

13530

Southern Appalachian Low-Elevation Pine Forest

BpS Model/Description Version: Aug. 2020

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Modelers		Reviewers	
Malcolm Hodges	mhodes@tnc.org	None	None
Dan Chan	dchan@gfc.state.ga.us	None	None
Louis Hyman	louis.hyman@forestry.alabama.gov	None	None

Model adopted from Great Smoky Mountains National Park (GSMNP) Landscape Conservation Forecasting (LCF) project. Portions of the description below were also taken from the GSMNP LCF documentation.

Vegetation Type

Forest and Woodland

Map Zones

46, 48, 53, 54, 57, 59, 60, 61

Geographic Range

This system is found primarily in the Appalachian regions of Tennessee, Kentucky, and the Southern Blue Ridge in northern Georgia, western North Carolina, southeastern Tennessee, the Cumberlands of Alabama, and southwestern Virginia (NatureServe 2007).

Biophysical Site Description

Occurs on a variety of topographic and landscape positions, including ridgetops, upper and midslopes, in mountain valleys, and in lower ranges. Bedrock may be a variety of types, but system is limited to acidic substrates (NatureServe 2007). This system consists of shortleaf pine- and Virginia pine-dominated forests in the lower elevation southern Appalachians and adjacent Piedmont and Cumberland Plateau, extending into the Interior Low Plateau of Kentucky and Tennessee. Fire is important in maintaining Shortleaf pine-dominated types. The natural habitat of Virginia pine is xeric fire refuges such as exposed rock outcrops with patchy and light fuels. It is thus somewhat comparable to Table Mountain pine, but at lower elevations. Under natural conditions, it would occupy minor land area as a type, but would have scattered individuals surviving in mixture with shortleaf pine.

This system is common to the Southern Appalachians but less so in the adjacent Piedmont, typically occupying xeric to dry sites at elevations generally below 700m on ridge tops, western, south and southwestern aspects. Occasionally Virginia pine is also found dry-mesic sites as a pioneering vegetation.

Vegetation Description

Vegetation consists of closed-to-open forest that is dominated by shortleaf pine (*Pinus echinata*) or Virginia pine (*Pinus virginiana*). Pitch pine (*Pinus rigida*) may sometimes be present. Hardwoods may be abundant at times, especially dry-site oaks such as *Quercus falcata*, *Quercus prinus* and *Quercus coccinea*. Other overstory components vary with moisture regimes but could

include several other pine species, red and white oaks, other hardwoods, and/or eastern red cedar. Many stands are strongly even-aged and density-dependent based on age.

The hardwood component may be partly the result of fire suppression. The shrub layer may be well-developed, with *Vaccinium pallidum*, *Gaylussacia baccata*, or other acid-tolerant species most characteristic. Herbs are usually sparse but may include *Pityopsis graminifolia* and *Tephrosia virginiana*. Herbs probably were more abundant, and shrubs less dense, when fires occurred more frequently, and the communities of this system may have been grassy under more natural conditions, with *Schizachyrium scoparium* being a typical component, possibly with *Danthonia* sp (NatureServe 2007).

Virginia pine is an aggressive invader following disturbance and might be considered uncharacteristic vegetation on some sites. The frequency of its occurrence in the Southern Appalachian forested landscapes today is undoubtedly greater than in pre-settlement times. Its niche appears best fitted to xeric sites on thin soils (e.g. “necklace” stands adjacent to bluff lines in the Cumberlands and Appalachians). Virginia pine is increasingly at risk of mortality to disturbance agents as it matures. Older trees are particularly susceptible to pine beetle attacks due to slow radial growth and relatively high growing densities on often poor sites. Older trees are also more prone to windthrow. Few stands reach 100yrs of age with most stands “breaking up” at 50-75yrs of age.

In addition to the species listed below, the 2017 reviewer added the following commonly occurring species: *Q. montana*, *Q. velutina*, *Q. stellata*

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
PIVI2	<i>Pinus virginiana</i>	Virginia pine
PIEC2	<i>Pinus echinata</i>	Shortleaf pine
QUFA	<i>Quercus falcata</i>	Southern red oak
QUPR2	<i>Quercus prinus</i>	Chestnut oak
QUCO2	<i>Quercus coccinea</i>	Scarlet oak
CAGL8	<i>Carya glabra</i>	Pignut hickory
VAPA4	<i>Vaccinium pallidum</i>	Blue ridge blueberry
GABA	<i>Gaylussacia baccata</i>	Black huckleberry

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

Disturbance Description

Fire is an important influence and may be the only factor determining the occurrence of this system; it would be a hardwood forest without fire. Fires were probably frequent and of low-intensity, or a mix of low- and high-intensity. Fire is important in determining the dominance of the two pines and the presence of the hardwood components and the overall vegetation structure.

Shortleaf pine (*P. echinata*) when mature is resistant to fire, while Virginia pine (*P. virginiana*) is less adapted to fire with thinner bark and higher mortality rates (particularly in young stands), and *P. virginiana* seedlings are easily killed by fire and will not resprout. It can however, survive repeated low intensity fires. The natural occurrence of *P. virginiana* on infertile, thin soils allows

the community to persist in a specialized edaphic niche. It is a prolific seeder and is able to pioneer on these and other disturbed sites. *P. virginiana* often develops "red heart" rot, caused by *Fomes pini*, at ages beyond ~60yrs. Virginia pine is very shallow-rooted and susceptible to windthrow. Heavy snow and ice can create significant stand openings. Initial openings give rise to further windthrow and even larger openings as trees fall into gaps.

Under present conditions, the Southern pine beetle is an important factor in this system. Beetle outbreaks can kill pines without creating conditions for pines to regenerate.

In the absence of fire to maintain the ecosystem, natural Virginia pine stands could succeed to varying vegetation cover: (a) xeric oaks such as scarlet oak, chestnut oak, blackjack oak, and post oak; (b) mountain laurel, sourwood, red maple, and huckleberry; and (c) eastern white pine overstory.

Effects of logging and past clearing as well as fire suppression make understanding of this system's natural character and dynamics difficult. Some pine-dominated areas appear to be successional stands established in former hardwood forests after logging or cultivation, and would not be expected to have the same dynamics or ecosystem characteristics as natural pine forests maintained by fire. In natural pine forests, logging may allow pines to regenerate or may change the composition to weedy hardwoods. It might alter canopy composition as well as structure (NatureServe 2007).

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	154	5	25	125
Moderate (Mixed)	67	11		
Low (Surface)	9	84	5	15
All Fires	8	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

Spatial scale and pattern are generally characterized as large patch. Most remnants in relatively natural condition are probably small patches. In its most natural setting, topography generally limits the patch size of the ecological community.

Adjacency or Identification Concerns

Examples with significant hardwood component may be classified as Southern Piedmont Dry Oak-(Pine) Forest (CES202.339 – Biophysical Setting [BpS] 1368). NatureServe (2007) also notes that this system probably usually bordered and intermixed with Southern Appalachian Oak Forest (CES202.886-- BpS1315) and Southern and Central Appalachian Cove Forest (CES202.373 -- BpS1318) may be present in more mesic areas. It may also intergrade into Southern Appalachian Montane Pine Forest and Woodland (CES202.331 -- BpS1352) at high elevations.

The relationship between this system and Southern Appalachian Montane Pine Forest and Woodland (CES202.331 -- BpS1352) may need further clarification. Southern Appalachian Low-Elevation Pine Forest (CES202.332) is distinguished by its occurrence as large patches on

lower terrain (generally below 700m [2300ft]) and less extreme topography. The vegetation of the two systems may overlap but pitch pine and Table Mountain pine are more typical of the former, while shortleaf pine and Virginia pine are more typical of the latter (NatureServe 2007).

This system (CES202.332) at its western extent in central Tennessee would be distinguished from equivalent Ozarkian systems (e.g., Ozark-Ouachita Shortleaf Pine-Oak Forest and Woodland (CES202.313 -- BpS1367)) by the presence of *Pinus virginiana* and *Quercus prinus*, which do not cross the Mississippi River (NatureServe 2007).

Issues or Problems

Native Uncharacteristic Conditions

Absence of fire without pine reproduction may lead to succession to hardwood forest types.

Effects of logging and past clearing as well as fire suppression make understanding of this system's natural character and dynamics difficult. Some pine-dominated areas appear to be successional stands established in former hardwood forests after logging or cultivation, and would not be expected to have the same dynamics or ecosystem characteristics as natural pine forests maintained by fire. In natural pine forests, logging may allow pines to regenerate or may change the composition to weedy hardwoods. It might alter canopy composition as well as structure (NatureServe 2007).

Comments

This BpS is really a combination of Rapid Assessment (RA) model descriptions for R8PIVlap - Appalachian Virginia Pine and R8PIECap - Appalachian Shortleaf Pine. The RA modeler for each was Roger D. Fryar and each was reviewed by Ron Stephens rstephens@fs.fed.us.

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	B	B	B
Tree	10-25	D	D	D	D	D	D	D	E	E	E
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.

Class A	10	Early Development 1 - All Structures
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Symbol	Scientific Name	Common Name	Canopy Position
PIVI2	<i>Pinus virginiana</i>	Virginia pine	Upper
PIEC2	<i>Pinus echinata</i>	Shortleaf pine	Upper
VACCI	<i>Vaccinium</i>	Blueberry	Upper

Dense seedling and sapling stands with variable herbaceous or woody understory vegetation. Stands originating from Virginia pine forests may have dense pine seedlings with very little understory. Shortleaf-originating stands may include hickory, yellow poplar, dogwood, blueberry, blackberry, huckleberry, grasses, and forbs.

Sapling >4.5ft; <5"DBH

Class B	13	Mid Development 1 - Closed
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Symbol	Scientific Name	Common Name	Canopy Position
PIVI2	<i>Pinus virginiana</i>	Virginia pine	Upper
VACCI	<i>Vaccinium</i>	Blueberry	Upper

Poletimber and small sawtimber stands dominated by Virginia pines with minor components of shortleaf pine and other woody and herbaceous vegetation. Stands are often dense.

Pole 5-9" DBH

Class C	28	Mid Development 1 - Open
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Symbol	Scientific Name	Common Name	Canopy Position
PIEC2	<i>Pinus echinata</i>	Shortleaf pine	Upper
PIVI2	<i>Pinus virginiana</i>	Virginia pine	Upper
QUERC	<i>Quercus</i>	Oak	Low-Mid
CARYA	<i>Carya</i>	Hickory	Low-Mid

Description

Canopy trees are dominated by shortleaf pine, relatively open with grassy understory. Oak and hickory may also be present in canopy or midstory. Virginia pine may be present in pockets protected from fire.

Maximum Tree Size Class

Pole 5-9" DBH

Class D	36	Late Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIEC2	Pinus echinata	Shortleaf pine	Upper
QUERC	Quercus	Oak	Mid-Upper
CARYA	Carya	Hickory	Mid-Upper
COFL2	Cornus florida	Flowering dogwood	Middle

Description

Canopy is dominated by shortleaf pine. Some open parklike stands with grassy understories; overstory contains varying amounts of pine, oak and hickory. Variable midstory development possible with dogwood, oak, and hickories.

Maximum Tree Size Class

Medium 9-21"DBH

Class E	13	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIVI2	Pinus virginiana	Virginia pine	Upper
VACCI	Vaccinium	Blueberry	Low-Mid

Description

Small sawtimber stands dominated by Virginia pines with gaps occurring from tree mortality caused by native insects, wind, ice and snow.

Maximum Tree Size Class

Medium 9-21"DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	15
Mid1:CLS	16	Late1:CLS	70
Mid1:OPN	16	Late1:OPN	70

Late1:CLS	71	Late1:CLS	999
Late1:OPN	71	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
Alternative Succession	Early1:ALL	Mid1:CLS	1	1	Yes	9
Replacement Fire	Early1:ALL	Early1:ALL	0.01	100	Yes	0
Mixed Fire	Early1:ALL	Early1:ALL	0.05	20	No	0
Surface Fire	Early1:ALL	Early1:ALL	0.125	8	No	0
Alternative Succession	Mid1:OPN	Mid1:CLS	1	1	No	20
Wind or Weather or Stress	Mid1:OPN	Mid1:OPN	0.0033	303	No	0
Insects or Disease	Mid1:OPN	Early1:ALL	0.0033	303	Yes	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.005	200	Yes	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.01	100	No	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.125	8	No	0
Wind or Weather or Stress	Mid1:CLS	Mid1:OPN	0.0033	303	No	0
Insects or Disease	Mid1:CLS	Early1:ALL	0.0033	303	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.01	100	Yes	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.02	50	No	0
Surface Fire	Mid1:CLS	Mid1:OPN	0.1	10	No	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.1	10	No	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	No	20
Wind or Weather or Stress	Late1:OPN	Early1:ALL	0.0025	400	Yes	0
Wind or Weather or Stress	Late1:OPN	Late1:OPN	0.0033	303	No	0
Insects or Disease	Late1:OPN	Early1:ALL	0.0033	303	Yes	0
Replacement Fire	Late1:OPN	Early1:ALL	0.005	200	Yes	0
Mixed Fire	Late1:OPN	Late1:OPN	0.008	125	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.111	9	No	0
Wind or Weather or Stress	Late1:CLS	Early1:ALL	0.0025	400	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.0033	303	No	0

Insects or Disease	Late1:CLS	Early1:ALL	0.0033	303	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.008	125	Yes	0
Mixed Fire	Late1:CLS	Late1:OPN	0.013	77	No	0
Surface Fire	Late1:CLS	Late1:OPN	0.091	11	No	0
Surface Fire	Late1:CLS	Late1:CLS	0.091	11	No	0

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