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Southern Appalachian Northern Hardwood Forest

BpS Model/Description Version: Aug. 2020

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Modelers		Reviewers	
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None	None	None	None
None	None	None	None

Model adopted from the Great Smoky Mountains National Park Landscape Conservation Forecasting project, with associated changes to the description to match the model definitions

Vegetation Type

Forest and Woodland

Map Zones

53, 57

Geographic Range

This system ranges from northwestern Georgia, western North Carolina and eastern Tennessee to Virginia and West Virginia. The Northern Hardwood component also occurs in small part on Black Mountain in eastern Kentucky.

Biophysical Site Description

High elevation sites in the Southern Appalachians. Generally occurring on all topographic positions above 1,372m (4,500ft) in the southern extent of the range, elevations may be considerably lower in the northern part of the range. At elevations greater than 1,676m (5,500ft) (975m in West Virginia), spruce-fir forests become the predominant type, though the range of this sub-type is extremely limited within this zone. Soils are highly variable, ranging from deep mineral soils to well-developed boulder fields. Soils are most often rocky and acidic, with low base saturation. A thick organic soil layer is frequently present. Overall hydrology is mesic, ranging from wet in bogs, seeps, and the most protected sites to dry-mesic on some exposed upper slopes and ridges. Mesic conditions are maintained by high annual rainfall, frequent fog deposition, low temperatures, and heavy shading.

Vegetation Description

Co-dominant trees in Southern Appalachian Northern Hardwood Forests are sugar maple (*Acer saccharum* var. *saccharum*), American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*) and yellow buckeye (*Aesculus flava*) in variable proportions. Overall floristic composition varies with specific site conditions, and two community types have been recognized by VANHP ecologists. The first is widespread throughout the higher elevations of the southern Virginia Blue Ridge and also represents outliers of the global type in the adjacent Ridge and Valley. Sugar maple and yellow buckeye are prominent in the overstory, along with yellow birch and beech. Black cherry (*Prunus serotina* var. *serotina*), white ash (*Fraxinus americana*) and northern red oak (*Quercus rubra*) are very minor overstory associates. Sapling sugar maple, striped maple (*Acer pensylvanicum*) and, more locally, mountain maple (*Acer spicatum*) are abundant understory species. Smooth blackberry (*Rubus canadensis*) is the only common shrub.

Herb layers are moderately dense and usually contain nutrient-demanding species such as blue cohosh (*Caulophyllum thalictroides*) and wood nettle (*Laportea canadensis*) at low cover. However, the most abundant and constant herbs of this type are Appalachian white snakeroot (*Ageratina altissima* var. *roanensis*), southern lady fern (*Athyrium filix-femina* var. *asplenoides*), evergreen wood-fern (*Dryopteris intermedia*) and sweet white violet (*Viola blanda* var. *blanda*). This unit generally occurs on straight to concave slopes with west, north, or east aspects, and soils with slightly higher base status (particularly manganese levels) than those of the following.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
BEAL2	<i>Betula alleghaniensis</i>	Yellow birch
QURU	<i>Quercus rubra</i>	Northern red oak
ACSA3	<i>Acer saccharum</i>	Sugar maple
FAGR	<i>Fagus grandifolia</i>	American beech
TSCA	<i>Tsuga canadensis</i>	Eastern hemlock
AEFL	<i>Aesculus flava</i>	Yellow buckeye
LITU	<i>Liriodendron tulipifera</i>	Tuliptree

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

Disturbance Description

This setting is characterized by stable, uneven aged forests. Canopy dynamics are primarily driven by single or multiple tree disturbances, encouraging gap-phase regeneration. Primary disturbance factors are wind events and ice storms. Extreme weather-driven events can also be important in larger scale disturbances. These are all more important than fire, although they predispose forests to fire during drought conditions. Fire Regime Group V. Destructive fires occurred rarely within this biophysical setting, usually occurring after catastrophic wind events, following periods of extreme drought. As much as 25% of this biophysical setting may be considered in a non-fire regime. When they occur, fires are severe and affect large patch sizes. Surface fire is extremely rare, at more than 1,000yr intervals, while replacement fire is more frequent at 300-1,000yr intervals. In spruce-fir dominated parts of this setting, replacement fires are severe and kill most trees and understory, removing most to all of the canopy and allowing pioneer species to emerge. Recent research indicates that on the most exposed sites, stand replacement fires in spruce-fir can result in a stable shrub-dominated community ("heath balds"). Mixed fires pass through the understory of the northern hardwood component, killing most smaller trees, leaving behind some large, well-established trees while creating canopy openings. Occurrence of fire is most frequent on sites where northern red oak dominates.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	691	25		
Moderate (Mixed)	675	25		
Low (Surface)	347	50		
All Fires	172	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

Large scale. All landforms above 4,500ft elevation are included.

Adjacency or Identification Concerns

The northern hardwood component of this biophysical setting can have a nearly indistinguishable transition to the adjacent cove-hardwood community (mixed mesophytic). Montane oak forests can be found above 4500ft on very exposed slopes.

Issues or Problems

In modern times other disturbances, especially logging, logging slash fires, balsam woolly adelgid (an exotic species), chestnut blight (exotic fungus), acid deposition and climate change are playing an important role.

Native Uncharacteristic Conditions

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	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	B	B	B	B
Tree	10-25	D	D	D	D	D	D	E	E	E	E
Tree	25-50	D	D	D	D	D	D	E	E	E	E
Tree	>50	D	D	D	D	D	D	E	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	6	Early Development 1 - All Structures
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
RUAL	Rubus allegheniensis	Allegheny blackberry	Mid-Upper
RUCA16	Rubus canadensis	Smooth blackberry	Mid-Upper
PRPE2	Prunus pensylvanica	Pin cherry	Upper
BEAL2	Betula alleghaniensis	Yellow birch	Upper

Description

Typical gap replacement. Mostly single to multiple tree-sized gaps, but extreme weather-driven events can create larger scale openings. Stand replacement fires in northern hardwoods or spruce-fir also result in this class. Stand replacement in spruce-fir leads to a northern hardwood pathway. *Rubus alleghaniensis*, *Rubus canadensis*, *Prunus pennsylvanica*, *Betula alleghaniensis*, *Quercus rubra*, *Fagus grandifolia*.

Maximum Tree Size Class

Sapling >4.5ft; <5"DBH

Class B	21	Mid Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ABFR	<i>Abies fraseri</i>	Fraser fir	Upper
PIRU	<i>Picea rubens</i>	Red spruce	Upper
FAGR	<i>Fagus grandifolia</i>	American beech	Upper
BEAL2	<i>Betula alleghaniensis</i>	Yellow birch	Upper

Description

Typical closed canopy stand development following single tree to stand replacement events. *Betula alleghaniensis*, *Abies fraseri* (or *A. balsamea*), *Picea rubens*, *Prunus pennsylvanica*, and *Fagus grandifolia*. *Quercus rubra* may be locally important on more exposed sites.

Maximum Tree Size Class

Medium 9-21"DBH

Class C	1	Mid Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ABFR	<i>Abies fraseri</i>	Fraser fir	Upper
PIRU	<i>Picea rubens</i>	Red spruce	Upper
FAGR	<i>Fagus grandifolia</i>	American beech	Upper
BEAL2	<i>Betula alleghaniensis</i>	Yellow birch	Upper

Description

Typical open stand development following single tree to stand replacement events. *Betula alleghaniensis*, *Abies fraseri* (or *A. balsamea*), *Picea rubens*, *Prunus pennsylvanica*, and *Fagus grandifolia*. *Quercus rubra* may be locally important on more exposed sites.

Maximum Tree Size Class

Medium 9-21"DBH

Class D	4	Late Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QURU	<i>Quercus rubra</i>	Northern red oak	Upper
BEAL2	<i>Betula alleghaniensis</i>	Yellow birch	Upper
RUAL	<i>Rubus allegheniensis</i>	Allegheny blackberry	Low-Mid
PRPE2	<i>Prunus pensylvanica</i>	Pin cherry	Upper

Description

More open stands of northern hardwoods, especially red oak, resulting from rare mixed fires. *Quercus rubra*, *Betula alleghaniensis*, *Fagus grandifolia*, *Rubus alleghaniensis*, *Prunus pensylvanica*. Note that this description does not include balds, although they may be subsumed in this type. Well-developed deciduous shrub layer and dense herbaceous layer are frequent.

Maximum Tree Size Class

Large 21-33"DBH

Class E	68	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
BEAL2	<i>Betula alleghaniensis</i>	Yellow birch	Upper
ABFR	<i>Abies fraseri</i>	Fraser fir	Upper
PIRU	<i>Picea rubens</i>	Red spruce	Upper
FAGR	<i>Fagus grandifolia</i>	American beech	Upper

Description

Closed mature forest. *Betula alleghaniensis*, *Abies fraseri* (or *A. balsamea*), *Picea rubens*, *Fagus grandifolia*, *Acer saccharum*. *Tsuga canadensis* or *Quercus rubra* may be locally important. Well-developed deciduous shrub layer and dense herbaceous layer are frequent.

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	15
Mid1:CLS	16	Late1:CLS	75
Mid1:OPN	16	Late1:OPN	75
Late1:CLS	76	Late1:CLS	999
Late1:OPN	76	Late1:OPN	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	0.0015	667	Yes	0
Mixed Fire	Early1:ALL	Mid1:OPN	0.002	500	Yes	0
Surface Fire	Early1:ALL	Early1:ALL	0.003	333	No	0
Alternative Succession	Mid1:OPN	Mid1:CLS	1	1	No	25
Replacement Fire	Mid1:OPN	Early1:ALL	0.0015	667	Yes	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.002	500	No	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.003	333	No	0
Optional 1	Mid1:OPN	Early1:ALL	0.003	333	Yes	0
Wind or Weather or Stress	Mid1:OPN	Mid1:OPN	0.007	143	No	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.0015	667	No	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.0015	667	Yes	0
Wind or Weather or Stress	Mid1:CLS	Mid1:OPN	0.0025	400	No	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.003	333	No	0
Optional 1	Mid1:CLS	Early1:ALL	0.003	333	Yes	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	No	25
Mixed Fire	Late1:OPN	Late1:OPN	0.001	1000	No	0
Replacement Fire	Late1:OPN	Early1:ALL	0.0015	667	Yes	0
Surface Fire	Late1:OPN	Late1:OPN	0.003	333	No	0
Optional 1	Late1:OPN	Early1:ALL	0.003	333	Yes	0
Insects or Disease	Late1:OPN	Late1:OPN	0.005	200	No	0
Wind or Weather or Stress	Late1:OPN	Late1:OPN	0.007	143	No	0
Mixed Fire	Late1:CLS	Late1:OPN	0.0015	667	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.0015	667	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.0025	400	No	0
Surface Fire	Late1:CLS	Late1:CLS	0.003	333	No	0
Optional 1	Late1:CLS	Early1:ALL	0.003	333	Yes	0
Insects or Disease	Late1:CLS	Late1:OPN	0.005	200	No	0

Optional Disturbances

Optional 1: extreme weather

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