

13210

South-Central Interior Mesophytic Forest

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Vegetation Type

Forest and Woodland

Map Zones

47, 48, 53, 57

Geographic Range

The Interior-mesophytic forest system is found on the non-coastal plain portion of the Western Mesophytic Forest Region, extending north into unglaciated portions of the Beech-Maple Forest Region, of Braun (1950). There is much variability in different examples of this system across its range, with the composition of some occurrences in the escarpment of the Cumberland Plateau approaching that of examples of Southern and Central Appalachian Cove Forest (CES202.373). In limited areas of the region, some stands may contain hemlock (*Tsuga canadensis*). These are noteworthy on a local basis, as the tree is less well distributed in the range of this system than it is in corresponding environments at higher elevation in the Appalachians or to the north.

Biophysical Site Description

These high-diversity, predominately deciduous forests occur on deep and enriched soils (in some cases due to, or enhanced by, the presence of limestone or related base-rich geology), in non-montane settings and usually in somewhat protected landscape positions such as coves or lower slopes. This system is found in southern Ridge and Valley and portions of the Interior Low Plateau where it is located entirely south of the glacial boundary. Dominant species include *Acer saccharum*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Aesculus glabra*, *Quercus rubra*, *Acer negundo*, and *Juglans nigra*. *Tsuga canadensis* may be a component of some stands. Trees may grow very large in undisturbed areas. The herb layer is very rich, often with abundant spring ephemerals.

Vegetation Description

A diverse closed-canopy forest with dominant species including: beech (*Fagus grandifolia*), tulip-poplar (*Liriodendron tulipifera*), American basswood (*Tilia americana* var. *heterophylla*), sugar maple (*Acer saccharum*), yellow buckeye (*Aesculus flava*), *Magnolia acuminata*, and *Juglans nigra*, red oak (*Quercus rubra*), white oak (*Q. alba*) and formerly American chestnut (*Castanea dentata*) (Braun 1950, Muller 1982). The oak component tends to grade from white oaks in the southern areas to red and black oaks in the northern geographic range of this forest type. *Tsuga canadensis* may be a minor component of some stands. Trees may grow very large in undisturbed areas. In the northern areas, both white (*Fraxinus americana*) and green ash (*Fraxinus pennsylvanica*) can be up to 10-15% of forest type (C. Emanuel, personal

communication). This forest type developed primarily on mesic, sheltered landscapes positions (e.g., lower slopes, coves, ravines) but also occurred on some dry-mesic slopes, where presumably fire was infrequent (Wade et al. 2000).

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
QURU	<i>Quercus rubra</i>	Northern red oak
JUNI	<i>Juglans nigra</i>	Black walnut
ACNE2	<i>Acer negundo</i>	Boxelder
AEGL	<i>Aesculus glabra</i>	Ohio buckeye

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

Disturbance Description

The interior-mesophytic forest type is fire regime class III, surface fires with return intervals 50-200yrs+. 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 or droughts. Straight-line winds or microbursts may cause blow-downs on a scale of 1-100ac. Due to the mesic nature of these forests, stand replacement fires happen very infrequently. Ice storm damage is a more common disturbance than fire in this system, and yet ice storm frequency directly feeds into fuel loading at these sites. Decay is the main consumer of downed fuels in these moist settings. The oaks found within this forest type are susceptible to Gypsy Moth, but these 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.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	867	8		
Moderate (Mixed)	532	13		
Low (Surface)	86	79		
All Fires	68	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 forest occur more continuously on north and east facing toe slopes, and interfinger with oak-hickory on side slopes up to the northern hardwood zone and higher elevations.

Adjacency or Identification Concerns

Mapping mixed mesophytic forests would likely focus on specific topographic positions, such as coves, valley bottoms typically v-shaped (excluding broad u-shaped floodplains), lower north and east facing slopes; sometimes west and south facing lower slopes where moisture permits; wet-mesic to mesic conditions on the landscape; rich fertile conditions/sites; shaded topographic positions (Nowacki personal communication). On side slopes, mixed mesophytic forest

interbraid with oak-hickory forests, with mixed-mesophytic occurring in v-notches and coves (drainages) and oak-hickory on interfluves.

Uncharacteristic types (structure/composition/etc.) that may frequently occur today in this Biophysical Setting (BpS) include: non-native invasive species (plants, animals, insects, pathogens, etc.), deer herbivory (limiting species composition and structure), and perhaps rarely historical fire suppression.

This forest type grades into Northeastern Interior Dry-Mesic Oak Forest (1303), where this forest type grades into northern sites when soils are sometimes drier (shallower soils, sandier parent material), and as elevation is increased.

Issues or Problems

Though Küchler (1964) mapped and described this region as mixed-mesophytic, witness tree data (from early land surveys) and studies of old-growth forests suggest that mixed-oak forests were more abundant than mixed-mesophytic forests in many areas prior to European settlement (Beatley 1959, McCarthy et al. 1987, Abrams et al. 1995, Dyer 2001, McCarthy et al. 2001, Rentch et al. 2003). Delineating the potential boundaries of "mixed-mesophytic" forest type today should recognize that this boundary is influenced by human management interactions: historic logging and high-grading, the absence of fire, deer populations (herbivory), and non-native invasive species (plants, animals, insects and disease). The result is that mesophytic species may have invaded oak-hickory-savanna habitats particularly where fire suppression has dominated.

Native Uncharacteristic Conditions

Tree of Heaven (*Ailanthus altissima*) is a significant invader in these sites, due to its ability to persist in fairly intact canopy as well as its high water demand (K. Brown, personal communication).

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	A	A	A	A	A	A
Tree	10-25	UN	UN	UN	UN	B	B	B	B	B	B
Tree	25-50	UN	UN	UN	UN	D	D	D	C	C	C

Tree	>50	UN	UN	UN	UN	D	D	D	D	D	D
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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 2 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
FRAM2	Fraxinus americana	White ash	Upper
LITU	Liriodendron tulipifera	Tuliptree	Upper
ULAM	Ulmus americana	American elm	Upper
ACRU	Acer rubrum	Red maple	Upper

Description

Regenerating stands established after catastrophic disturbance, primarily wind and ice storms and infrequently by fire. Tree regeneration unfolds from a combination of stump and root sprouts and the seedbank. This short-lived stage exists until canopy closure occurs and resource competition for growing space begins. This also includes tree gap dynamics.

Maximum Tree Size Class

Sapling >4.5ft; <5"DBH

Class B 11 Mid Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
LITU	Liriodendron tulipifera	Tuliptree	Upper
ACRU	Acer rubrum	Red maple	Upper
QURU	Quercus rubra	Northern red oak	Lower
FRAM2	Fraxinus americana	White ash	Lower

Description

Mid-seral closed overstory; stem exclusion stage. Although canopy closure occurs at approximately 10yrs of age, intense competition between canopy dominants begins after the stand is approximately 20yrs old. Large gaps are not common, as mortality from tree suppression tends to result from crown overtopping (not gap formation). Red oak is found as seedlings in the understory (and is found as a canopy dominant in later successional stages). These stands will remain in this self-thinning, closed canopy condition for many decades.

Maximum Tree Size Class

Medium 9-21"DBH

Class C	32	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
FAGR	<i>Fagus grandifolia</i>	American beech	None
ACSA3	<i>Acer saccharum</i>	Sugar maple	None
LITU	<i>Liriodendron tulipifera</i>	Tuliptree	None
QURU	<i>Quercus rubra</i>	Northern red oak	None

Description

Closed-canopy, mature, mixed-mesophytic forests that develop on mesic landscape positions, on deep, rich soils, and the presence of limestone and/or base-rich geologic parent material. Dominant trees are 100yrs+ of age. Dominant species include *Fagus grandifolia*, *Acer saccharum*, *Liriodendron tulipifera*, *Quercus rubra*; also *Tilia americana* va. *Heterophylla*, *Aesculus flava*, *Tsuga canadensis*.

Maximum Tree Size Class

Large 21-33"DBH

Class D	55	Late Development 2 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ACSA3	<i>Acer saccharum</i>	Sugar maple	Upper
LITU	<i>Liriodendron tulipifera</i>	Tuliptree	Upper
FAGR	<i>Fagus grandifolia</i>	American beech	Upper
QURU	<i>Quercus rubra</i>	Northern red oak	Upper

Description

Late successional stands, which feature: some individual trees nearing maximum age and size for their species, multiple canopy strata, gaps, regeneration of multiple age and size classes, and coarse woody debris (standing and down) (Davis 1993). Dominant species: *Fagus grandifolia*, *Acer saccharum*, *Liriodendron tulipifera*, *Quercus rubra*. Fire is infrequent with low intensity (e.g., surface fires during droughts). Canopy structure is maintained by wind, ice, insect and disease events, and the scale of disturbance is dominated by gap dynamics (Davis 1993).

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	9
Mid1:CLS	10	Late1:CLS	60

Late1:CLS	61	Late2:CLS	200
Late2:CLS	201	Late2: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
Mixed Fire	Early1:ALL	Early1:ALL	0.007	143	No	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.002	500	Yes	0
Wind or Weather or Stress	Mid1:CLS	Early1:ALL	0.004	250	Yes	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.012	83	No	0
Wind or Weather or Stress	Late1:CLS	Early1:ALL	0.001	1000	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.001	1000	Yes	0
Mixed Fire	Late1:CLS	Late1:CLS	0.002	500	No	0
Insects or Disease	Late1:CLS	Early1:ALL	0.002	500	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.01	100	No	0
Replacement Fire	Late2:CLS	Early1:ALL	0.001	1000	Yes	0
Mixed Fire	Late2:CLS	Late1:CLS	0.002	500	Yes	0
Wind or Weather or Stress	Late2:CLS	Late2:CLS	0.003	333	No	0
Insects or Disease	Late2:CLS	Late2:CLS	0.003	333	No	0
Surface Fire	Late2:CLS	Late2:CLS	0.013	77	No	0

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