13530

Southern Appalachian Low-Elevation Pine Forest

BpS Model/Description Version: Aug. 2020

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| **Modelers** |  | **Reviewers** |  |
| Malcolm Hodges | mhodges@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 | *Pinus virginiana* | Virginia pine |
| PIEC2 | *Pinus echinata* | Shortleaf pine |
| QUFA | *Quercus falcata* | Southern red oak |
| QUPR2 | *Quercus prinus* | Chestnut oak |
| QUCO2 | *Quercus coccinea* | Scarlet oak |
| CAGL8 | *Carya glabra* | Pignut hickory |
| VAPA4 | *Vaccinium pallidum* | Blue ridge blueberry |
| GABA | *Gaylussacia baccata* | 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.

**Description**

Class A 10 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIVI2 | Pinus virginiana | Virginia pine | Upper |
| PIEC2 | Pinus echinata | Shortleaf pine | Upper |
| VACCI | Vaccinium | Blueberry | Upper |

Description

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.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5"DBH

Class B 13 Mid Development 1 - Closed

Indicator Species

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

Description

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.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class C 28 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIEC2 | Pinus echinata | Shortleaf pine | Upper |
| PIVI2 | Pinus virginiana | Virginia pine | Upper |
| QUERC | Quercus | Oak | Low-Mid |
| CARYA | Carya | 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

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

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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