14730

Gulf and Atlantic Coastal Plain Floodplain Systems

BpS Model/Description Version: Aug. 2020

Update: 3/18

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Vegetation Type

Woody Wetland

Map Zones

45, 46, 47, 98, 99

Geographic Range

The majority of this Biophysical Setting (BpS) occurs in floodplains and on terraces of large streams within the Mississippi Alluvial Plain from southern Illinois to the Gulf of Mexico. Smaller units occur along other large streams in the Gulf Coastal Plain, the Atlantic Coastal Plain, and along the Arkansas River in the Interior Highlands. It is recorded from Alabama, Arkansas, Illinois, Kentucky, Louisiana, Maryland, Missouri, Mississippi, Oklahoma, Tennessee, and Texas. (NatureServe 2007).

Biophysical Site Description

This BpS occurs on floodplain terraces of large streams in the Mississippi Alluvial Plain, Gulf Coastal Plain, central and southern Atlantic Coastal Plain, and Arkansas Valley. It excludes the open water, *Taxodium distichum--Nyssa aquatica* and *Quercus lyrata* (baldcypress--tupelo and laurel oak) that occur in deep water alluvial swamps, sloughs, and depressions that are flooded most or all of a given year; those are covered under Gulf and Atlantic Coastal Plain Swamp Systems. Synonyms for this BpS and its subdivisions include alluvial forest, southern bottomland hardwood forest.

Vegetation Description

Apart from treefall gaps, marshes, and non-forested canebrakes, there is a continuous canopy of deciduous broadleaved species. Relative dominance of canopy tree species may vary according to regional location and hydrology. The tree canopy ranges from approximately 80-150ft tall. The understory is <80 feet tall and is usually composed of the canopy species and deciduous broad-leaved understory species. Understory shrub density is generally low but may be dense on ridges within the bottoms that are less subject to inundation. The herbaceous layer is generally sparse due to shade and/or frequent inundation, although there may be relatively thick herbaceous vegetation in treefall gaps and early seral stages. There are usually more than 10 species of canopy trees and more than 30 tree and shrub species total. Canopy tree density is within 15-30 trees/ac and canopy tree basal area is within 100-210ft/ac. Many canopy trees exceed 20in in diameter.

River banks and flat, poorly drained areas within the floodplain are often dominated by *Populus deltoides* (cottonwood), *Betula nigra* (river birch), *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), *Acer negundo* (box elder), *Platanus occidentalis* (sycamore), *Ulmus americana* (American elm), *Fraxinus pennsylvanica* (green ash), *Fraxinus caroliniana* (Carolina ash), *Celtis laevigata* (sugarberry), *Celtis occidentalis* (hackberry), *Carya aquatica* (water hickory), *Diospyros virginiana* (persimmon), *Magnolia virginiana* (sweet bay), *Quercus laurifolia* (diamond leaf oak), and *Quercus lyrata* (overcup oak). Ridges and levees in low areas and higher areas near the edges of floodplains may be dominated by *Liquidambar styraciflua* (sweet gum), *Quercus nigra* (water oak), *Quercus phellos* (willow oak), *Quercus michauxii* (swamp chestnut oak), *Quercus nuttallii* (Nuttall's red oak), *Quercus shumardii* (Shumard's red oak), *Quercus virginiana* (live oak), *Prunus serotina* (black cherry), *Ulmus alata* (winged elm), *Pinus taeda* (loblolly pine), *Carya illinoensis* (pecan), *Carya glabra* (pignut hickory), *Carya cordiformis* (bitternut hickory), and *Carya ovata* (shagbark hickory). Comprehensive species lists for these communities can be found in Heineke (1987).

Additional dominant species include Silver Maple (*Acer saccharinum*), Cotton Wood (*Populus deltoides*) and Overcup Oak (*Quercus lyrata*).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| QUTE | *Quercus texana* | Quercus texana |
| CELA | *Celtis laevigata* | Sugarberry |
| QUPH | *Quercus phellos* | Willow oak |
| QUNI | *Quercus nigra* | Water oak |
| QUMI | *Quercus michauxii* | Swamp chestnut oak |
| CAIL | *Carex illota* | Sheep sedge |
| ULAM | *Ulmus americana* | American elm |
| FRPE | *Fraxinus pennsylvanica* | Green ash |

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

Disturbance Description

The dominant ecological processes in bottomland hardwood forests are windfall gaps and periodic flooding. Windfall gaps occur on the local (a single mature canopy tree) and the landscape (tornadoes or hurricanes) scale. When canopy trees fall, seedlings in the understory are released and compete for a spot in the canopy. This leads to dense areas of herbaceous and woody vegetation in windfall gaps of all sizes. This is a major process in forest regeneration in bottomland hardwood forests. Flooding is more frequent on the lower terraces but frequently floods higher terraces (Wharton zones IV & V). Catastrophic floods can cause the loss of canopy over large areas. Canopy decline and reproductive failure can create late-seral open stands. Duration of flooding varies with the placement of a site in the landscape and is a dominant process affecting vegetation on a given site. Flooding can deposit alluvium or scour the ground, depending on the landscape position of a site and the severity of the flood event. Fire is infrequent on the lower terraces, but was frequent historically on older terraces outside the floodplain and crept into the floodplains. Wharton et al. (1982) mention that a serious fire season occurs on an average of about every 5-8yrs in the bottomland hardwood forests of the Mississippi Alluvial Plain. It is conjectured that Native Americans maintained canebrakes by deliberate fall burning. Infrequent, mild surface fires would occur in the system; however, they would not alter species composition or structure. Changes in hydrology due to the activities of beaver are also an important ecological process in bottomland hardwood forests. Beaver impoundments kill trees, sometimes over large areas, and may create open water habitat, cypress-tupelo stands, or cause stand replacement. Meandering streams are dynamic and frequently change course, eroding into the floodplain and depositing new point bars, thus creating new habitat for early seral plant communities. Insect outbreaks would occur infrequently in closed canopy states.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 113 | 46 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) | 98 | 54 |  |  |
| All Fires | 53 | 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 BpS occurred in patches of millions of acres in the Mississippi Alluvial Plain, with smaller areas covered in larger streams in the coastal plain and Arkansas Valley.

Adjacency or Identification Concerns

This BpS grades into the Gulf and Atlantic Coastal Plain Swamp Systems (451480) which occurs on the lowest, wettest areas of the bottomlands. It also is bordered by a number of upland communities from which fire would have occasionally burned down into the bottoms, especially in drought years. When adjacent to Grand Prairie and loblolly flatwoods the Mean Fire Return Interval (MFRI) increases in floodplain system.

Issues or Problems

The fire history of this BpS is poorly understood, in part because there has been the widespread assumption that it didn't burn. However, the fact that it had extensive cane understory and canebrakes indicates that fire was much more common than is generally believed. These canebrakes exist as a patch community maintained by wind and fire. The effects of beaver ponds on forest dynamics in this system are also poorly understood at the landscape level, especially in the presettlement context. Note that the model assumes that a single pixel represents the area occupied by a single very mature canopy tree. This accounts for the treefall gap ecological process.

Native Uncharacteristic Conditions

Comments

Models and descriptions for map zone (MZ) 46, MZ47, MZ60, and MZ99 were identified as duplicates during the BpS review process. However, during the review we added MZ45 and MZ98 to the MZ46, 47 group and removed MZ60.

This model was created for the Mississippi Alluvial Plain and later extended to cover the range of this systems aggregate around the Gulf and Atlantic coastal plains north to the Chesapeake Bay. It includes the following Ecological Systems:

• Atlantic Coastal Plain Large River Floodplain Forest (CES203.066)

• Atlantic Coastal Plain Small Blackwater River Floodplain Forest (CES203.249)

• Atlantic Coastal Plain Small Brownwater River Floodplain Forest (CES203.250)

• East Gulf Coastal Plain Large River Floodplain Forest (CES203.489)

• Mississippi River High Floodplain (Bottomland) Forest (CES203.196)

• Mississippi River Low Floodplain (Bottomland) Forest (CES203.195)

• Mississippi River Riparian Forest (CES203.190)

• Red River Large Floodplain Forest (CES203.065)

• Southern Coastal Plain Blackwater River Floodplain Forest (CES203.493)

• West Gulf Coastal Plain Large River Floodplain Forest (CES203.488)

This model was adapted slightly from the Rapid Assessment model R5SOFPif. The changes were so slight the original modelers were left in 1 and 2.

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 | A | A | A | A | A | A | A | B | B | B |
| Tree | 10-25 | D | D | D | D | D | D | D | B | B | B |
| Tree | 25-50 | D | D | D | D | D | D | D | C | C | C |
| Tree | >50 | D | D | D | D | D | D | D | C | C | C |

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 21 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUTE | Quercus texana | Quercus texana | Lower |
| QUPH | Quercus phellos | Willow oak | Lower |
| LIST | Linum striatum | Ridged yellow flax | Lower |
| FRPE | Fraxinus pennsylvanica | Green ash | Lower |

Description

This class includes small scale windfall gaps (the principal method of regeneration in mature bottomland hardwood forests in the absence of larger scale disturbance), large scale catastrophic wind disturbance (tornado & hurricane), water impoundment and inundation caused by channel blockage), and catastrophic stand replacement during major flood events. This class includes the fire maintained canebrake community (non-forested type). Average replacement fire is higher in this state because of the canebreak community. Infrequent surface fire maintains this class until it succeeds to B.

Overcup Oak (*Quercus lyrata*) is also an indicator species in this successional stage and resides in the lower canopy.

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

Class B 32 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUNI | Quercus nigra | Water oak | Upper |
| QUPH | Quercus phellos | Willow oak | Upper |
| CELA | Celtis laevigata | Sugarberry | Upper |
| FRPE | Fraxinus pennsylvanica | Green ash | Upper |

Description

This class is a mid seral stage bottomland hardwood forest with a closed canopy. Replacement fire is rare in this state. Infrequent surface fire maintains this class until succession. Other replacement disturbances include large scale catastrophic wind disturbance (tornado & hurricane), water impoundment and inundation caused by channel blockage), catastrophic stand replacement during major flood events, and insect outbreaks.

*Maximum Tree Size Class*  
Large 21-33"DBH

Class C 27 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUTE | Quercus texana | Quercus texana | Upper |
| QUPH | Quercus phellos | Willow oak | Upper |
| ULAM | Ulmus americana | American elm | Upper |
| QULY | Quercus lyrata | Overcup oak | Upper |

Description

This class is a mature, late seral closed canopy bottomland hardwood forest. Replacement fire is rare in this state. Infrequent surface fire maintains this class. Other rare disturbances have either a replacement or thinning effect including large scale catastrophic wind disturbance (tornado & hurricane), water impoundment and inundation caused by channel blockage), catastrophic stand replacement during major flood events, and insect outbreaks.

*Maximum Tree Size Class*  
Very Large >33"DBH

Class D 20 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUTE | Quercus texana | Quercus texana | Upper |
| LIST | Linum striatum | Ridged yellow flax | Upper |
| QULY | Quercus lyrata | Overcup oak | Upper |

Description

This class occurs through overstory decline in old growth stages, combined with reproductive failure. Replacement fire rare in this state. Infrequent surface fire maintains this class. Other rare disturbances have either a replacement or maintenance effect including large scale catastrophic wind disturbance (tornado & hurricane), water impoundment and inundation caused by channel blockage), catastrophic stand replacement during major flood events, and insect outbreaks.

*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:CLS | 19 |
| Mid1:CLS | 20 | Late1:CLS | 79 |
| Late1:CLS | 80 | Late1:CLS | 999 |
| Late1:OPN | 80 | 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** |
| Surface Fire | Early1:ALL | Early1:ALL | 0.01 | 100 | No | 0 |
| Optional 1 | Early1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.033 | 30 | Yes | 0 |
| Insects or Disease | Mid1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Wind or Weather or Stress | Mid1:CLS | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Optional 1 | Mid1:CLS | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.01 | 100 | No | 0 |
| Wind or Weather or Stress | Late1:OPN | Late1:OPN | 0.002 | 500 | No | 0 |
| Optional 1 | Late1:OPN | Late1:OPN | 0.002 | 500 | No | 0 |
| Insects or Disease | Late1:OPN | Late1:OPN | 0.002 | 500 | No | 0 |
| 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 |
| Optional 1 | Late1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Late1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.01 | 100 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 0 |
| Optional 1 | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 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 |
| Optional 1 | Late1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Late1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.01 | 100 | No | 0 |

Optional Disturbances

Optional 1: Flooding

References

Foti, T.L. 2001. Presettlement forests of the Black Swamp Area, Cache River, Woodruff County, Arkansas from notes of the first land survey. In: Hamel, P. B. and T. L. Foti, tech. eds. Bottomland hardwoods of the Mississippi Alluvial Valley: characteristics and management of natural function, structure, and composition. 1995 October 28. Fayetteville, AR. Gen. Tech. Rep. SRS-42. Asheville, NC: USDA Forest Service, Southern Research Station. 109 pp.

Gerstacker, F. 2004 (reprint). Wild Sports: rambling and hunting trips through the United States of North America. Stackpole Books. 409 pp.

Heineke, T. 1987. The flora and plant communities of the Middle Mississippi River Valley. PhD dissertation. Southern Illinois University. 653 pp.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 11 October 2007

Tingle, J. L., C. V. Klimas, and T. L. Foti. 2001. Application of General Land Office survey notes to bottomland hardwood ecosystem management and restoration in the Lower Mississippi Valley--an example from Desha County, AR. In: Hamel, P. B. and T. L. Foti, tech. eds. Bottomland hardwoods of the Mississippi Alluvial Valley: characteristics and management of natural function, structure, and composition. 1995 October 28. Fayetteville, AR. Gen. Tech. Rep. SRS-42. Asheville, NC: USDA Forest Service, Southern Research Station. 109 pp.

Wharton, C. H., W. M. Kitchens, E.C Pendleton and T. W. Sipe. 1982. The ecology of bottomland hardwood swamps of the Southeast: a community profile. US Fish and Wildlife Service, Biological Services Program, Washington, DC. FWS/OBS-81/37. 133 pp.