

13520

Southern Appalachian Montane Pine Forest and Woodland

BpS Model/Description

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Vegetation Type

Forest and Woodland

Map Zones

53, 54, 57, 59, 60, 61

Geographic Range

Blue Ridge Mountains of Tennessee, North Carolina, and Virginia (including extreme northeast Georgia and northwest South Carolina). Mountains of the Ridge and Valley in Virginia, West Virginia, and into southern Pennsylvania. Western extent is along the Kentucky-Virginia border on Pine Mountain.

There may also be isolated examples occurring on ridges or monadnocks like Pine Mountain (map zone [MZ] 54, Georgia), Kings Mountain (MZ59, North Carolina), and Pilot Mountain and Hanging Rock in North Carolina.

Biophysical Site Description

Occurs on xeric to dry sites at moderate to upper elevations between 1,000ft and 4,000ft. Typically described as “ridgetop communities” in the ecological system description (see next paragraph), this community occupies the driest and most fire-prone of sites. Sites are typically located on convex, south to west facets of steep spur ridges, narrow rocky crests, and cliff tops. They occur at elevations from <300m (1,000ft) to >1,200m (4,000ft) on various substrates, but most commonly on acidic, sedimentary, and metasedimentary substrates (e.g., sandstone, quartzite, and shale). A few stands occur on piedmont monadnocks and foothills. Soils are very infertile, shallow, and drought prone. Thick, poorly decomposed duff layers, along with dead wood and inflammable shrubs, contribute to a strongly fire-prone habitat.

During the Biophysical Setting (BpS) review, Lafon et al. (2017) indicated the community should not be restricted to “ridgetops” as the concept is typically described. According to them, many people believe these stands only occupy narrow ridgetops, when in fact they are primarily on the sides of slopes that face west or south. See, for example, our comments about this topic on pages 56-57 of Lafon et al., *Fire History of the Appalachian Region: A Review and Synthesis* (GTR SRS-219).

Vegetation Description

Overstory pine species dominate, with up to 70% species specific (e.g., *Pinus pungens* or *Pinus rigida*, sometimes with *Pinus virginiana* or rarely *Pinus echinata* co-dominant [NatureServe 2007]). Chestnut oak (*Q. prinus*), scarlet oak (*Quercus coccinea*), and other pines may also be in overstories. Mid-stories, when present, may include mountain laurel (*Kalmia latifolia*), blackgum (*Nyssa sylvatica*), red maple (*Acer rubrum*), sourwood (*Oxydendrum arboretum*), black locust (*Robinia pseudoacacia*), and sprouts of American chestnut (*Castanea dentata*). Understories can include hobblebush (*Viburnum lantanoides*), blueberries (*Vaccinium* spp.), huckleberries (*Gaylussacia* spp.), *Galax urceolata*, sedges, and other herbaceous species.

Short-stature Table Mountain pine (*Pinus pungens*) and pitch pine (*Pinus rigida*) are usually the dominants forming an open overstory, often with co-dominant chestnut oak (*Quercus prinus*). Less important tree associates include scarlet oak (*Quercus coccinea*), Virginia pine (*Pinus virginiana*), and sassafras (*Sassafras albidum*). Except in the piedmont stands, bear oak (*Quercus ilicifolia*) is characteristically abundant in the shrub layer, along with various ericaceous species. Colonial shrubs usually pre-empt available microhabitats for most herbaceous species, but bracken fern (*Pteridium aquilinum* var. *latiusculum*) and turkeybeard (*Xerophyllum asphodeloides*) are often competitive enough to achieve significant cover.

The globally rare variable sedge (*Carex polymorpha*), the state-rare northern pine snake (*Pituophis melanoleucus melanoleucus*), several rare moths, and all bear oak feeders are locally associated with these woodlands. More common and conspicuous animals often found in these dry, rocky, semi-open habitats include the northern fence lizard (*Sceloporus undulatus hyacinthinus*) and the five-lined skink (*Eumeces fasciatus*).

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
PIPU5	<i>Pinus pungens</i>	Table Mountain pine
PIRI	<i>Pinus rigida</i>	Pitch pine
QUPR2	<i>Quercus prinus</i>	Chestnut oak
QUCO2	<i>Quercus coccinea</i>	Scarlet oak
GAYLU	<i>Gaylussacia</i>	Huckleberry
VACCI	<i>Vaccinium</i>	Blueberry
QUIL	<i>Quercus ilicifolia</i>	Bear oak

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

Disturbance Description

LANDFIRE adopted the Great Smoky Mountains National Park LCF state-and-transition model for this BpS. This is their description quoted from the final report of the project:

Montane Pine-Oak-Heath has a mixed-severity fire regime. The system generally occurs on the most exposed, rugged, and isolated landscapes, which have had a greater average distance from prehistoric and historic human use (thus less prone to be impacted by anthropogenic fire regimes) and smaller fire compartments. The effect of the greater isolation is less frequent fire and corresponding fuel buildup that tends to increase fire severity when fires do occur. Surface fires occurred on average every 20-25 years, and mixed severity fires occur every 60 years on average. Due to fuel buildup processes, mixed severity fires are more likely to occur in closed s-classes that have missed one or more fire rotations. The relatively high frequency of

these mixed severity fires best places this system into the Landfire Fire Regime Group III, though some stands in the system operate more as Fire Regime Group I, with much more frequent surface fires. Fires can occur virtually any time of year, but most commonly occur during the dormant season, between November and May. Fires in the winter months of December and January are rare. Replacement fires (>75% top-kill) are more uncommon, but still occur on an average of every 97 years, making this system the most likely in the Park to experience high-intensity stand replacement fires. Replacement fires are typically associated with several missed fire rotations and extreme droughts. High severity fires may also be associated with extreme wind events during any time of year.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	86	6		
Moderate (Mixed)	99	5		
Low (Surface)	5	89		
All Fires	5	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.

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

These pine-dominated forests and woodlands occurred as large patches within a matrix of oak-dominated forests and woodlands.

NatureServe (2007) notes that contiguous bodies of this system probably once covered dozens to >100ac. Patches often occur in complexes with other systems.

Adjacency or Identification Concerns

This system is similar to and should be compared with BpS 1377 -- Central Appalachian Pine-Oak Rocky Woodland (CES202.600). Distinctions between these systems and BpS 1353 -- Southern Appalachian Low-Elevation Pine Forest (CES202.332) and 1354 -- North-Central Appalachian Pine Barrens (CES202.590) should also be reviewed.

A subset of northern and central Appalachian Pine-Oak/Heath communities that occurs on exposed, high-elevation summits of sedimentary ridges are sometimes referred to as montane or Appalachian “pine barrens.” Although these communities are fire influenced, the vegetation retains a dwarfed, shrubland (<6m [20ft] tall) physiognomy, even during long absences of fire due to extremely shallow, xeric soils and constant exposure to severe winds and ice. Only one occurrence of such a “pine barren” is documented in Virginia, covering about 60ha (150ac) on Warm Springs Mountain (Bath County), at elevations between 1,100m and 1,200m (3,600ft and 4,000ft). Larger examples occur in nearby West Virginia at elevations of 1,200-1,375m (4,000-4,500ft) on the summit of North Fork Mountain (Pendleton County). The singular Virginia occurrence is characterized by dense, nearly impenetrable thickets of Catawba rhododendron (*Rhododendron catawbiense*), bear oak (*Quercus ilicifolia*), mountain laurel (*Kalmia latifolia*), black huckleberry (*Gaylussacia baccata*), and late lowbush blueberry (*Vaccinium angustifolium*), with scattered emergent (but still shrub-size) pitch pine (*Pinus rigida*). The

average height of the barrens vegetation varies from knee high in years following intense burns to about 5m (16ft). Compositionally and environmentally, the Central Appalachian “pine barrens” can be considered part of the Pine-Oak/Heath Woodlands ecological group, but more study is needed to determine whether the Virginia stand represents a distinct community type.

NatureServe (2007) makes the following comments regarding adjacent ecological systems: “This system is almost always bordered and intermixed with Southern Appalachian Oak Forest (CES202.886 -- BpS 1315) or (in the northern half of its range) by Central Appalachian Pine-Oak Rocky Woodland (CES202.600 -- BpS 1377).”

The distinctions are made more difficult by the suppression of fire and subsequent invasion of less fire-tolerant species such as *Acer rubrum* and *Nyssa sylvatica*. Generally speaking, communities with a heavy component of pine (at least 25% or 50% of canopy) are categorized as Southern Appalachian Montane Pine Forest and Woodland (CES202.331-- BpS 1352), whereas communities with a much smaller component of pines are considered Southern Appalachian Oak Forest (CES202.886 -- BpS 1315) or Central Appalachian Pine-Oak Rocky Woodland (CES202.600 -- BpS 1377). Central Appalachian Pine-Oak Rocky Woodland (CES202.600) is distinguished by a mixed or deciduous canopy and an absence of *Pinus pungens*. At the highest elevations that this system is seen, it may intergrade with Southern Appalachian Grass and Shrub Bald (CES202.294 -- BpS 1414).

Stands with *Pinus echinata* present are generally accommodated by Southern Appalachian Low-Elevation Pine Forest (CES202.332 -- BpS 1353). The relationship between these two systems may need further clarification. Southern Appalachian Low-Elevation Pine Forest (CES202.332) is distinguished by occurrence as small patches on the most extreme topography, as well as by the species of pines dominating. However, *Pinus echinata* may co-dominate in Southern Appalachian Low-Elevation Pine Forest (CES202.332) at times.

Sites that would support Southern Appalachian Montane Pine Forest and Woodland (CES202.331-- BpS 1352) under a natural fire regime, but which have lost the pines by logging, southern pine beetle infestation, or senescence in the absence of fire, should probably be regarded as degraded examples of this system.

Issues or Problems

Native Uncharacteristic Conditions

Now-present and increasingly abundant red maple (*Acer rubrum*), white pine (*Pinus strobes*), blackgum (*Nyssa sylvatica*), oak (*Quercus* spp), and mountain laurel (*Kalmia latifolia*) have been typified as the “native invasive” in pine forests and woodlands. Their abundance in these systems measured in both stem density and basal area has grown considerably due to fire suppression and the marked increase in fire return interval (FRI). The increasing abundance of oak, white pine, red maple, and blackgum in this type can be attributed to fire suppression. In the absence of frequent fire, encroachment by oak (and other tree/shrub species) occurs, leading to dense and overcrowded stands with little, if any, pine regeneration. In these encroached stands, the older, remaining stressed pines are more likely predisposed to insect infestation.

In many stands, mountain laurel seems to be a greater problem than any of the tree species (Lafon, pers. comm.).

Sites that would support Southern Appalachian Montane Pine Forest and Woodland (CES202.331-- BpS 1352) under a natural fire regime, but which have lost the pines by logging, southern pine beetle infestation, or senescence in the absence of fire, should probably be regarded as degraded examples of this system (NatureServe 2007).

Comments

Charles Lafon felt the following points made in the report are particularly important, because sometimes they are overlooked:

- It is noted that although the stands often are referred to as “ridgetop communities,” they actually cover larger areas (i.e., the south- and west-facing facets of spurs).
- The importance of patchiness in burning. Patchiness (along with temporal variability in FRI) likely was important for the survival of pine seedlings.
- The role of canopy-thinning disturbances other than fire (e.g., southern pine beetle, ice storms).

In addition, Lafon adds the following comment:

Concerning 2-9yr FRI, I think this interval is largely based on our fire history studies. I would clarify that this is the typical interval at which fires were recorded anywhere in our study sites (i.e., scarring at least one tree). Some of the fires may have burned only a portion of the study areas. Filtering out the potentially small-extent fires reveals slightly longer return intervals -- on the order of 5-15yrs for the more widespread fires. This is still an important point to keep in mind. However, observations of the ability of fire to spread easily through the stands suggests that the standard mean fire interval, or MFI (not the more conservative filtered MFI), may in fact provide the best estimate of fire frequency. In discussing this issue with Cecil Frost with regard to fire behavior within natural fire compartments, he also suggested that the fire compartments would have encompassed large areas of a mountainside, which means the standard MFI (not filtered MFI) would be appropriate. We discuss this issue on pages 54-56 of our General Technical Report.

The model from the Great Smoky Mountains LCF project was adopted for all map zones because 95% of the area mapped to this BpS is in map zone 57, and the Southern Appalachians are considered to be the core area for this BpS.

Succession Classes

Mapping Rules

[illegible]

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 13 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIRI	<i>Pinus rigida</i>	Pitch pine	Mid-Upper
PIPU5	<i>Pinus pungens</i>	Table Mountain pine	Mid-Upper
QUCO2	<i>Quercus coccinea</i>	Scarlet oak	Mid-Upper
QUPR2	<i>Quercus prinus</i>	Chestnut oak	Mid-Upper

Description

In this class, very dense regeneration of seedlings/saplings and coppice (scattered oak grubs, pine regeneration, and low shrubs) 5-15ft in height. No understory in the truest sense of the word. Scattered among the seedlings/saplings and coppice are developing clumps of warm-season grasses such as little bluestem, big bluestem, and Indian grass, along with ericaceous shrubs including *Vaccinium*, *Gaylussacia*, *Kalmia*, and *Pieris*. Other commonly encountered plants are dry-site sedges, bear oak, sweet fern, and composites. Fire is likely the dominant disturbance event, with surface fires occurring more frequently than stand-replacing fires.

Maximum Tree Size Class

Sapling >4.5ft; <5" DBH

Class B 3 Mid Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIRI	<i>Pinus rigida</i>	Pitch pine	Mid-Upper
PIPU5	<i>Pinus pungens</i>	Table Mountain pine	Mid-Upper
QUCO2	<i>Quercus coccinea</i>	Scarlet oak	Mid-Upper
QUPR2	<i>Quercus prinus</i>	Chestnut oak	Mid-Upper

Description

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Medium 9-21" DBH

Class C	24	Mid Development 1 - Open
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Symbol	Scie
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Symbol	Scientific Name	Common Name	Canopy Position
PIRI	<i>Pinus rigida</i>	Pitch pine	Mid-Upper
PIPU5	<i>Pinus pungens</i>	Table Mountain pine	Mid-Upper
QUCO2	<i>Quercus coccinea</i>	Scarlet oak	Mid-Upper
QUPR2	<i>Quercus prinus</i>	Chestnut oak	Mid-Upper

Mid-seral op

herbaceous/grass and mixed low-shrub understory. In the absence of frequent fire, woody understory increases in height and cover, including mountain laurel and other ericaceous species. Oak species found interspersed among the pine are multi-stemmed -- a result of coppice from fire events.

Medium 9-21" DBH

Class D	54	Late Development 1 - Open
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Symbol	Science
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Symbol	Scientific Name	Common Name	Canopy Position
PIRI	<i>Pinus rigida</i>	Pitch pine	Upper
PIPU5	<i>Pinus pungens</i>	Table Mountain pine	Upper
QUCO2	<i>Quercus coccinea</i>	Scarlet oak	Mid-Upper
QUPR2	<i>Quercus prinus</i>	Chestnut oak	Mid-Upper

Late-Develo

woodland, with scattered, low fire-suppressed shrubs and interspersed grasses and herbs. Greater than 40% cover of herbaceous and graminoid species present in the groundcover

The vegetation of this class is similar to Class C, except this class has more mature trees.

Large 21-33" DBH

Large 21-33" DBH

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIRI	<i>Pinus rigida</i>	Pitch pine	Upper
PIPU5	<i>Pinus pungens</i>	Table Mountain pine	Upper
QUCO2	<i>Quercus coccinea</i>	Scarlet oak	Mid-Upper
QUPR2	<i>Quercus prinus</i>	Chestnut oak	Mid-Upper

Description

Late-seral, closed canopy, pine-oak-dominated overstory. Little herbaceous cover and dense shrub layer.

This class is a closed-canopy pine-oak forest that results after prolonged periods of fire suppression or microtopography that protects the forest from fire. A shift in dominance from pine to oak would be expected in the absence of fire for long durations and would be hastened by ice storms and pine beetle infestation.

During the BpS review, Lafon noted that this vegetation would not remain indefinitely as a “climax” or “old-growth” stand. Without fire, it would eventually shift toward oak, red maple, and perhaps other species such as hemlock (ignoring adelgid) and chestnut (disregarding blight, given that these models pertain to pre-European conditions). It might be more accurate to class the TMP-PP-chestnut oak as mid-successional, to be followed by a hardwood-dominated community after ~100-150yrs. The model was not changed due to LANDFIRE’s five-state constraint, but local modelers should consider this comment when they revise the model for local use.

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:OPN	15
Mid1:OPN	16	Late1:OPN	70
Mid1:CLS	16	Late1:CLS	70
Late1:OPN	71	Late1:OPN	999
Late1:CLS	71	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
Alternative Succession	Early1:ALL	Mid1:CLS	1	1	Yes	14

Replacement Fire	Early1:ALL	Early1:ALL	0.05	20	Yes	0
Surface Fire	Early1:ALL	Early1:ALL	0.15	7	No	0
Alternative Succession	Mid1:OPN	Mid1:CLS	1	1	Yes	20
Wind or Weather or Stress	Mid1:OPN	Early1:ALL	0.001	1000	Yes	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.007	143	Yes	0
Insects or Disease	Mid1:OPN	Mid1:OPN	0.01	100	No	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.013	77	No	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.2	5	No	0
Wind or Weather or Stress	Mid1:CLS	Early1:ALL	0.002	500	Yes	0
Optional 1	Mid1:CLS	Mid1:OPN	0.004	250	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.013	77	Yes	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.02	50	Yes	0
Insects or Disease	Mid1:CLS	Mid1:CLS	0.02	50	No	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.2	5	No	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	20
Wind or Weather or Stress	Late1:OPN	Early1:ALL	0.001	1000	Yes	0
Replacement Fire	Late1:OPN	Early1:ALL	0.005	200	Yes	0
Mixed Fire	Late1:OPN	Late1:OPN	0.01	100	No	0
Insects or Disease	Late1:OPN	Late1:OPN	0.013	77	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.2	5	No	0
Wind or Weather or Stress	Late1:CLS	Early1:ALL	0.001	1000	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.002	500	Yes	0
Optional 1	Late1:CLS	Late1:OPN	0.004	250	Yes	0
Mixed Fire	Late1:CLS	Late1:OPN	0.013	77	Yes	0
Insects or Disease	Late1:CLS	Late1:OPN	0.013	77	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.04	25	No	0

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