

13420

Piedmont Hardpan Woodland and Forest

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Forest and Woodland

Map Zones

59

Geographic Range

As is currently known, this system is found in the Piedmont of Maryland, Virginia, North Carolina, and Georgia. Its status in Alabama is not known. Its occurrence may be more frequent in the Triassic Basins, but is not restricted to them.

Biophysical Site Description

This system occurs in places in the Piedmont where a particularly dense clay hardpan, apparently generally of Montmorillonite, has developed. The substrate is typically mafic igneous or metamorphic rock (gabbro, basalt, diabase, or amphibolite) but occasionally is slate. The density of the clay, or its shrink-swell properties, limits penetration of water into the soil and limits penetration of roots, creating xeric conditions for plants despite the presence of deep soil. These areas generally occur on unusually flat uplands but may occur on tops of narrower ridges. Only a minority of these substrates form the distinctive soil conditions of this system. Local topography that promotes runoff is important to forming this system. Areas with these soil conditions but with concave topography perch water and support Piedmont depressional wetlands. Soils in most examples are basic or circumneutral, but those formed from slate are somewhat acidic. In Virginia and adjacent Maryland, this system occupies one of the largest Triassic basins in eastern North America. It includes a mix of sedimentary rocks, especially siltstone, mixed with igneous intrusions. The igneous rocks weather to form more mafic soils, while the sedimentary rocks are more acidic. The local landscape may best be thought of as a lowland, in comparison with the surrounding and prevailing topography

Vegetation Description

Vegetation consists of xerophytic species, most typically consisting of open forests or woodlands of *Quercus stellata*, with *Quercus marilandica* as a characteristic associate in North Carolina. In Virginia and adjacent Maryland, *Quercus alba*, *Fraxinus Americana*, and *Carya glabra* are common canopy components. The open canopy leads to a better developed herb layer than in most Piedmont forests, one that is usually grassy. Some of these sites may have once supported open prairies or prairie savannas when they burned more frequently. A significant flora of shade-intolerant herbs with prairie affinities is present in open areas on these soils to support this idea. In contrast to upland forests of adjacent portions of the Virginia Piedmont, there is a pronounced difference in the abundance of hickory present (Farrell and Ware 1991, Ware 1992).

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUST	<i>Quercus stellata</i>	Post oak
QUMA3	<i>Quercus marilandica</i>	Blackjack oak
QUAL	<i>Quercus alba</i>	White oak
CAAL27	<i>Carya alba</i>	Mockernut hickory
FRAM2	<i>Fraxinus americana</i>	White ash
SCSC	<i>Schizachyrium scoparium</i>	Little bluestem
PIEC2	<i>Pinus echinata</i>	Shortleaf pine
VACCI	<i>Vaccinium</i>	Blueberry

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

Disturbance Description

Fire was probably once the most important natural dynamic process, but the universal elimination of fire in the Piedmont makes this difficult to tell. The xeric nature of the sites may have allowed fire to create open vegetation on these sites at the same frequency at which it allowed forests to exist on more typical soils. Fire would have kept canopies open by limiting trees and would have promoted a more diverse, grass-dominated herb layer. Bison may have once been a significant influence on this system.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	307	2		
Moderate (Mixed)	331	1		
Low (Surface)	5	97		
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.

Scale Description

Described by Charlotte, North Carolina Rapid Assessment workshop participants as small and patchy. NatureServe indicates this type occurs in patches up to dozens of acres. Surface fires may range in size from 10-500ac. Within this vegetation type there was considerable patchiness in overstory composition, related to topography and disturbance. In openings created by windthrow or disease, regeneration occurred. Larger gaps were created by tropical storms, tornadoes, or bark beetle outbreaks. Also, large openings were created by replacement fires following extensive droughts coupled with disease outbreaks and associated mortality.

Adjacency or Identification Concerns

On the piedmont there were smaller and more dispersed prairies which included several distinct types depending upon soils and geological substrates such as diabase and serpentine. These areas may remain open longer under infrequent fire conditions because of edaphic factors that retard woody succession, and may be interpreted as a phase of this system (patch prairies).

Issues or Problems

Charlotte workshop participants indicated this type did exist, but would be difficult to identify and map. A landscape fragmented with urban areas is difficult to burn at landscape scale. This system has been altered through land use conversion (agriculture, development, loblolly pine

plantations) and fire suppression, and under these conditions, may be difficult to distinguish from ordinary Piedmont Oak-Hickory forests.

Native Uncharacteristic Conditions

The almost total exclusion of fire in the map zone has nearly eliminated the more open succession classes of this system. Seed sources for herbs and oaks have been depleted due to a lack of fire, and history of ag production in these systems. Ashes, Florida and Chalk Maples, Sweetgum, Red Maple, Black Gum and Tulip Poplar are now more common.

Comments

This model was developed from literature, and slightly adapted from 5913680 Piedmont Dry Oak Pine. These two ecological systems are very similar, but in general the late-open class of 5913420 would likely be more persistent than typical oak systems because the hardpan conditions are created by soil/site properties. Thus, disturbances are not necessary to maintain a more open condition. An Optional disturbance was added to the closed classes to mimic the tendency of these sites to create/maintain open conditions due to hardpan conditions.

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	C	C	C	C	C	C	C	B	B	B
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 9 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
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Maximum Tree Size Class

Medium 9-21"DBH

Class D	44	Late Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUST	Quercus stellata	Post oak	Low-Mid
QUAL	Quercus alba	White oak	Upper
CARYA	Carya	Hickory	Low-Mid
SCSC	Schizachyrium scoparium	Little bluestem	Lower

Description

Class D is a prairie, savanna, and open woodland with large oaks and hickories, with low shrub cover and a grass/forb dominated understory. Herbaceous understory may be dominant on upper south facing slopes (prairie phase). The overstory is mature trees. Rare replacement fires occur during extreme droughts.

Maximum Tree Size Class

Very Large >33"DBH

Class E	4	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUAL	Quercus alba	White oak	Upper
CARYA	Carya	Hickory	Low-Mid
QUVE	Quercus velutina	Black oak	Upper
FRAM2	Fraxinus americana	White ash	Upper

Description

This class represents a closed-canopy late-seral stage with mature to old trees. The closed canopy is dominated by oaks and hickory, with understory components including white ash, chalk and Florida maples, dogwood and black gum. The precise composition will vary depending on slope and aspect. The lower strata will tend to be shrub dominated with a sparse herb layer composed of forbs to the exclusion of grasses.

Maximum Tree Size Class

Very Large >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	75
Mid1:CLS	16	Late1:CLS	75
Late1:OPN	76	Late1:OPN	999
Late1:CLS	76	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	0.005	200	Yes	0
Surface Fire	Early1:ALL	Early1:ALL	0.08	13	No	0
Alternative Succession	Mid1:OPN	Mid1:CLS	1	1	Yes	12
Wind or Weather or Stress	Mid1:OPN	Early1:ALL	0.003	333	Yes	0
Native Grazing	Mid1:OPN	Mid1:OPN	0.004	250	No	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.005	200	Yes	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.25	4	No	0
Wind or Weather or Stress	Mid1:CLS	Early1:ALL	0.003	333	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.003	333	Yes	0
Insects or Disease	Mid1:CLS	Mid1:OPN	0.004	250	Yes	0
Wind or Weather or Stress	Mid1:CLS	Mid1:OPN	0.005	200	Yes	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.02	50	Yes	0
Optional 1	Mid1:CLS	Mid1:OPN	0.05	20	Yes	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.05	20	No	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	15
Wind or Weather or Stress	Late1:OPN	Early1:ALL	0.002	500	Yes	0
Replacement Fire	Late1:OPN	Early1:ALL	0.002	500	Yes	0
Insects or Disease	Late1:OPN	Early1:ALL	0.002	500	Yes	0
Native Grazing	Late1:OPN	Late1:OPN	0.007	143	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.25	4	No	0
Insects or Disease	Late1:CLS	Late1:OPN	0.002	500	Yes	0
Wind or Weather or Stress	Late1:CLS	Early1:ALL	0.002	500	Yes	0

Replacement Fire	Late1:CLS	Early1:ALL	0.002	500	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.01	100	Yes	0
Mixed Fire	Late1:CLS	Late1:OPN	0.01	100	Yes	0
Optional 1	Late1:CLS	Late1:OPN	0.05	20	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.06	17	No	0

Optional Disturbances

Optional 1: Hardpan soil conditions

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