

13210

South-Central Interior Mesophytic Forest

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
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Vegetation Type

Forest and Woodland

Map Zones

62

Geographic Range

This BpS model represents the mixed mesophytic forests of the unglaciated Allegheny plateau in southeastern OH, western PA, and north-central West VA. The distribution of this BpS generally coincides with the Mixed Mesophytic Forest Region described by Braun (1950), ranging from MZ62 south and west into portions of eastern KY, east-central TN, and northeastern AL. The system borders the Beech-Maple Forest Region to the north, the Western Mesophytic Forest Region to the west, the Oak-Chestnut Forest Region to the east, and the Hemlock-White Pine-Northern Hardwoods Region to the northeast (Braun 1950). In MZ62, this BpS is concentrated on unglaciated landscapes in Subsections 221Eg, 221Ef, 221Ee, 221Ed, 221Ec, 221Ea, 211Ga, and M221Ca.

Biophysical Site Description

Mixed mesophytic forests occur on moist, topographically protected areas (e.g. coves, v-shaped valleys, north- and east-facing toe slopes) within highly dissected hills and mountains in the unglaciated Allegheny plateau region. On slopes it forms a mosaic with pyrogenic oak-hickory forests (e.g., Northeastern Interior Dry-Mesic Oak Forest), whereby cove or mixed mesophytic forests are restricted to the most protected coves and oak-hickory occurs on the interfluves. 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, supporting over 30 canopy tree species. This model focuses on the mixed mesophytic forest as represented in MZ62.

NatureServe (2007) separates the South-Central Interior Mesophytic Forest from the Southern and Central Appalachian Cove Forest (1318), which is found in regions east of 1321, including portions of eastern PA, eastern West VA, western VA, eastern KY, eastern TN, western NC, and northern GA.

Vegetation Description

This BpS supports very high diversity of canopy species. In MZ62, characteristic trees include 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 (*Quercus alba*), cucumber-tree (*Magnolia acuminata*), white ash (*Fraxinus americana*), black walnut (*Juglans nigra*), shagbark hickory (*Carya ovata*), red elm (*Ulmus rubra*), black gum (*Nyssa sylvatica*), and, formerly, American chestnut (*Castanea dentata*) (Braun 1950, Braun 1961, Fike 1999, Muller 1982). Hemlock (*Tsuga canadensis*) occupies protected slopes, but is not characteristically dominant (Fike 1999). In addition to these species, numerous other species are often present as scattered individuals in the canopy. This forest type developed primarily on mesic, sheltered landscape positions (e.g., lower slopes, coves, ravines, north and east aspects) but also occurred on some dry-mesic slopes, where presumably fire was infrequent (Wade et al. 2000). In addition to slope and aspect, substrate base status impacts the distribution and abundance of canopy trees (Runkle and Whitney 1987). A preponderance of white oak may be related to colonization events associated with historically favorable climatic conditions (McCarthy et al. 2001).

Common subcanopy and shrub species may include sourwood (*Oxydendrum arboreum*), paw-paw (*Asimina triloba*), bladdernut (*Staphylea trifoliata*), rosebay (*Rhododendron maximum*), umbrella magnolia (*Magnolia tripetala*), redbud (*Cercis canadensis*), spicebush (*Lindera benzoin*), wild hydrangea (*Hydrangea arborescens*), flowering dogwood (*Cornus florida*), maple-leaved viburnum (*Viburnum acerifolium*), musclewood (*Carpinus caroliniana*), sassafras (*Sassafras albidum*), and witch-hazel (*Hamamelis virginiana*) (Braun 1950, Runkle and Whitney 1987, Fike 1999, McCarthy et al. 2001, McEwan et al. 2005).

The ground layer of this BpS is often lush and species-rich (Braun 1950, Fike 1999). Spring-flowering herbs are abundant, and are represented by large white trillium (*Trillium grandiflorum*), drooping trillium (*T. flexipes*), purple trillium (*T. erectum*), toadshade (*T. sessile*), yellow trout-lily (*Erythronium americanum*), wood phlox (*Phlox divaricata*), wood anemone (*Anemone quinquefolia*), squirrel-corn (*Dicentra canadensis*), dutchman's-breeches (*D. cucullaria*), speckled wood lily (*Clintonia umbellulata*), blue cohosh (*Caulophyllum thalictroides*), foamflower (*Tiarella cordifolia*), bloodroot (*Sanguinaria canadensis*), spring beauty (*Claytonia virginica*) and a variety of other species. Ferns are often well-represented (Braun 1950, Fike 1999, McEwan et al. 2005, NatureServe 2007).

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
FAGR	<i>Fagus grandifolia</i>	American beech
LITU	<i>Liriodendron tulipifera</i>	Tuliptree
ACSA3	<i>Acer saccharum</i>	Sugar maple
TIAMH	<i>Tilia americana</i> var. <i>heterophylla</i>	American basswood
AEFL	<i>Aesculus flava</i>	Yellow buckeye
QURU	<i>Quercus rubra</i>	Northern red oak
QUAL	<i>Quercus alba</i>	White oak
FRAM2	<i>Fraxinus americana</i>	White ash

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

Disturbance Description

The mixed-mesophytic forest type is fire regime class III (Wade et al. 2000). Mixed severity fires will occur approximately every 500yrs opening the canopy with increased mortality. This effect may also be achieved by recurrent, severe insect defoliations, droughts, or ice storms. Straight-line winds or microbursts may cause blow-downs on a scale of one to 100ac. Stand replacement fires happen very infrequently. This BpS 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 and oaks are not typically a dominant species in stands of this type.

NatureServe (2007) makes note that this system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration on a fine scale. Occasional extreme wind or ice events may disturb larger patches. Natural fire dynamics are not well-known and probably only occurred in years that were extremely dry. Surface fires may have occurred at moderate frequency but were probably usually low enough in intensity to have only limited effects. The source of some fires was Indian ignitions for the purpose of seed collection. Replacement fires likely only occurred following extreme drought, coupled with ice, insect, or wind disturbance. Most of the component species are among the less fire-tolerant in the region.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	944	20		
Moderate (Mixed)	786	24		
Low (Surface)	336	56		
All Fires	188	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

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

NatureServe (2007) notes that most individual patches are tens to sometimes a few hundred acres. Because it frequently occurs in mosaics with other systems, separation distance for occurrences has a strong effect on the size of occurrences. Complexes of thousands of acres of this system are possible.

Adjacency or Identification Concerns

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

Issues or Problems

Witness tree data (from early land surveys) and studies of old-growth forests suggest that mixed-oak forests were generally more abundant on the landscape than mixed-mesophytic forests prior

to European settlement (Beatley 1959, McCarthy et al. 1987, Abrams et al. 1995, Dyer 2001, McCarthy et al. 2001, Rentch et al. 2003). The delineation of the 'cove' or '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 of some of the characteristic mesic taxa out of coves, potentially replacing previous oak-dominated vegetation on drier and more exposed sites than those typically associated with 'mesic' vegetation.

This model was developed to represent the mixed mesophytic forest type as expressed in MZ62.

Native Uncharacteristic Conditions

Uncharacteristic types (structure/composition/etc.) that may frequently occur today in this BpS include: non-native invasive species (plants, animals, insects, pathogens, etc.), deer herbivory (limiting species composition and structure), and absence of fire. The exotic tree *Ailanthus altissima* may dominate local canopy gaps, replacing native canopy trees and forming dense, clonal stands; the exotic grass *Microstegium vimineum* may dominate the herbaceous stratum of stands where it has become established.

Comments

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	UN	UN	UN	UN	UN
Herb	0.5-1.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Herb	>1.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
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	A	A	A	A	A	A	A	A	A	A
Tree	5-10	UN	UN	UN	UN	UN	UN	UN	B	B	B
Tree	10-25	UN	UN	UN	UN	UN	UN	UN	B	B	B
Tree	25-50	UN	UN	UN	UN	UN	C	C	C	C	C
Tree	>50	UN	UN	UN	UN	UN	C	C	C	C	C

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	3	Early Development 1 - All Structures
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
FAGR	<i>Fagus grandifolia</i>	American beech	Upper
LITU	<i>Liriodendron tulipifera</i>	Tuliptree	Upper
ACSA3	<i>Acer saccharum</i>	Sugar maple	Upper
CADE12	<i>Castanea dentata</i>	American chestnut	Upper

Description

Regenerating stands 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 seed bank. This short-lived stage exists until canopy closure occurs and resource competition for growing space begins.

Maximum Tree Size Class

Sapling >4.5ft; <5"DBH

Class B 34 Mid Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
LITU	<i>Liriodendron tulipifera</i>	Tuliptree	Upper
BEAL2	<i>Betula alleghaniensis</i>	Yellow birch	Upper
ACSA3	<i>Acer saccharum</i>	Sugar maple	Mid-Upper
FAGR	<i>Fagus grandifolia</i>	American beech	Mid-Upper

Description

Mid-seral closed overstory; stem exclusion stage. Intense competition begins after canopy closure 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. *Liriodendron tulipifera* and *Betula alleghaniensis* may temporarily out compete some other slower-growing species.

Maximum Tree Size Class

Pole 5-9" DBH

Class C 63 Late Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
FAGR	Fagus grandifolia	American beech	Upper
ACSA3	Acer saccharum	Sugar maple	Upper
LITU	Liriodendron tulipifera	Tuliptree	Upper
BEAL2	Betula alleghaniensis	Yellow birch	Middle

Description

Closed-canopy mixed-mesophytic forests that develop on mesic landscape positions and have dominant trees that are 100yrs+ of age. Dominant species include *Fagus grandifolia*, *Acer saccharum*, *Liriodendron tulipifera*, *Castanea denata*; also *Tilia americana* var. *heterophylla*, *Aesculus flava*, *Tsuga canadensis*, *Prunus serotina*, *Quercus alba*, and *Quercus rubra*. Low intensity surface fires with a 300-year return interval maintain system in this class. Leaf litter-removing surface fires in August or September, prior to hemlock seed set, can result in a solid understory of hemlock.

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:CLS	9
Mid1:CLS	10	Late1:CLS	99
Late1:CLS	100	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	0.003	333	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.001	1000	Yes	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.003	333	No	0
Wind or Weather or Stress	Mid1:CLS	Early1:ALL	0.003	333	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.001	1000	Yes	0
Mixed Fire	Late1:CLS	Mid1:CLS	0.002	500	Yes	0
Wind or Weather or Stress	Late1:CLS	Early1:ALL	0.002	500	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.003	333	No	0

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