

Class B is dominated by a young to early mature canopy with some obligate midstory and understory species. The closed condition is a function of understory/midstory development and depending on the age of the overstory, at least two strata are present. The fire frequency primarily impacts the amount of subcanopy vegetation. Under standard conditions, e.g., infrequent and low intensity fires, the stands have dense undergrowth and are considered closed.

Maximum Tree Size Class

Medium 9-21"DBH

Class C	6	Mid Development 1 - Open
----------------	----------	---------------------------------

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
FAGR	Fagus grandifolia	American beech	Upper

QUPA5	Quercus pagoda	Cherrybark oak	Upper
LITU	Liriodendron tulipifera	Tuliptree	Upper

Description

Class C has the same overstory composition and structure as B, but without a well-developed midstory. Surface fires serve to maintain the open understory in these stands.

Maximum Tree Size Class

Medium 9-21"DBH

Class D	15	Late Development 1 - Open
----------------	-----------	----------------------------------

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
FAGR	Fagus grandifolia	American beech	Upper
QUPA5	Quercus pagoda	Cherrybark oak	Upper
LITU	Liriodendron tulipifera	Tuliptree	Upper

Description

Class D is characterized by an early to late mature canopy that may exceed 100ft in height. Dominant overstory species vary depending on location and stand history. The open condition is dependent on the absence of multi-layered vertical structure. Surface fires maintain the open understory in these stands.

Maximum Tree Size Class

Large 21-33"DBH

Class E	41	Late Development 1 - Closed
----------------	-----------	------------------------------------

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
FAGR	Fagus grandifolia	American beech	Upper
QUPA5	Quercus pagoda	Cherrybark oak	Upper
LITU	Liriodendron tulipifera	Tuliptree	Upper

Description

Class E exhibits the same overstory composition and structure as D. However, well-developed lower layers are present containing canopy species and other species confined to those levels. Fire frequency primarily impacts the amount of subcanopy vegetation. Under standard conditions, e.g., infrequent and low intensity fires, the stands have dense undergrowth and are considered closed.

Maximum Tree Size Class
Large 21-33"DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:CLS	14
Mid1:OPN	15	Late1:OPN	79
Mid1:CLS	15	Late1:CLS	79
Late1:OPN	80	Late1:OPN	999
Late1:CLS	80	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
Replacement Fire	Early1:ALL	Early1:ALL	0.004	250	Yes	0
Mixed Fire	Early1:ALL	Early1:ALL	0.01	100	No	0
Alternative Succession	Mid1:OPN	Mid1:CLS	1	1	Yes	25
Wind or Weather or Stress	Mid1:OPN	Early1:ALL	0.002	500	Yes	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.003	333	Yes	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.04	25	No	0
Wind or Weather or Stress	Mid1:CLS	Early1:ALL	0.003	333	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.003	333	Yes	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.006	167	Yes	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.012	83	No	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	25
Replacement Fire	Late1:OPN	Early1:ALL	0.002	500	Yes	0
Wind or Weather or Stress	Late1:OPN	Early1:ALL	0.003	333	Yes	0
Surface Fire	Late1:OPN	Late1:OPN	0.04	25	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.002	500	Yes	0
Wind or Weather or Stress	Late1:CLS	Early1:ALL	0.004	250	Yes	0
Mixed Fire	Late1:CLS	Late1:OPN	0.009	111	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.018	56	No	0

References

- Braun, E.L. 1950. Deciduous Forests of Eastern North America. New York, NY: Free Press. 596 pp.
- Brown, J.K. and J. Kapler-Smith, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42. vol 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.
- Bryant, W.S., W.C. McComb and J.S. Fralish. 1993. Oak-hickory forests (western mesophytic/oak hickory forests). Pages 143-201 in: W.H. Martin, S.G. Boyce and A.C. Echternacht, eds. Biodiversity of the Southeastern United States: upland terrestrial communities, New York, NY: Wiley.
- Buckner, E.R. 1989. Evolution of forest types in the Southeast. In: T.A. Waldrop, ed. Proceedings: Pine-hardwood mixtures: a symposium on management and ecology of the type. Gen. Tech. Rep. SE-58. Atlanta, GA: USDA Forest Service, Southeastern Forest Experiment Station. 271 pp.
- Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow and J. Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, VA.
- Frost, C.C. 1998. Presettlement fire frequency regimes of the United States: a first approximation. In: Pruden, Theresa L. and Brennan, Leonard A., eds. Fire in ecosystem management: shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tallahassee, FL: Tall Timbers Research Station. Pp. 70-81.
- Greenberg, C.H., D.E. McLeod and D.L. Loftis. 1997. An old-growth definition for western mesophytic and mixed mesophytic forests. Gen. Tech. Rep. SRS-16. Asheville, NC: USDA Forest Service, Southern Research Station. 16 pp.
- Hinkle, C.R., W.C. McComb, J.M. Safley, Jr. and P.A. Schmalzer. 1993. Mixed mesophytic forests. Pages 203-253 in: Martin, W.H., Boyce, S.G. and Echternacht, A.C., eds. Biodiversity of the Southeastern United States: upland terrestrial communities. New York, NY: Wiley.
- NatureServe. 2006. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 18 July 2006.
- NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available:
<http://www.fs.fed.us/database/feis/>.