13550
Northern Atlantic Coastal Plain Pitch Pine Barrens

BpS Model/Description Version: Aug. 2020

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Vegetation Type
Forest and Woodland

Map Zones
60, 65

Model Splits or Lumps
This biophysical setting is lumped with 14560, map zone 60.

Geographic Range
Northeastern United States, specifically, southeastern New Jersey, Long Island, Cape Cod and scattered inland locations throughout New York and New England.

Biophysical Site Description
Pine Barrens (northeastern oak-pine forests, Kuchler PNV 110), in general occur on glacial sand plains with substrates that include outwash plains, stabilized sand dunes, and glacial till.

These barrens are found on coarse textured, well-drained, low nutrient soils of the coastal plain and scattered inland locations throughout central-southern New England and adjacent New York.

Vegetation Description
Entire Vegetation description was taken from Jordan et al. (2003):

Pitch pine (*Pinus rigida*) barrens in northeastern North America include woodlands and shrublands with an open tree canopy (10-60% cover) of pitch pine and a dense understory of scrub oak (*Quercus ilicifolia*), black huckleberry (*Gaylussacia baccata*), low blueberry (*Vaccinium pallidum*), and lowbush blueberry (*Vaccinium angustifolium*) (Table 1). Common groundcover plants include golden heather (*Hudsonia ericoides*), bearberry (*Arctostaphylos uva-ursi*) and wintergreen (*Gaultheria procumbens*). Herbaceous species include Pennsylvania sedge (*Carex pensylvanica*), bracken fern (*Pteridium aquilinum*), low-growing panic grasses (*Panicum* spp.), joint weed (*Polygonella articulata*), and cow-wheat (*Melampyrum lineare*). Although overall species richness is low in pine barrens, many rare and endemic species are found in these systems.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
PIRI	*Pinus rigida*	Pitch pine
QUIL	*Quercus ilicifolia*	Bear oak

QUVE	*Quercus velutina*	Black oak
QUAL	*Quercus alba*	White oak
QUCO2	*Quercus coccinea*	Scarlet oak
GABA	*Gaylussacia baccata*	Black huckleberry
VAPA4	*Vaccinium pallidum*	Blue ridge blueberry
QUST	*Quercus stellata*	Post oak

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

Disturbance Description

Pitch pine is a fire-adapted species. In frequently burned areas (such as the dwarf pine plains on Long Island and in New Jersey) some, but not all, pitch pines have serotinous cones, which only open and release seeds after fire. The incidence of serotiny declines as fire frequency decreases (Givnish 1981; Jordan unpublished).

Serotiny may not be present in Cape Cod pitch pine, and other areas with low fire frequencies. Pitch pine younger than 20-40yrs may produce stump sprouts after top-killing fire (Andresen 1959). If not top killed, pines may recover from fire by sprouting from branches and trunk. Pitch pine has thick, fire-resistant bark. Additionally, pitch pine is quick to mature and to produce seeds. Because of these characteristics, frequent fires of moderate-to-high intensity/severity eventually eliminate all other tree species except for pitch pine and scrub oak. Fire kills tree oak stems more readily than pines, but most tree oaks sprout. Prescribed burning favors pine over the more susceptible oak, as well as the herbaceous component over shrubs.

Different fire frequencies and intensities interrupt succession, accounting for variations in forest composition. Periodic severe wildfires with 40-100yr intervals have produced oak-pine mixtures over extensive areas of uplands while more frequent severe fires have created mixtures of pitch pine and shrub oaks. The most frequent and severe fires have created the pine plains.

Fires, especially large wildfires, have been a major factor in the development of the present differences among forest stands on similar sites in the Pine Barrens. Abandoned uplands sites generally progress from a grass or shrubland (fire return interval 2-3yrs), to pitch pine/scrub oak woodland (5-25yrs), to pure pitch pine forest with heath/oak scrublands (30-60yrs), to pitch pine/tree-sized oak forest (60-100yrs), to oak-hickory forest (100-200yrs).

The types of fire in the oak forests are very different from those in pitch pine woodlands. Oak forests can be shifted to pitch pine woodlands, but only with severe fires or high intensity fires that would kill canopy oaks.

Ice buildup and heavy snow may be a factor in some northeastern pine barrens. Ice storms can also be a factor in coastal barrens and oak forests. They would operate in all states, but have most impact as tree canopy increases. Return intervals would vary from 5-50yrs. The scale of disturbance processes differs with the extent of each barrens system.

Pine barrens are heavily influenced by fire, the composition and structure of the pine barrens components vary with fire frequency, intensity and severity. In general, tree oaks are more prevalent in those stands having a long fire return interval for high severity fires, while at the other extreme, return intervals of 8-10yrs for high severity, top-killing fires foster the growth of "pine plains," i.e., dwarf pine stands 1m in height.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	77	10		
Moderate (Mixed)	31	25		
Low (Surface)	12	65		
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

Pre-Columbian disturbance (replacement fire), wide scale in nature and ranged from several hundred acres to hundreds of thousands of acres.

Native Americans fired the landscape for reasons including, but not limited to, access, game drives, and food production. This information alludes to the frequency of fire on the landscape.

Adjacency or Identification Concerns

There are two associated pine barrens types within these systems: wetland pine barrens and frost pockets. Frost pockets occur from Pennsylvania through Long Island, Cape Cod, to Maine, with wetland pine barrens occurring mostly in New Jersey.

Wetland pine barrens are wet areas within the pine barrens forest areas that demonstrate wetland and upland pine barrens vegetation. Where fire frequency is high, these areas may be dominated by large, wet grasslands.

Frost pockets are characterized by localized topography providing for cold air intrusion, traditional cooling, and heating. Temperature extremes can be dramatic with below-freezing temperatures being recorded during all months of the year. Vegetation structure is zonal as temperature extremes moderate toward the upper edges of these sites. Within frost pockets, vegetation ranges from microbial crusts where temperature extremes are greatest to shrubs and finally tree components as temperature extremes moderate.

Additionally, Coastal Plain ponds and Atlantic White Cedar swamps may be embedded in these pine barrens (NatureServe 2007).

From Jordan et al (2003): In the absence of frequent fire, frost damage, insect herbivory, cutting, or other disturbance, trees invade and barrens convert to closed-canopy forest (Forman, 1979; Little, 1979; Schweitzer and Rawinski, 1988; Thompson, 1995; Kurczewski and Boyle, 2000; Motzkin et al., 2002).

Issues or Problems

Model assumptions

Class A represents many possibilities at this point, e.g., anything from pine plains, to shrublands, to mixtures of oak and pine, or just to mixed oak.

Class B represents mid-seral closed. Although there is an open canopy of pitch pine, there will be a closed understory of dominant scrub oak.

In the absence of a pitch pine seed source, class A will automatically progress to class E.

Class D represents the climatic climax community with fire. Should no fire occur in class D for 200yrs (three cumulative fire cycles at 65yrs each if adding all fire probabilities), it will climax at E, an oak-hickory forest.

Within the model class B, the canopy is considered closed based on scrub oak and not the overstory tree species, pitch pine.

Native Uncharacteristic Conditions

Comments

A concern of Marilyn Jordan is that no non-fire related disturbances have been captured. Hurricanes, insect disturbance and land clearing are all considered to be important.

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	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Herb	0.5-1.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Herb	>1.0	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
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	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	0-5	UN	UN	B	B	B	B	UN	UN	UN	UN
Tree	5-10	UN	UN	C	C	C	C	E	E	E	E
Tree	10-25	UN	UN	D	D	D	D	E	E	E	E
Tree	25-50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN

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

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUPR	Quercus prinoides	Quercus prinoides	Lower
QUIL	Quercus ilicifolia	Bear oak	Lower
CAPE6	Carex pensylvanica	Pennsylvania sedge	Upper
PTAQ	Pteridium aquilinum	Western brackenfern	Upper

Description
Grass and/or shrubs. This class can include *Carex* spp., *Panicum* spp., *Pteridium aquilinum*, *Vaccinium* spp., and *Gaylussacia baccata*.

Maximum Tree Size Class
None

Class B 24 Mid Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIRI	Pinus rigida	Pitch pine	Upper
QUIL	Quercus ilicifolia	Bear oak	Low-Mid
QUPR	Quercus prinoides	Quercus prinoides	Low-Mid

Description
Scrub oak (*Quercus ilicifolia*) is the dominant life form at this stage.

The canopy here is considered open, based on pitch pine and not the understory tree species, scrub oak. This is a woodland type seral stage with PIRI having 10-60% min and max canopy closure respectively. QUIL and QUPR have a 30-80% min and max canopy closure respectively.

Maximum Tree Size Class
Pole 5-9" DBH

Class C 39 Mid Development 2 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIRI	Pinus rigida	Pitch pine	Upper
QUIL	Quercus ilicifolia	Bear oak	Low-Mid
GABA	Gaylussacia baccata	Black huckleberry	Low-Mid
VAPA4	Vaccinium pallidum	Blue ridge blueberry	Low-Mid

Description
Pure pitch pine forest. Heaths may or may not be present, depending on fire history. PIRI has 60-100% min and max crown closure respectively

Maximum Tree Size Class
Pole 5-9" DBH

Class D 26 Late Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIRI	Pinus rigida	Pitch pine	Upper
QUIL	Quercus ilicifolia	Bear oak	Mid-Upper
GABA	Gaylussacia baccata	Black huckleberry	Low-Mid
VAPA4	Vaccinium pallidum	Blue ridge blueberry	Low-Mid

Description
Pitch pine-oak codominant. Canopy oak species include *Quercus velutina, Quercus coccinea, Quercus alba*, and *Quercus stellata.*

Maximum Tree Size Class
Medium 9-21"DBH

Class E 5 Late Development 2 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
VAPA4	Vaccinium pallidum	Blue ridge blueberry	Upper
QUIL	Quercus ilicifolia	Bear oak	Mid-Upper
GABA	Gaylussacia baccata	Black huckleberry	Low-Mid

Description
Oak heath or oak-hickory forest: *Carya* spp., *Quercus velutina, Quercus rubra,* and *Quercus alba. S*ome heath and scrub oak are present. Hickory can be a co-dominant, but oak-dominated forests are more common.

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	Mid2:CLS	19
Mid2:CLS	20	Late1:CLS	64
Late1:CLS	65	Late1:CLS	964
Late2:CLS	200	Late2: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
Replacement Fire	Early1:ALL	Early1:ALL	0.05	20	Yes	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.025	40	Yes	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.1	10	No	0
Wind or Weather or Stress	Mid2:CLS	Mid1:OPN	0.002	500	Yes	0
Replacement Fire	Mid2:CLS	Early1:ALL	0.0067	149	Yes	0
Mixed Fire	Mid2:CLS	Mid1:OPN	0.013	77	Yes	0
Surface Fire	Mid2:CLS	Mid2:CLS	0.2	5	No	0
Alternative Succession	Late1:CLS	Late2:CLS	1	1	Yes	200
Wind or Weather or Stress	Late1:CLS	Mid1:OPN	0.002	500	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.007	143	Yes	0
Mixed Fire	Late1:CLS	Mid1:OPN	0.01	100	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.025	40	No	0
Replacement Fire	Late2:CLS	Early1:ALL	0.002	500	Yes	0
Surface Fire	Late2:CLS	Late2:CLS	0.01	100	No	0

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