14520

Atlantic Coastal Plain Peatland Pocosin and Canebrake

BpS Model/Description Version: Aug. 2020

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| Margit Bucher | mbucher@tnc.org | Chris Szell | cszell@tnc.org |
|  |  | Milo Pyne | milo\_pyne@natureserve.org |
|  |  | Mike Schafale | michael.schafale@ncmail.net |

Vegetation Type

Woody Wetland

Map Zones

58, 60

Geographic Range

Pocosins exist along the coastal plain from southeastern VA, south through NC and into SC, with NC encompassing the majority of this ecological land type. The most extensive examples are on large domed peatlands in the outer coastal plain, but medium to small patches occur in peat-filled Carolina bays and other depressions.

Biophysical Site Description

This system occurs on broad interfluvial flats and in small to large, very gentle basins and swales, largely on the outermost terraces of the Outer Coastal Plain. Some occurrences are in large to small peat-filled Carolina bays. Smaller patches occur in shallow swales associated with relict coastal dune system or other irregular sandy surfaces. Most of the largest occurrences are domed peatlands with the deepest peat associated with topographic highs in the center, but deep peats are also associated with buried drainage channels. Soils range from wet mineral soils with mucky surface layers to peats several meters deep (NatureServe 2006).

Hydrology is driven by rainfall and sheet flow. The low hydraulic conductivity of the organic material limits interaction with the groundwater. The raised center of domed peatlands is fed only by rainwater and is therefore a true ombrotrophic bog. More peripheral portions are fed by sheet flow from the center, and so receive only acidic water low in nutrients. Occurrences in Carolina bays and other basins appear to be similarly isolated from surface or groundwater inflow from adjacent areas. Soils are normally saturated throughout the winter and well into the growing season, though the organic material may dry enough to burn during droughts. Standing water is limited to local depressions and disturbed areas. Soil saturation and peat depth, with its corresponding nutrient limitation, are the primary drivers of vegetational zonation as well as the distinction between this system and adjacent ones, but their effect may be modified by drainage patterns (NatureServe 2006).

Pocosins occur as evergreen shrub thickets or woodlands on peat soils generally 0.5-3m deep. Soil saturation, sheet flow, and peat depth create a distinct zonation, with average vegetation heights of 20-30m characteristic of pond pine woodland on shallow peat.

Stature of vegetation increases with decreasing peat depth. An open pond pine canopy with 1.5-3m tall shrubs exemplifies shallower peats or what often is referred to as “High Pocosin,” while deeper peat examples have shrubs rarely over 1.5m tall and are called “Low Pocosin.”

Low Pocosin: Central, deepest parts of domed peatlands on poorly drained interstream flats, and peat-filled Carolina bays and swales. Peat deposits, greater than one meter deep, or shallower and over very oligotrophic wet sands (Schafale and Weakley 1990).

High Pocosin: Central to intermediate parts of domed peatlands on poorly drained interstream flats, and peat-filled Carolina bays and swales. Peat deposits, 1.5m deep or shallower, and over very oligotrophic wet sands (Schafale and Weakley 1990).

Vegetation Description

A characteristic suite of primarily evergreen shrubs, greenbriars (*Smilax laurifolia*) and pond pine (*Pinus serotina*) dominate. Pond pine is present as a canopy tree with *Persea palustris*, *Gordonia lasianthus*, and *Magnolia virginiana* as midstory. Historic canebreaks (*Arundinaria gigantea* ssp. *tecta*) are thought to be part of this pond pine woodland ecosystem under frequent fire regimes which are no longer common in pocosin. In low and high pocosin, pond pine is present as sparse, stunted trees, forming an important structural component but not a true canopy. The shrub layer is often very dense. Vegetation height and density vary with peat depth as well as fire history. The deepest peats are incapable of supporting shrubs over 1.5m tall (Low Pocosin), while shallower peats may have shrubs 1.5-3m tall (High Pocosin). Small (usually 2-5m) openings dominated by mosses, ferns, sedges, or forbs may be present, as may small clumps of taller shrubs. In most pocosins today, herbs are scarce and limited to small openings, thought to be created by fires burning down through layers of the organic peat. Historically, these openings are thought to have been much more extensive. The dense shrub layer common to high and low pocosin sites is dominated by fetterbush (*Lyonia lucida*), titi (*Cyrilla racemiflora*), gallberry (*Ilex glabra*) and zenobia (*Zenobia pulverulenta*), with less dense populations of large gallberry (*Ilex coriacea*) and greenbrier (*Smilax laurifolia*). Pools or openings, usually small and found in the sites with deeper peats, may be dominated by herbaceous species such as leather-leaf (*Chamaedaphne* [*Cassandra*] *calyculata*), sedge (*Carex striata* [*walteriana*]), Virginia chain fern (*Woodwardia virginica*), trumpets (*Sarracenia flava*), broomsedge (*Andropogon glomeratus*), *Sphagnum* spp., and rarely, cranberry (*Vaccinium macrocarpon*).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PISE | *Pinus serotina* | Pond pine |
| CYRA | *Cyrilla racemiflora* | Swamp titi |
| ILGL | *Ilex glabra* | Inkberry |
| ARGIT8 | *Arundinaria gigantea ssp. tecta* | Switchcane |
| ZEPU3 | *Zenobia pulverulenta* | Honeycup |
| PISE | *Pinus serotina* | Pond pine |
| MAVI2 | *Magnolia virginiana* | Sweetbay |
| PEPA37 | *Persea palustris* | Swamp bay |

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

Disturbance Description

Fire is an important factor in pocosin systems. Natural fire-return intervals are not well known with frequency dependent upon where the pocosin occurs in the landscape (e.g. more fire sheltered topography or whether there is a natural ignition source nearby), but are probably on the order of a few years or several decades (2-30yrs) in the wettest areas over deep peat with severe nutrient limitations. Christensen (1981) suggests longer intervals of upward of 60yrs.

Peripheral areas may be subject to fire as often as the surrounding vegetation burns. Fires are typically intense due to the density and flammability of the vegetation, killing all above-ground vegetation. They are followed by vigorous root sprouting by shrubs and hardwoods, leading to recovery of standing biomass within a few years. Pond pine (*Pinus serotina*) recovers by epicormic sprouting or by regeneration from seeds released from serotinous cones. Recovery may be somewhat slower in high pocosin because of the higher normal biomass, but productivity is also higher. Some species, such as *Zenobia pulverulenta* and various herbs, recover particularly quickly and dominate several years after a fire, until they are out-competed by *Cyrilla* and *Lyonia*. Species diversity is generally highest right after a fire and declines gradually. Fires during droughts may ignite peat, forming holes that take longer to recover. Herb-dominated openings in pocosins may depend on peat fires, though this is not well documented. Natural fires occur in large patches, creating a shifting patch structure in the system that interacts with the vegetational zonation created by peat depth. Fires burn most intensely in spring with low humidity (less than 35% RH), winds over 15 miles per hour, and low live fuel moisture.

Peat buildup raises the water table in the center, creating the domed structure of the largest peatlands and allowing the wetland to spread out as wetness is increased at the edges (NatureServe 2006).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 14 | 53 |  |  |
| Moderate (Mixed) | 15 | 47 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 7 | 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

This system has three recognizable landscape patterns within it: domed peatlands, peat-filled Carolina Bays, and small swales (NatureServe 2006). Some occurrences are in large to small peat-filled Carolina bays. Smaller patches occur in shallow swales associated with relict coastal dune systems or other irregular sandy surfaces. The deep peatlands can cover vast areas of unfragmented land. The Croatan National Forest in eastern NC has three nearly intact tracts of pocosin, each close to 10,000ac in size. Dare County Bombing Range, Alligator River Wildlife Refuge, Holly Shelter and Angola Bay Gamelands and the Green Swamp also contain 5-10,000ac pocosins.

Adjacency or Identification Concerns

Pine plantations in drained pocosins may be difficult to distinguish from class E. Riverine and non-riverine swamp forest have a stronger deciduous hardwood component than pocosin. Since class A is no longer present in more extensive areas in the current landscape, it should not be difficult to distinguish pocosin from marshes based on signature. In most pocosins today, the original canebreak component is no longer found.

Fire suppressed, isolated longleaf pine savannas are invaded by pond pine and pocosin shrubs and can be difficult to distinguish from pocosin on satellite imagery without using soil information.

Schafale and Weakley (1990) note that Low Pocosin communities are at the end of a gradient of wetness, nutrient availability, and usually, peat depth, grading to High Pocosin in slightly drier areas with shallower peat. Low Pocosins are the least productive and most stunted communities of this series. However, the relationships of this series of pocosin communities are somewhat complicated by fire. Representing the extreme of peatland development, true Low Pocosins are much rarer than High Pocosins or Pond Pine Woodlands. Alternatively, High Pocosins are distinguished from other peatland community types by the persistent stature of the shrubby vegetation, intermediate between Low Pocosin and Pond Pine Woodland (1.5-3m tall) and the sparse distribution and relatively low stature of the few trees. Pond Pine Woodlands may resemble High Pocosins immediately after a severe fire, but regrowth over a period of years reestablishes the visible distinctiveness. Prior to this, "false high pocosins" can often be distinguished from true High Pocosins by the presence of incompletely burned woody material such as large pond pines, although the distinction is more difficult for High Pocosins than Low Pocosins. Recently burned High Pocosins may resemble Low Pocosin (Schafale and Weakley 1990).

Issues or Problems

Model assumptions: This model combines a range of peat depth and fertility, hence vegetation regrowth (and reburn potential) vary widely among sites and classes described here. MFRI are crude estimates over a broad range of pocosins and pond pine woodland. Classes B and E are unlikely to be represented on deep peat. The historically extensive canebreaks no longer exist. Although the previous extent and location of canebrake has not been comprehensively mapped 37% percentage of Dare Co. has been identified by Frost (pers. comm.) as canebrake with local mapping efforts. Canebrake can be mapped with historic aerials at a local scale, but cannot be mapped appropriately from satellite aerials. Not many surveys have been conducted in the shrubby 'wastelands'.

Native Uncharacteristic Conditions

Extreme site conditions make pocosin vegetation relatively resilient to conversion to atypical states. Logging of trees, in rare cases where it is economically viable, creates a state resembling class D. Intensive artificial drainage, bedding and pine plantation establishment, if successful, create conditions that differ somewhat from any of the reference condition states. Pine plantations without intensive site alteration are generally unsuccessful. Successful fire exclusion for long periods leads to stagnation in a state resembling class E (dense pond pine) but not in the outer parts, with lost productivity and increased dead fuels but little superficial change in structure.

Comments

Both the VDDT model and description information from the Rapid Assessment model (R9PCSN) by B. Kicklighter and the FRCC file from M. Schafale were modified to create this BpS.

The model description and VDDT model were reviewed and modified by a group of ecologists in Durham, NC on Jan. 23, 2007 and included Mike Schafale, Cecil Frost, Margit Bucher, Rob Evans, Milo Pyne and Chris Szell.

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 | 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 | C | C | B | B | B | B | B | B | B | B |
| Tree | 5-10 | UN | UN | D | D | D | E | E | E | E | E |
| Tree | 10-25 | UN | UN | D | D | D | E | E | E | E | E |
| Tree | 25-50 | UN | UN | D | D | D | E | E | E | E | E |
| Tree | >50 | UN | UN | D | D | D | E | 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 17 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CAST41 | Carex striata | Walter's sedge | Upper |
| CHAMA5 | Chamaedaphne | Leatherleaf | Upper |
| WOVI | Woodwardia virginica | Virginia chainfern | Upper |
| ARGIT8 | Arundinaria gigantea ssp. tecta | Switchcane | Upper |

Description

Class describes a grass/sedge/herb dominated pocosin that is presently found only in small patches. Historically these patches would have been extensive and dominated by cane (*Arundinaria gigantea* ssp. *tecta*) on shallower and more fertile soils (i.e. canebreaks) or sedge (*Carex striata* (*walteriana*) and *Andropogon glomeratus*) on ombotrophic deep peat (over 1.5m peat depth, low pocosin). Chain fern (*Woodwardia viginiana*) would have dominated with a few early successional evergreen pocosin shrubs (*Chamaedaphne* [*Cassandra*] *calyculata*) and *Zenobia pulverulenta* appearing. *Sarracenia flava*, *Andropogon glomeratus*, *Sphagnum* spp., and *Vaccinium macrocarpon*. Grasses, sedges, ferns and forbs dominate over shrubs (*Chameadaphne* and *Zenobia*).

Fires would have maintained the herbaceous stage and prevent the establishment of a pine canopy. Less frequent fires allow pines to establish a canopy. Fire topkills vegetation, which quickly resprouts even if several inches of peat burn during drought conditions. Deeper peat burns create open patches of ground or open water. Very frequent prescribed burns in the low pocosins of the Croatan NF are beginning to restore this class on a small scale.

*Maximum Tree Size Class*  
None

Class B 15 Mid Development 1 - Closed

DBH

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ILGL | Ilex glabra | Inkberry | Low-Mid |
| GOLA | Gordonia lasianthus | Loblolly bay | Middle |
| MAVI2 | Magnolia virginiana | Sweetbay | Middle |
| PISE | Pinus serotina | Pond pine | Upper |

Description

Class is characterized by an increasingly dense shrub layer with herbaceous openings and scattered emergent pond pine saplings. However, shrubs are the dominant lifeform over the herbs.

Fires in these shrublands have not burned frequently or a fire did not burn with sufficient intensity to prevent pond pine from beginning to establish a canopy. Bays (Magnolia, Persea and Gordonia) are beginning to emerge towards a mid-story in the later stages of this class on shallower peat. This class establishes with higher probability and in less abundance than on shallower organic soils (Pond pine woodlands are tall pocosin types -- see Schafale and Weakley 1990). Fire return intervals are longer to allow shrubby fuel loads to recover to carry fire.

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

Class C 31 Mid Development 1 - Open

DBH

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ZEPU3 | Zenobia pulverulenta | Honeycup | Upper |
| ARGIT8 | Arundinaria gigantea ssp. tecta | Switchcane | Upper |
| CAST41 | Carex striata | Walter's sedge | Lower |
| PISE | Pinus serotina | Pond pine | Upper |

Description

Class is an open evergreen shrubland with an open canopy of pond pine saplings and scattered herb openings. Early succession shrubs (*Zenobia pulverulenta*, *Chaedaphne calyculata*) are mixed in with herbs. Fire top-kills the shrub and herb layer, but the sparsely scattered pond pines survive. The Upper Layer lifeform is the scattered pond pines and few hardwoods beginning to emerge as the true upper canopy. The dominant lifeform is the woody shrub. Very scattered Pond pines and a few hardwoods are beginning to emerge as the true upper layer.

Fires every would maintain the vegetation in this class until the pines mature. Less frequent fire or more fertile conditions would allow more pines and bay to survive and establish a denser canopy and mid-story.

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

Class D 23 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PISE | Pinus serotina | Pond pine | Upper |
| CYRA | Cyrilla racemiflora | Swamp titi | Middle |
| ZENOB | Zenobia | Honeycup | Middle |
| ARGI | Arundinaria gigantea | Giant cane | Middle |

Description

Class describes an open canopy of pond pine over shrubs or cane (on shallower peat). The pines over shrub or deeper peat variant is frequently observed on aerials from the late 1930s (prior to effective fire suppression). This class is characterized as a two tiered shrub and canopy structure allowing individual pines emerging over the shrub layer to appear as distinct crowns. The shrub layer is out-competing future tree regeneration until the next fire occurrence. Evergreen shrubs or cane dominate.

*Maximum Tree Size Class*  
Medium 9-21"DBH

Class E 14 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PISE | Pinus serotina | Pond pine | Upper |
| MAVI2 | Magnolia virginiana | Sweetbay | Mid-Upper |
| PEPA37 | Persea palustris | Swamp bay | Mid-Upper |
| GALA | Galeopsis ladanum | Red hempnettle | Mid-Upper |

Description

Class contains 'Bay Forest' and Pond pine Woodland as described by Schafale and Weakley (1990). This class would not be found on deep peat. In bay forests, pond pine forms an open to moderately dense canopy. As the forest matures, hardwoods (*Magnolia*, *Persea*, and *Gordonia*) and later red maple and gum will dominate over pond pine which cannot recruit under shade. Pond pine woodlands are found on a thinner organic layer and a denser canopy of pond pines intermixed with scattered Bays (*Gordonia lasianthus*, *Persea* spp., and *Magnolia* spp.), red maple (*Acer rubrum*), swamp black gum (*Nyssa sylvatica*), Atlantic white cedar (*Chamaecyparis thyoides*) and bald or pond cypress (*Taxodium distichum*, *T. ascendens*) forms.

The dominant lifeform can be a mid-story of bays. With increasing age, pond pines and a few hardwoods are in the true upper layer, but do not produce a canopy closure. The shrub layer minimum height is one meter and the maximum height can exceed three meters.

*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 | 4 |
| Mid1:OPN | 5 | Late1:OPN | 40 |
| Mid1:CLS | 5 | Late1:CLS | 40 |
| Late1:OPN | 41 | Late1:OPN | 300 |
| Late1:CLS | 41 | Late1:CLS | 500 |

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 | 0.35 | 3 | Yes | 0 |
| Alternative Succession | Mid1:OPN | Mid1:CLS | 1 | 1 | Yes | 20 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.013 | 77 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.08 | 13 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.017 | 59 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.05 | 20 | No | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.017 | 59 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.08 | 13 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Mid1:CLS | 0.005 | 200 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.017 | 59 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:CLS | 0.1 | 10 | No | 0 |

References

Brown, J.K. and J. Kapler-Smith, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42. vol 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.

Christensen, N.L. 1981. Fire regimes in Southeastern ecosystems. In Fire regimes and ecosystem properties, proceedings of the conference. U.S.D.A. Forest Service Gen. Tech. Rep. WO-26.

Frost, Cecil C. 1995. Presettlement fire regimes in southeastern marshes, peatlands and

swamps. Pages 39-60 in: Cerulean, Susan I. and Engstrom, R. Todd, eds. Fire in wetlands: a

management perspective. Proc. Tall Timbers Fire Ecol. Conf. No. 19.

Kologiski, R.L. 1977. The phytosociology of the Green Swamp, North Carolina. Tech. Bul. No 250. NC Agricultural Experiment Station. 89 pp.

NatureServe. 2006. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 18 July 2006.

Schafale, Michael P. and Weakley, Alan S. 1990. Classification of the Natural Communities of North Carolina, Third Approximation. North Carolina Heritage Program, Raleigh, NC: Department of Environment and Natural Resources. 321 pp.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/.

Wells, B.W. 1928. Plant communities of the Coastal Plain of North Carolina and their successional relations. Ecology 9: 230-242.