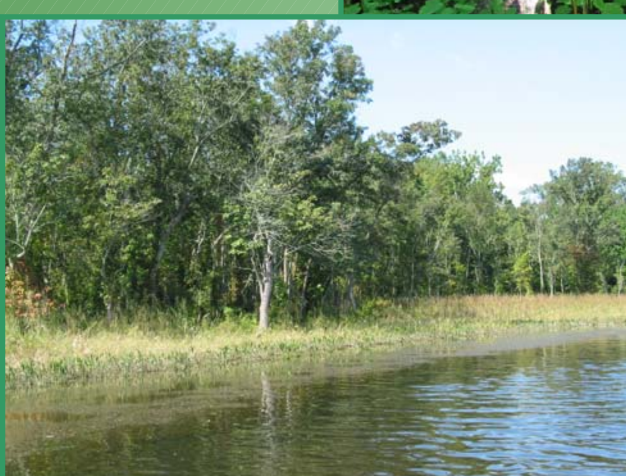
Forested Tidal Wetland Communities of Maryland's Eastern Shore

Identification, Assessment, and Monitoring



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The United States Environmental Protection Agency
Clean Water Act 1998 State Wetlands Development
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Identification, Assessment and Monitoring

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INTRODUCTION

In recent years, the practice of natural resource conservation through the protection of rare, threatened, and endangered species has come under fire by both the general public and the scientific community (Wilcove *et al.* 1996). These species have served as regulatory endpoint umbrellas, used to protect the larger systems that they inhabit. These procedures have led to the focus of conservation efforts onto majestic species like the Bald Eagle and charming species like the Spotted Owl (Harwell *et al.* 1990). These species have acted as representatives for their natural systems, but rare species usually do not play a major ecological role within these systems. Actually, the endpoints of conservation efforts should be the natural systems themselves (Harwell *et al.* 1990). Originally, these representatives served their systems well; it is difficult to induce the public to feel strongly about the conservation of ecologically important endpoints such as predatory mites (Pimentel and Edwards 1982) and other invertebrates (Wilson 1987), arbuscular mycorhizal fungi (Van der Heijden *et al.* 1998), or the nitrogen cycle (Barbour *et al.* 1987). But, land protection based on charismatic endangered animal species can create a great deal of public controversy (e.g. Spotted Owl conservation in the Pacific Northwest) and often leaves many questions unresolved (Williams 1996). What happens to land that is currently protected, because of the presence of a species, once that species recovers and is de-listed? What happens to the same type of land if the species becomes extinct? Also, these conservation concepts can lead to the intentional degradation of private land in order to ensure that no endangered species move in and create a regulatory situation, such as in the case of the Red-cockaded Woodpecker in the Southeastern United States (Bean and Wilcove 1997, Bonnie 1997).

The complications associated with species level conservation have given rise to a relatively new method in the protection of natural resources. Vegetation communities have been identified as generally appropriate units of biodiversity conservation, they are hierarchically above individual species but more manageable than larger landscape units such as watersheds or physiographic provinces (Thompson 1996). The definition of vegetation communities used in this report closely follows that of Mueller-Dombois and Ellenberg (1974): communities are physiognomically uniform assemblages of plants which are ecologically related to each other and their physical environment, and predictably found under similar habitat conditions. The abiotic environment is not a component of the definition of vegetation communities; it is assumed that these conditions determine the combination of species within the concept (Thompson 1996). Often, the vegetation community descriptions are necessarily vague, recognizing that these associations intergrade at ecotones and that boundaries are artificial constructs necessary for conservation. Vegetation communities are merely empirical tools used for natural resource conservation, not an absolute representation of ecological truth (Thompson 1996).

Historically, a debate has transpired as to whether vegetation actually consists of distinct communities or a continuum of overlapping species ranges (Grossman *et al.* 1994). Much of this discussion centered around the “supra-organism” view of F. E. Clements (1936) versus the “individualistic” view of H. Gleason (1926). A full treatise of this debate can be found in Whittaker (1962) and Mueller-Dombois and Ellenberg (1974). More recently, Austin and Smith (1989) have reevaluated this debate and emphasized that there is not actually a polar dichotomy between these two concepts, rather the frames of reference of the observer are in conflict. Vegetation patterns are characterized by the link between individual species distribution patterns, their occurrence in landscape features, and the distribution of the landscape features (Grossman *et al.* 1994). Species can be individually distributed along gradients, uni-dimensional or complex, following any possible model (Austin 1987, Austin and Smith 1989). The pattern of distribution of the landscape features that control environmental factors constrains the pattern of species combinations, their distribution in the landscape, and their frequency (Grossman *et al.* 1994). Thus the views of community and continuum complement, rather than exclude each other (Westhoff and Van der Maarel 1978, Austin 1991).

Vegetation communities are a tractable level of hierarchy for establishing preservation benchmarks because their conservation allows the protection of the overall trophic structure, which is essentially biodiversity (Harwell *et al.* 1990). Also, there are some legal provisions for protecting vegetation communities: Section 403 © of the Federal Water Pollution Control Act specifically calls for consideration of changes in species diversity (Harwell 1984b), and Section 301(h) of the Federal Water Pollution Control Act indirectly calls for maintenance of species diversity through its "balanced indigenous population" endpoint as interpreted by regulations and litigation (Harwell 1984a). Generally, high priority vegetation communities are habitat to high priority plant and animal species, protection of the community will protect these species (Keddy and Wisheu 1989; Noss 1987). Conservation using this "coarse-filter" approach has been documented for some taxa (Panzer and Schwartz 1998). Also, vegetation communities, with their associated biological, chemical, and physical processes, drive the biogeochemical processes of the earth (Naeem *et al.* 1994). Vegetation community based inventories give a better assessment of the status, distribution, and interrelatedness of vegetation types across the landscape as compared to the historically more prevalent methods of jurisdictionally based (ie. county or agency) inventory. Often, these types of inventory are limited to smaller geographic land units, lead to haphazard data collection, and conclude with improper understanding of community rarity.

Unlike species, vegetation communities are not always self-evident on the landscape. A series of floristic data, collected across both geographic and temporal gradients, is often necessary for naming and understanding vegetation community types. This information must be expressed within the organizational framework of a community classification for the best utilization of the biological data. This classification is a way of collecting uniform hierarchical data that facilitates effective resource stewardship by ensuring compatibility and widespread use of the information by various individuals and agencies (Grossman *et al.* 1994). The United States National Vegetation Classification System (USNVC; Grossman *et al.* 1998) is a current priority of NatureServe and the network of Natural Heritage Programs. This system is the product of a great body of earlier scientific work and over twenty years of data collection by these organizations. Classification is a critical ingredient in the recipe of conservation, it allows for the accurate identification and description of the full range of vegetation community types within the landscape. This along with information on rarity permits formation of proper protection priorities.

Within the framework of the USNVC (Grossman *et al.* 1998) are hierarchically more finely divided classifications at the regional and state levels. This project contributes to the development of the Maryland natural community classification (Harrison 2004b) which is used for management within the state, comparison to other states, and fine tuning community alliances and associations of the USNVC (Grossman *et al.* 1998). In addition, development of the classification through a series of "special projects", intensely focusing on a small subset of community types, yields the required detailed description of community types as well as the identification and mapping of exemplary examples of these types as reference sites.

With the exception to portions of Garrett and Worcester Counties, the entire land surface area of Maryland lies within the Chesapeake Bay drainage basin. This is one of the largest and most productive estuaries in the United States (Lipson and Lipson 1997). All of the wetlands within the Chesapeake drainage are integral to the healthy function of the Bay. The phrase "Chesapeake Bay Drainage" is painted on the storm drains in Baltimore City and "The Bay Starts Here" stickers adorn the sinks of many public bathrooms. These statements are also true of the wetlands scattered throughout the state. In order to truly protect the Bay, the sources and buffers throughout its watershed must receive protection priority. In addition to their connection with the Chesapeake Bay, Maryland's wetlands are critical habitat for numerous rare, threatened, and endangered plant and animal species and serve valuable ecosystem functions such as flood control, water filtration, and nutrient recycling (Tiner and Burke 1995).

Fragmentation and development pressures are degrading Maryland's wetland resources at an alarming rate. An estimated 1.2 million acres of wetlands occurred in Maryland before European settlement, but that number is now reduced to 600,000 acres (Tiner and Burke 1995). Of these 600,000 acres of wetlands, approximately 57 percent are represented by palustrine wetlands and 42 percent are represented by estuarine wetlands (Tiner and Burke 1995). According to the Tiner and Finn (1986) study, a significant decline in palustrine (6%) and estuarine (8%) emergent wetland acreage occurred from 1955 to 1978. Conversion of tidal wetlands to deepwater habitat, creation of saltwater and freshwater impoundments, ditching, and the overall lack of Federal and State wetland regulations during this period facilitated much of the acreage loss. This drastic loss has also accelerated the need for more qualitative information on the character and significance of these wetland resources. This information is necessary for setting protection priorities and initiating existing protection mechanisms. This study was restricted to all forested tidal wetlands on Maryland's Eastern Shore, with the exception of tidal portions of the Potomac and Patuxent Rivers where exemplary stands where known to occur.

One impediment to wetland protection and restoration efforts is the lack of adequate benchmarks against which to assess ecological integrity. The health of an ecosystem is difficult, if not impossible to assess without explicit knowledge of the target community. Objective measures of the impacts of anthropogenic disturbance on the complex and vast ecosystems of Maryland's forested tidal wetlands present a daunting challenge. The measurement of these stresses, documentation of changes, and estimation of geographic cover depends upon the identification of basic units of these wetlands, the component communities, which are some of the end products of this project.

PURPOSE

The purpose of this project was to classify and describe forested tidal wetlands on Maryland's Eastern Shore in an effort to develop a more complete understanding of these communities. The classification generated by this study and presented in this report will be used to augment the ongoing Maryland natural community classification (Harrison 2004b) and the USNVC (Grossman *et al.* 1998). With this classification, exemplary examples of each community type were identified and described as reference sites. The information gathered in this project will be used to complement other projects studying tidal wetlands in the eastern United States.

The information generated by this project will simplify the regulatory review of these tidal wetlands by providing the quantitative data necessary to objectively rank these communities as to their rarity and biological importance. The results of this study will be used to aid in the conservation of rare communities, to assist in current regulation, to support vegetation mapping projects and to interpret regional data at higher hierarchical levels. They will also be used by the US EPA cooperators to determine baseline levels of parameters within reference wetlands for long-term modeling and conservation.

The end products of this project are: a detailed vegetation community classification and description and reference site descriptions for long term monitoring. These products will be utilized by the Maryland Department of the Environment: Non-tidal Wetlands and Waterways Division, Maryland Department of Natural Resources: Wildlife and Heritage Service, NatureServe, and traditional users of the Natural Heritage's Biological Conservation Database.

METHODS

Landscape Analysis

In order to collect ecologically pertinent information, the intricate process of Landscape Analysis must supersede field surveys. The process starts with the development of a preliminary definition of the abiotic and biotic factors that contribute to the community structure of the system of study. Our definition of forested tidal wetlands was primarily based on that defined within the literature. For the purposes of this study, forested tidal wetlands are broadly defined as diurnal to irregularly flooded palustrine or estuarine wetlands dominated by trees greater than 6m in height and greater than 5% in cover. Depending on canopy coverage different physiognomic classes are represented in this broad definition. Included are sparse woodland (5-25% cover), woodland (25-60% cover), and forested (60-100% cover) classes.

Once a clear search image was established, the process of assembling a portfolio of potential sites occurred using the standard methodologies employed by The Nature Conservancy and the network of state Natural Heritage Programs. The primary method of selecting sample sites was facilitated through the use of digital orthophotographic quadrangles coupled with National Wetland Inventory maps. At the completion of the Landscape Analysis phase of the project, 227 potential survey sites were identified. If required, owners of private land and managers of public land were contacted and site visits were approved. If required, proper plant collection permits for public and private land were obtained.

Landscape analysis for this project occurred during the period from January 2003 to April 2003.

Spatial Distribution of Vegetation: Implications for Sampling Design

An effective and accurate vegetation classification requires sampling the full range of compositional heterogeneity, but the complex spatial nature of vegetation presents a number of problems when designing an optimal sampling scheme at the landscape scale (Grossman *et al.* 1994). Some characteristics of a good sampling approach are flexibility, replicability, and cost effectiveness; it attempts to characterize as many vegetation patterns possible with efficiency in mind (Grossman *et al.* 1994). Due to time, budgetary constraints, and large geographic area of Maryland's Eastern Shore, it was implausible to use the methods of multiple random plot samples of a single vegetation type at one site or repeated sampling of single plots over time to capture the overall composition. Also, randomization procedures may actually be counterproductive to the intent of ecological surveys, especially where the occurrences of natural patterns are known to be non-random (Gillison and Brewer 1985). In general, plant communities do not occur randomly on the landscape, they occur where the abiotic factors constrain the individual species that constitute the community. Although sampling theory emphasizes randomization in order to provide a probability structure for statistical analysis or to give credibility to statistical models, the recovery of vegetation patterns are not necessarily accomplished by standard statistical sampling procedures (Gillison and Brewer 1985).

To compensate for these restrictions, an inherently subjective method of selecting sample locations was employed to capture the full floristic range, both among and within vegetation types. While the number of samples within each vegetation type was proportional to its abundance across the entire landscape, types with greater within-type heterogeneity required more intensive sampling.

Field Surveys

Sampling was stratified such that vegetation types were sampled in approximate proportion to their representation on the landscape, and sampling occurred across the entire eastern shore region of Maryland. Attempts were made to capture the full range of variation in local conditions, including hydrological regime, inundation frequency, salinity, soil drainage class, soil texture, and elevation. A random approach was used to the extent possible to aid in the selection of sites from the set of potential sites, but several factors contributed to the need for a primarily subjective and non-random approach to the actual location and configuration of sample plots. These include the need to place plots in homogeneous vegetation, the necessity to capture as much of the floral heterogeneity of a site as possible, the desire to ease future relocation, and the existence of restrictions on site access.

The field work for this project occurred during the 2003 growing season and followed standard vegetation sampling protocols utilized by The Nature Conservancy and the network of state Natural Heritage Programs (Sneddon 1993). The sites identified in landscape analysis were visited and given an initial qualitative rank, which is a relative scale where “A” is excellent, “B” is good, “C” is marginal or fair, and “D” is poor. The ranking was based on four factors: Quality, Condition, Viability, and Defensibility. Only those sites receiving ranks A - C qualified for quantitative survey. Knowledge of the history of land management was also important for the initial ranking (Grossman *et al.* 1994). These surveys attempted to avoid ecotones and areas subjected to significant disturbance events.

Site selection and plot layout placed plots in fairly homogeneous vegetation and avoided sites recently disturbed by human activities or natural events that may have resulted in atypical composition or structure. Plots were small enough to encompass homogeneous vegetation and uniform local conditions and large enough to capture the full range of within-community variation in species composition and vegetation structure.

Vegetation Sampling
At each survey site, project ecologists became familiar with the vegetation and potential vegetation communities. Then, one temporary survey plot was established in the most representative location for each potential community type at each site. The Natural Heritage Methodology utilizes 10 m X 10 m (100 m^2) for herbaceous vegetation, 15 m X 15 m (225 m^2) for shrubland vegetation, and 20 m X 20 m (400 m^2) for forest vegetation, as recommended by Mueller-Dombois and Ellenberg (1974). Botanical nomenclature follows that of Kartesz (1999).

Each plot was surveyed for presence of all vascular plant species rooted in the plot and the percent ground cover was recorded for each species and then converted to the appropriate cover class (Table 1). Cover was estimated by a summation of vertical projections of the canopies of each individual of each species and recorded as a percentage, with a maximum value of 100. Any species not rooted within the survey plot, but included in the community were recorded and assigned a cover of zero. The total percent cover for each physiognomic strata was estimated and the dominants of each strata were recorded. Six classes were used to define the total vegetative cover for each stratum and are as follows: very sparse (0-5%), sparse (5-25%), very open (25-40%), open (40-60%), moderately dense (60-80%), and dense (80-100%).

Table 1. Cover class scores used in field sampling and data analysis

Estimated Percent Cover	Cover Class	Cover Class Midpoints (%)
Trace	1	0.05
< 1%	2	0.55
1 – 2%	3	1.50
2 – 5%	4	3.50
5 – 10%	5	7.50
10 – 25%	6	17.5
25 – 50%	7	37.5
50 – 75%	8	62.5
75 – 100%	9	87.5

Appendix 1 (Maryland NHP Community Survey, page 2) contains a sample field form used by the Maryland Natural Heritage Program to record vegetation sample plot data.

Environmental Parameters
At each vegetation sample plot, environmental data (Table 2) were recorded in the appropriate sections of the field forms (see Appendix 1). Topographic position was determined in the field using USGS 7.5 minute quadrangle maps. Elevation measurements were obtained at the sample plot using the Magellan Meridian global positioning system (GPS) units and later verified utilizing Maptech® Terrain Navigator Pro (Version 6.02) mapping software. Slope inclination and aspect were estimated visually in the field. Soil drainage class, soil moisture regime, slope, and slope shape were determined using scalar values. Assignment of hydrologic regime and determination of inundation frequency were based on site position relative to water sources, examination of soil surveys and National Wetlands Inventory maps, and on-site assessment. Salinity measurements were obtained from a BIO-MARINE® Aquafauna refractometer and averaged on-site after three readings. Finally, surface substrate cover was estimated visually such that all values sum to 100 %.

Table 2. Environmental data reported for each vegetation sample plot.

System	Soil Moisture Regime	Inundation	Surface Substrate (% cover)	
A – terrestrial	A – very xeric	A – never	Decaying wood	
B – palustrine	B – xeric (moist for brief	B – infrequently	Bedrock	
C – estuarine	time)	C – regularly; for <6 mos	Boulders (>24" diameter)	
D – marine	C – somewhat xeric	D – regularly; for >6 mos	Stones (>10" round or >15" flattened)	
E – riverine	(moist for short time)	E – always submerged	Cobbles (3-10"; rounded)	
	D – submesic (moist	by shallow water.	Channery (thin; <6")	
Physiographic Province	for mod. short time)	F – always submerged	Gravel	
A – coastal plain (Upper)	E – mesic (moist for sig	by deep water	Mineral soil	
B – coastal plain (Lower)	time)		Organic matter	
C – fall line	F – subhygric (wet for sig	**Hydrological Regime**	Water	
D – piedmont	part of growing	A - Terrestrial	Other:	
E – blue ridge	season (mottles<20cm)		Moss/lichen cover	
F – ridge and valley	G – hygric (wet for most	Tidal		
G – Appalachian plateau	of the growing season	A – Irregularly exposed	**Slope**	
	perm seepage/mottling	B – Regularly flooded	A – 0-3% (level or nearly so)	
Topographic Position	H – subhydric (water	C – Irregularlly flooded	B – 3-8 (gentle/undulating)	
A – plain/level	table at or above	D – Wind tidally flooded	C – 8-16 (sloping/rolling)	
B – toe	surface for most of		D – 16-30 (moderately/hilly)	
C – lower slope	the year.	Non-Tidal	E – 30-65 (steep)	
D – middle slope	I – hydric (water table	A – Permanently flooded	F – 65-75 (very steep)	
E – upper slope	at or above surface	B – Semiperman. flooded	G – 75-100 (extremely steep)	
F – escarpment	year round)	C – Seasonally flooded	H – hummock and hollow microtopography	
G – ledge/terrace	__ - ephemeral seepage/	D – Intermittently flooded	I – irregular craggy/bouldery microtopography	
H – crest	subsurface water pres	E – Temporarily flooded		
I – basin/depression	locally in plot	F – Saturated		
J – floodplain	**Soil Drainage Class**		**Slope Shape**	**Aspect**
K – stream bottom	A – very poorly drained	**Salinity/Halinity**	**Vertically Horizontally**	F (Flat)
	B – poorly drained	A – Saltwater	C-concave C-concave	V (Variable)
	C – somewhat poorly	B – Brackish	X-convex X-convex	N NE
	D – moderately drained	C – Oligohaline	S-straight S-straight	E SE
	E – well drained	D – Freshwater		S SW
	F – rapidly drained	_______ ppt		

Appendix 1 (Maryland NHP Community Survey, page 1) contains a sample field form for recording environmental parameters.

Site Descriptors

Brief descriptions of each community including characteristic species and community processes, as well as its landscape context were recorded. An elevation range and community size were determined from USGS 7.5 minute quadrangle maps and Magellan Meridian global positioning system (GPS) units coupled with Maptech® Terrain Navigator Pro (Version 6.02) mapping software. Comments on management needs, protection, ownership, disturbances, and threats were recorded. The landform, geology, soil, hydrology, system, and physiognomic characteristics were described. The vegetation structure was summarized by recording the dominant vascular plant species, height, and estimate of the total percent cover for each physiognomic strata. Then each community occurrence surveyed was ranked again, in comparison to other examples that were surveyed for quantitative data within the scope of the project.

Appendix 1 (Maryland NHP Community Survey, page 1) contains a sample field form for recording site descriptors.

Metadata
The location of each community plot was measured in the field using Magellan Meridian global positioning system (GPS) units or subsequently determined from USGS 7.5 minute quadrangle maps and/or Maptech® Terrain Navigator Pro (Version 6.02) mapping software. Each sample plot was assigned a alphanumeric identifier for database use. Dates of sampling, participants, county, physiographic region, and USGS 1:24,000 topographic map quadrangle were recorded. The size and configuration of each plot were noted and photo documentation typically consisted of at least digital photograph of the entire plot. A site sketch map and cross sectional map accompanied each field form (See Appendix 1; Maryland NHP Community Survey, page 1) indicating orientation of the plot, location of photo point(s), and distances and directions to any landmarks.

Field surveys occurred in the time period from April 2003 to November 2003.

Data Compilation and Analysis
After the completion of field surveys, data were entered into a Microsoft Access database so subsequent operations could be organized and performed in an efficient manner. A table of environmental variables, plot codes, species, and cover values was exported from the database and transcribed to an Excel spreadsheet. To ensure consistency with the USNVC, botanical nomenclature follows that of Kartesz (1999). Cover class scores for each species was then entered for each vegetation sample plot. Error checking procedures included manual inspection for transcription errors, invalid formats, values, and species codes. After error checking was completed, archival data files and data forms were prepared. As necessary, environmental variables and site descriptors were calculated or derived and numerical indices derived from descriptive scalars (e.g. inundation). The Excel spreadsheet files were then converted to PC-ORD format (Version 4.25; McCune and Mefford 1999).

Data analysis involved both classification and ordination techniques on the full data set. Then various further reductions were derived by separately removing weedy species, poor quality sites, and herbs. TWINSPAN (Hill 1979b) and Cluster Analysis within PC-ORD (Version 4.25; McCune and Mefford 1999) were used as tools for developing a classification of vegetation types. Both of these analyses were used because Two Way Indicator Species Analysis is a polythetic divisive classification model while Cluster Analysis is a polythetic agglomerative classification model. They determine classifications using different assumptions and mathematical algorithms (Gauch 1982, Jongman *et al.* 1995).

Two-way indicator species analysis or TWINSPAN implemented in PC-ORD (Version 4.25; McCune and Mefford 1999) was performed on the entire untransformed data set. Default settings of minimum group size for division (5), maximum number of indicators for division (5), and maximum level of divisions (6) were selected. Pseudospecies cut levels selected were user defined and set to the nine cover class scores (Table 1) determined from cover estimations. Cluster analysis performed in PC-ORD (Version 4.25; McCune and Mefford 1999) used the Lance-Williams Flexible-Beta linkage method (Lance and Williams 1967, 1968) with distance measure set to Sorensen (Bray-Curtis) (Bray and Curtis 1957) and beta (β) set to the default value of –0.25. Initial analyses involved clustering 76 vegetation sample plots using raw cover class scores. This procedure resulted in a dendrogram containing three primary clades that coarsely represented 1) tidal hardwood swamps dominated by *Fraxinus* spp. 2) tidal forests/woodlands dominated by *Taxodium distichum*, and 3) tidal woodlands dominated by *Pinus taeda*. Plots representing each clade were then separated into data subsets and reclustered independently into compositionally similar vegetation types (associations).

Vegetation types recognized using these classification statistics were refined through subsequent interpretation and comparison with other data. Compositional summary statistics (Table 3) for each type were then calculated using a customized Excel macro written in Visual Basic by Philip P. Coulling of the Virginia Natural Heritage Program. These statistics were used to guide the selection of diagnostic and nominal species for each type, with reference, where possible, to existing vegetation community types. This resulted in a meaningful classification of associations, which was cross-walked with existing vegetation community types in the USNVC using the Ecology Access Reporting Tool (Version 2.7; NatureServe 2002) and regional classifications from various states.

Table 3. Compositional Summary Statistics (adapted from Fleming and Coulling 2001)

Compositional Statistic	Definition
Frequency	The number of samples in a group in which a species occurs
Mean Cover	Back-transformed cover class value corresponding to mean percent cover calculated from midpoint values of cover class ranges
Relative Cover	The arithmetic difference between mean cover (for a given group of samples) and total mean cover (for the entire dataset)(= Mean Cover – Total Mean Cover)
Constancy	The proportion of samples in a group in which a species occurs (= frequency / number of samples in a group x 100)
Fidelity	The degree to which a species is restricted to a group, expressed as the proportion of total frequency that frequency in a give group constitutes (= frequency / total frequency x 100)
Indicator Value (IV)	(= Constancy x Fidelity / 100)
Indicator Value Adjusted by Cover, Scale	(Adj IV [scaled]) (= Indicator Value x Mean Cover / 9)
Indicator Value Adjusted by Cover, Unscaled	(Adj IV [unscaled]) (= Indicator Value x $2^{\text{relative cover}}$)
Mean Species Richness	The average number of species present per plot *(S)*; only species rooted inside plot boundaries were included in this calculation
Homoteneity	The mean constancy of the *S* most constant species, expressed as a fraction; higher values for homoteneity indicate a greater uniformity in species composition among plots.

Ordination techniques were used to identify the relationships of recognized vegetation types to one another and the environmental gradients along which they are distributed (Gauch 1982; Jongman *et al.* 1995). These techniques were also used to validate the vegetation types determined with the classification models. Ordination was performed using the Detrended Correspondence Analysis (Hill 1989a) and Non-metric Multidemsional Scaling (NMDS; Kruskal 1964) modules in PC-ORD (McCune and Mefford 1995).

The objective algorithms of the analysis techniques within PC-ORD were the primary tool used to determine the vegetation classification (McCune and Mefford 1995). But, these analysis techniques often do not recognize compositional subtleties of similar communities. They often focus on presence or absence of certain species, which can be due to seasonal and conditional biases rather than true community shift. Therefore, a certain degree of subjective determination by highly trained project ecologists, with the consultation of regional ecologists, was utilized to fine-tune the classification.

Detailed descriptions of each vegetation community type were prepared. They contain descriptions of physiognomy and composition, the range of habitat conditions across which a type occurs, and spatial distribution. They also include the features that distinguish a type from similar types, nomenclatural synonymy, global and state conservation rank, lists of rare species, a discussion of characteristic species, and conservation and management concerns. Also, a list of high quality reference sites was created. These include detailed site descriptions and accurate digital maps created in Maptech® Terrain Navigator Pro (Version 6.02) and ArcView 3.2a.

Data compilation and analysis occurred during the time period from December 2003 to March 2004.

RESULTS

Of the 227 sites initially identified as potential tidal forests to visit, 158 sites were visited and quantitative vegetation data was collected from 79 plots. Existing data from seven plots was combined with 79 plots for an analysis of 86 plots. The analysis of these data yielded five associations representing three forest/woodland alliances of the USNVC. Of the three alliances recognized, the *Pinus taeda* tidal woodland alliance has been newly proposed to ensure proper placement within the hierarchy of the USNVC. Three of the five associations identified in Maryland are newly defined for the USNVC. These include the *Taxodium distichum – Nyssa biflora / Bignonia capreolata* Tidal Forest, *Taxodium distichum / Carex hyalinolepis* Tidal Woodland, and *Pinus taeda / Morella cerifera / Spartina patens* Tidal Woodland associations.

Community Descriptions

The interpretation of ecological statistics was used as a tool to clarify relationships of field observations. The classification of forested tidal wetland in Maryland ascertained five forest/woodland associations:

- ***Fraxinus pennsylvanica – Acer rubrum / Polygonum* spp. Tidal Woodland (CEGL006165)**
- ***Fraxinus profunda – Nyssa biflora / Ilex verticillata / Polygonum arifolium* Tidal Woodland (CEGL006287)**
- ***Taxodium distichum – Nyssa biflora / Bignonia capreolata* Tidal Forest (CEGL006850)**
- ***Taxodium distichum / Carex hyalinolepis* Tidal Woodland (CEGL006845)**
- ***Pinus taeda / Morella cerifera / Spartina patens* Tidal Woodland (CEGL006849)**

The complete descriptions of these vegetation communities can be found in the Community Description section of this report.

Reference Sites

One site containing an exemplary example of each of the five vegetation types was identified, mapped, and described. The order of these sites in this report corresponds to the order in which its vegetation community is described. These sites are: Upper Patuxent River, Marshyhope Creek, Pocomoke River, Hickory Point Cypress Swamp, and Moneystump Swamp – Blackwater River. Although representative vegetation exists on Maryland's eastern shore for the *Fraxinus pennsylvanica – Acer rubrum / Polygonum* spp. Tidal Woodland (CEGL006165) no eastern shore plots were selected as a reference site. Instead, the Upper Patuxent River on Maryland's western shore was chosen as the best example of this vegetation. The full descriptions of these sites can be found in the Reference Site Description section of this report.

DISCUSSION

Site Visits

During the landscape analysis for this project, 227 potential sites were identified for assessment. The most productive method used to determine these sites was analyzing digital orthophotography in conjunction with National Wetlands Inventory maps. Several sites were also identified through consultation with regional ecologists and from de novo surveys. During the field surveys for this project, approximately 158 of the 227 potential sites were visited for assessment. Approximately 79 sites were not sampled due to heterogeneous vegetation, small size, degraded habitats, inaccurate NWI signatures, and time constraints. After a preliminary understanding of forested tidal community types on the Eastern Shore was established, the need to collect additional data in those types tapered. However, several weeks were spent collecting plot data from the Western Shore of Maryland. This proved to be extremely beneficial in understanding the statewide distribution of certain *Fraxinus* spp. dominated communities. After the preliminary classification was developed, sites were visited to check this classification and data was collected only in suspected new community types. As a rule of thumb, between five and ten vegetation sample plots for each community type are best for an accurate classification. Since this classification has five community types, the 86 plots are considered ample for their description.

Classification

This project yielded five forested associations found within tidal wetlands of Maryland's Eastern Shore. This classification is a product of untangling statistical analyses and interpreting the landscape. These community types were determined by balancing the results of various classification and ordination techniques on several versions of collected data with the opinions of project ecologists, regional ecologists, and regional community classifications. One cannot solely utilize multivariate statistical methods and expect to determine an ecologically meaningful classification. These statistics are merely a tool, albeit an extremely powerful one, to assist in the understanding of ecological information. Often times, these tools cannot accurately examine subtle relationships between generally similar vegetation types and create groups based on the presence or absence of less ecologically meaningful species. Through subsequent analyses of these data, it was determined that all of the vegetation types are influenced by several abiotic factors. The dominant factors that determined the classification of these vegetation types are salinity, elevation, and frequency and duration of tidal flooding.

Forested Wetland Conditions – Past and Present

Many high quality examples of tidal forested wetlands were encountered on Maryland's Eastern Shore. Despite these exceptional examples, several areas on the Eastern Shore suffer from significant abiotic and biotic threats. Many of these threats have led to qualitative changes in wetland function, structure, and composition. Agricultural runoff, coastal erosion, upland development, logging, and the spread of invasive species such as Common reed *(Phragmites australis)* continue to place pressure on Maryland's wetlands. Recently, there has been a sharp reduction in overall wetland acreage loss due to strong regulation of coastal wetland alterations through Maryland's Tidal Wetlands Act and through Federal regulations (e.g., *Section 404 program, Section 10 program)* pursuant to the Federal Clean Water Act (Tiner and Burke 1995). Prior to these regulatory measures, most wetland loss was attributed to activities such as ditching, dredging, and impoundment construction. The effects of chronic, eustatic sea level rise in the Chesapeake Bay region has been well documented by many researchers. More recently, studies have centered around the estuarine marshes bordering Blackwater River in Dorchester County. Although chronic, eustatic sea level rise is thought to be the principal cause of wetland loss in certain areas, isostatic processes such as crustal plate elevation and local events such as subsidence resulting from groundwater withdrawal have also postulated to contribute to the phenomenon. Changes in vegetation structure and composition such as contemporary crown stress and tree mortality due to these suspected processes are apparent in this area and other parts of the Chesapeake Bay region. Such changes are believed to be an artifact of salinity gradients shifting upstream in estuarine tidal river systems. This phenomenon is visible along portions of the Blackwater River where fringing snags and stumps of Loblolly pine (*Pinus taeda*) border otherwise healthy forests. On the Potomac River, similar observations of this conversion to open woodlands and marsh in Ash (*Fraxinus* spp.) dominated tidal forests have also been noted (C. Lea, pers. comm.). Here, tidal forests dominated by Ash unusually contain a nearly monospecific herb dominance of Spatterdock or Broadleaf Pondlily (*Nuphar lutea* ssp. *advena*). Reduction in canopy cover will likely continue to accelerate the conversion of tidal forested habitats to open woodlands and marshes.

By definition, forested tidal wetlands are defined as diurnal to irregularly flooded palustrine or estuarine wetlands dominated by trees greater than 6m in height. For purposes of this study we have concentrated on those wetlands containing 5% or greater canopy coverage representing three physiognomic classes; sparse woodland (5-25% cover), woodland (25-60% cover), and forest (60-100% cover). In Maryland, forested tidal wetlands have been estimated to occupy a total of 16,798 acres (McCormick 1982). McCormick (1982) further splits these communities into three main groups distinguished by the most dominant species; Bald cypress forests, Red maple/Ash forests, and Loblolly pine swamp forests.

The first of these groups are Bald cypress forests, which cover approximately 4,000 acres in Worchester and Somerset Counties. This community is strongly associated with the Pocomoke River watershed, however small isolated occurrences are known from other locals throughout the coastal plain. Shreve (1910) mentions Bald cypress as common in the Pocomoke River, infrequent on the Wicomico River (Tonytank Creek), and known from portions of the western shore on Battle Creek (Calvert County) and near Marshall Hall (Charles County). The Pocomoke River supports the northern most significant extent of Bald cypress that undergoes lunar tidal inundation in the United States. During the early part of the eighteenth century, the cypress trees along the Pocomoke River supported a large and expanding shingle making industry. While this industry originally found its beginning in local housing construction, it quickly became a national supplier due to the high demand for this resilient wood, and by 1850 “hardly [any] decent-sized cypress [were] left standing in the whole swamp” (Dennis 1986). The devastation didn’t end there however because “shortly before the Civil War, the industry was revitalized” due to the discovery of huge remnant cypress logs embedded within the peat a few feet from the surface (Dennis 1986). These logs were subsequently mined, scooped out and dragged to where they could be cut into manageable sections (Dennis 1986). Finally, by 1920 this industry became defunct due to the manufacturing of cheaper redwood shingles from the west, however in 1930, a fire which “burned for eight months” destroyed any remaining fossilized cypress, “peat and embedded logs… leaving a watery waste of blackened snags” (Dennis 1986). Since that time, this watershed is slowly returning to perhaps its original state. While still young, the Bald cypress is once again gracing the canopy with its magnificent arching limbs. Two distinct Bald cypress types were determined from this project and include the *Taxodium distichum – Nyssa biflora / Bignonia capreolata* Tidal Forest (CEGL006850) and the *Taxodium distichum / Carex hyalinolepis* Tidal Woodland (CEGL006845).

The second of these community groups described by McCormick (1982) are tidal forests dominated by Red maple (*Acer rubrum)* and Ash (*Fraxinus* spp.*)*. This group is considered the most extensive occupying approximately 11,391 acres of coastal plain wetlands. Data analyses from this project yielded two distinct types distinguished by either Green ash *(Fraxinus pennsylvanica)* or Pumpkin ash *(Fraxinus profunda).* Historically seen as a rarity perhaps due to difficulties in identification, Pumpkin ash was found to be dominant throughout the majority of coastal plain tidal forests. These wetlands typically contain species of more southern origin such as Sweetbay *(Magnolia virginiana)* and Swamp Blackgum *(Nyssa biflora)* and are at the northernmost limit of their distribution in Maryland. Interestingly, at first glance similarities in species composition and structure between the Pumpkin ash type and Bald cypress community is uncanny. Even others have commented that the only noticeable “aspect that differentiates a Bald Cypress floodplain wetland from a deciduous mixed hardwood floodplain wetland, is the presence of Bald Cypress itself” which simply assumes dominance in the canopy over the other associated tree species (McAvoy 1993). While the exact reasons for their remarkable similarity is uncertain, a couple of possibilities could be; historically, Bald cypress was much more widespread and is now absent due to logging and lack of seed source, or that certain abiotic conditions have prevented Bald cypress from spreading into other river watersheds. Tidal forests dominated by Green ash and Red maple is considered a more northern type usually lacking the previously mentioned southern species. This type is at the southernmost limit of its distribution in Maryland. Aside from the dominant species, landscape position and soil composition of this type differed from the Pumpkin ash wetland type by apparent restriction to the uppermost portions of tidal rivers due to gradual elevation gradients and by soils containing considerable amounts of clay. The two types determined from the project are the *Fraxinus pennsylvanica – Acer rubrum / Polygonum* spp. Tidal Woodland (CEGL006165) and the *Fraxinus profunda – Nyssa biflora / Ilex verticillata / Polygonum arifolium* Tidal Woodland (CEGL006287).

The third and final group is seen as resulting from "sea level [rise] and coastal subsidence on the Delmarva Peninsula" (Tiner 1995). The estuarine forested wetlands dominated by Loblolly pine covers 1,253 acres, the majority of which (806 acres) are found in Dorchester County (McCormick 1982). This group is defined as being open and savanna like in composition and occurs where "low-lying pine flatwoods dominated by Loblolly pine are now subject to frequent tidal flooding with salt water" (Tiner 1995). Eventually these hydrologic conditions encourage halophytes to move into the understory, advancing the salt marsh into the bordering Loblolly pine community. According to Tiner, this is "not a recent phenomena, since similar observations were reported in the early 1900s (Shreve 1910a)" (Tiner 1995). Unfortunately, while Loblolly pine can withstand some flooding, long-term exposure during the growing season will eventually stress this species until its eventual demise. Tree mortality rates are extremely high within this community and dead trunks and stressed crowns are commonly seen within and in the surrounding areas. The *Pinus taeda – Morella cerifera / Spartina patens* Tidal Woodland (CEGL006849) is the single type described from this group.

Conservation Implications

Current conservation norms determine protection priorities based on species level information. Although the conservation of rare, threatened, and endangered species is a reasonable endpoint, often these species occur in highly fragmented and human dominated landscapes. These habitat conditions may not allow the persistence of these species. This type of conservation is substantively attempting to maintain biodiversity through protecting these occurrences as umbrella endpoints. However, the conservation of biodiversity may be better served through the protection of rare and/or exemplary common examples of vegetation communities. Vegetation communities can play a much broader role by linking habitat and process information to specific species requirements (WPC 1998). Potentially, the protection of vegetation communities will protect the full range of heterogeneity on the landscape, and thus biodiversity. Communities can have longer term viability than rare, threatened, and endangered species. Generally, a large scale stochastic event must occur to alter the structure and composition of vegetation communities at a site, while smaller scale events could eliminate a species from that same site.

Proper documentation and understanding of the biotic and abiotic factors that contribute to vegetation communities can lead to predictive ability of where these communities occur on the landscape, what species can be found within them, and what rarity and condition qualities exist. By creating a classification of Maryland's forested tidal wetland communities, this project has assisted in these factors.

The information obtained from this project will be used in planning and regulation by state agencies, federal agencies, municipalities, land trusts, and conservation groups concerned with protection of ecological values in the following ways:

> 1) Inventory information is used directly within the state's regulatory framework. The Wildlife and Heritage Service, Maryland Department of Natural Resources, serves as a clearing house of information on the status, location, and distribution of rare plant and animal species and exemplary natural communities in the state. The Wildlife and Heritage Service administers the state's Threatened and Endangered Species Act, which requires the compliance of state agencies, private land developers in the protection of threatened and endangered species with the state via permitting for proposed activities affecting said species.

The Wildlife and Heritage Service has long reviewed proposed activities of many state agencies, and is collaborating with the state's Water Resources Administration to review wetland permit applications. Water Resources' Water and Wetlands Program has adopted rules, which require that impacts on state-listed plant and animal species and exemplary natural communities tracked in the Biological Conservation Database (BCD) must be considered for all major and minor projects.

2) Protection results through the dissemination of Natural Heritage information to traditional users of this data, including federal agencies, developers, consultants, private landowners, municipalities, and conservation groups. These groups request natural resource information in the early planning stages of local projects, and for longer term municipal zoning, development planning , and conservation priority setting.

3) This inventory also complements Section 104(b)(3) projects undertaken by the Nontidal Wetlands and Wetlands and Waterways Division in several ways. The Water Resources Division is currently developing a computerized database for accessing permitting information more efficiently. Natural Heritage information on unique wetland resources could be represented as a GIS data layer in this database. This would help create a better permit review context for applications received by the Service. Although this option is available, Wildlife and Heritage Service staff currently review wetlands permits and other applications and provide comments on the potential project impacts directly to the Nontidal Wetlands and Waterways Division. This data will also aid in the development of watershed management plans. Inventory must be completed as one of the first steps in plan development.

4) The results from this project will be shared with the governments and conservation organizations of neighboring states with similar community types. This data will also be shared with NatureServe and The Nature Conservancy. The data will be compiled with the data from other states and analyzed with a regional perspective. This will increase the ability to recognize meaningful patterns and make classification decisions, which will in turn result in an improved context for making conservation and management decisions over a large and comprehensive landscape on the scale of natural community and species ranges (WPC 1998).

5) The results of this project provide the necessary baseline data for long term monitoring for assessing the function of similar tidal wetlands by other wetland researchers. Reference wetlands are recommended as the best examples of each community type defined for continued research by EPA cooperators. This information will also be used to provide a critical reference by which to measure the success of mitigation efforts.

TIDAL HARDWOOD SWAMPS

Community Descriptions

FRAXINUS PENNSYLVANICA – ACER RUBRUM / POLYGONUM SPP. TIDAL WOODLAND
Green Ash – Red Maple / Smartweed Tidal Woodland

GLOBAL ELEMENT CODE CEGL006165

NATIONAL SYNONYM Equivalent to *Acer rubrum - Fraxinus pennsylvanica / Polygonum* spp. Woodland [CEGL006165] of the USNVC.
Related in part to *Fraxinus (profunda, pennsylvanica) – (Nyssa biflora) / Polygonum arifolium* Woodland [CEGL006287] of the USNVC.

TNC SYSTEM Terrestrial
PHYSIOGNOMIC CLASS Woodland
PHYSIOGNOMIC SUBCLASS Deciduous Woodland
PHYSIOGNOMIC GROUP Cold-deciduous Woodland
PHYSIOGNOMIC SUBGROUP Natural/Semi-natural
FORMATION Tidal Cold-deciduous Woodland
ALLIANCE *Acer rubrum – Fraxinus pennsylvanica* Tidal Woodland Alliance
ECOLOGICAL SYSTEM Atlantic Coastal Plain Northern Tidal Wooded Swamp[CES203.282]

ENVIRONMENTAL DESCRIPTION
Tidal woodland of diurnally to irregularly flooded freshwater river systems on Maryland's coastal plain. This community type is restricted to the uppermost portions of tidal rivers where tidal influence is minimal due to gradual elevation gradients. Vegetation is best developed on larger river systems where tides occur over considerable distance. Salinity is typically less than 0.5 ppt due to the dilution of tidal inflow from sufficient upstream freshwater sources; however, spring high tides or low river discharge may result in pulses of higher salinity. Stands develop on low floodplains forming physiognomically distinct pockets, points and fringes varying in size from small patches to large (> 10 ha) stands. When compared to other forested tidal wetlands, this community type differs by occurring on slightly higher landscape positions containing firmer substrates. Hummock-and-hollow microtopographic features are still characteristic of these habitats although in some areas such features may be less pronounced. Soils are generally characterized as poorly drained slightly acidic tidal muck containing high amounts of silt and clay.

VEGETATION DESCRIPTION
Diverse and structurally complex tidal woodlands with open canopies dominated by *Fraxinus pennsylvanica*. Of the stands sampled, canopy (> 20 meters tall) coverage is generally less than 20%, poorly developed, and may sometimes be entirely absent. A moderately diverse and dense subcanopy is dominated by *Fraxinus pennsylvanica* (25-75% cover) and to a lesser extent *Acer rubrum* (1-10% cover). Although inconsistent, species such as *Ulmus americana, Carpinus caroliniana,* and *Salix* nigra may also occur in the subcanopy. Depending on landscape position and proximity to habitats with different flooding regimes (i.e. Non-tidal), stands may occasionally contain a few individuals of *Acer negundo* and *Platanus occidentalis.* These woodlands typically have a relatively open shrub stratum that is variable in species richness. The most constant shrub species include *Viburnum recognitum* (2-5% cover), *Rosa palustris* (1-2% cover) and *Ilex verticillata* (1-2% cover). Other notable taxa include *Lindera benzoin, Viburnum prunifolium, Cornus amomum,Alnus serrulata* and saplings of *Acer rubrum* and *Fraxinus pennsylvanica.* Lianas and herbaceous vines are also common in multiple strata and can abound in light gaps and on stand edges. Vines common in these woodlands includes species such as *Toxicodendron radicans, Smilax rotundifolia, Apios americana, Parthenocissus quinquefolia,* and *Mikania scandens.* Species richness in the herbaceous layer is exceptionally high and can be attributed to microtopographic features (i.e. hummock-and-hollows), elevation and duration of tidal flooding. Regularly flooded hollows primarily support flood-tolerant swamp species such as *Polygonum sagittatum, Polygonum arifolium, Polygonum punctatum, Impatiens capensis,* and *Peltandra virginica.* Species such as *Viola cucullata, Cicuta maculata, Onoclea sensibilis,* and *Boehmeria cylindrica* prefer establishment on slightly drier, elevated hummocks.

SUMMARY STATISTICS
Relative Basal Area: *Fraxinus pennsylvanica* (81.6% m^2/ha), *Acer rubrum* (8.4% m^2/ha)
Range of species richness of 5 sample plots is 29-51 species • 400 m^2.
Mean species richness of 5 sample plots is 37 species • 400 m^2.
Homoteneity = 0.638

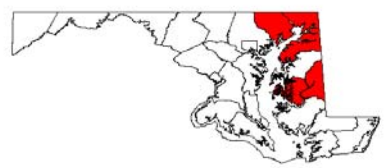
DIAGNOSTIC SPECIES
Fraxinus pennsylvanica

MOST ABUNDANT SPECIES

Stratum	Species
Tree	*Fraxinus pennsylvanica, Acer rubrum*
Shrub	*Viburnum recognitum, Ilex verticillata, Rosa palustris*
Vine	*Toxicodendron radicans, Smilax rotundifolia, Parthenocissus quinquefolia*
Herbaceous	*Polygonum arifolium, Polygonum sagittatum, Polygonum punctatum, Impatiens capensis, Peltandra virginica*

NOTEWORTHY SPECIES
[none]

DISTRIBUTION
Fraxinus pennsylvanica – Acer rubrum / Polygonum spp. tidal woodlands are restricted to the upper portions of coastal plain rivers and tributaries. In Maryland, this community type is supported by data from five vegetation sample plots, which are located from the Gunpowder (Little Gunpowder Falls), Patuxent (Back Channel), and Choptank (Tuckahoe Creek) River drainages. The potential for additional occurrences in the Chesapeake Bay watershed is high.



CONSERVATION RANK
S2

REFERENCE PLOTS (some plots may represent a single stand)
GUNP001, Little Gunpowder Falls, Baltimore County (Zone 18 381334E, 4362059N)
GUNP002, Little Gunpowder Falls, Baltimore County (Zone 18 381396E, 4362141N)
PATU001, Patuxent River, Prince Georges County (Zone 18 351903E, 4298219N)
TUCK001, Tuckahoe Creek, Talbot County (Zone 18 419685E, 4301228N)
TUCK004, Tuckahoe Creek, Talbot County (Zone 18 419606E, 4301491N)

COMMENTS
Naming vegetation types in the U.S. National Vegetation Classification require we follow standardized guidelines adopted by NatureServe. Nominal species are chosen from the most characteristic, dominant, and diagnostic species within a group of vegetation sample plots. From this study, it was determined that tidal swamp dominated by *Fraxinus pennsylvanica* in Maryland are conceptually equivalent to the *Acer rubrum - Fraxinus pennsylvanica / Polygonum* spp. woodland (CEGL006165) type in the USNVC. Although characteristic of this type, we determined *Acer rubrum* to be less important and *Fraxinus pennsylvanica* to be of higher diagnostic value. To emphasize the importance of *Fraxinus pennsylvanica,* we decided to place it first in the association name.

According to the National Vegetation Classification System (NatureServe 2003), *Acer rubrum - Fraxinus pennsylvanica / Polygonum* spp. woodlands (CEGL006165) are confined to tidal rivers of Massachusetts, New York, and New Jersey. Results from this study in Maryland indicate that a range extension is warranted. In addition, this vegetation type is likely analogous to the more southern *Fraxinus profunda – Nyssa biflora / Ilex verticillata / Polygonum arifolium* tidal woodland vegetation (CEGL006287). This association is differentiated from *Fraxinus pennsylvanica – Acer rubrum / Polygonum* spp. tidal swamps by the presence of more southern species, such as *Fraxinus profunda, Magnolia virginiana, Nyssa biflora,* and occasionally *Pinus taeda*.

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FRAXINUS PROFUNDA – NYSSA BIFLORA / ILEX VERTICILLATA / POLYGONUM ARIFOLIUM TIDAL WOODLAND
Pumpkin Ash – Swamp Blackgum / Winterberry / Halberd-leaf Tearthumb Tidal Woodland

GLOBAL ELEMENT CODE	CEGL006287
NATIONAL SYNONYM	Equivalent to *Fraxinus (profunda, pennsylvanica) – (Nyssa biflora) / Polygonum arifolium* Woodland [CEGL006287] of the USNVC. Related in part to *Acer rubrum - Fraxinus pennsylvanica / Polygonum spp*. Woodland [CEGL006165] of the USNVC.
TNC SYSTEM	Terrestrial
PHYSIOGNOMIC CLASS	Woodland
PHYSIOGNOMIC SUBCLASS	Deciduous Woodland
PHYSIOGNOMIC GROUP	Cold-deciduous Woodland
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural
FORMATION	Tidal Cold-deciduous Woodland
ALLIANCE	*Acer rubrum – Fraxinus pennsylvanica* Tidal Woodland Alliance
ECOLOGICAL SYSTEM	Atlantic Coastal Plain Northern Tidal Wooded Swamp[CES203.282]

ENVIRONMENTAL DESCRIPTION

Tidal woodland characteristic of diurnally or irregularly flooded freshwater systems bordering the upper reaches of Maryland's coastal plain rivers and tributaries. Salt concentrations of nearby waters are typically less than 0.5 ppt due to the dilution of tidal inflow from sufficient upstream freshwater sources; however, spring high tides or low river discharge may result in pulses of higher salinity. Development and persistence of these habitats is apparently limited downstream by salinity gradients and upstream by the availability of sufficient sediment. Therefore, these habitats are primarily associated with the upper end of the freshwater portion of the salinity gradient. Typically, these woodlands form a physiognomically distinct zone on low floodplains between dry, gradually sloping uplands and tidal emergent vegetation. Stand size is variable ranging from small patches in to large (>40 hectares), linear stands. Pronounced hummock-and-hollow microtopography is characteristic of this community type. Hollows are regularly inundated by tidal water, whereas hummocks are less frequently flooded thus supporting the establishment of trees and mesophytic herbs. Soils are poorly drained slightly acidic tidal muck consisting of variable amounts of silt or fine sands mixed with partially decomposed organic matter.

VEGETATION DESCRIPTION

This vegetation type belongs to a group of structurally complex woodlands with open (25-50% cover) canopies and floristically diverse multiple lower strata. The canopy is dominated by *Fraxinus profunda,* (10-25% cover), *Nyssa biflora* (5-10% cover) and *Acer rubrum* (10-25% cover). Less frequent taxa may include *Fraxinus pennsylvanica, Liquidambar styraciflua, Ulmus americana* and *Pinus taeda.* Although not distinct, the subcanopy is often comprised of trees such as *Fraxinus profunda, Acer rubrum,* and tall shrubs of *Magnolia virginiana.* A dense and remarkably diverse shrub stratum just below the subcanopy consistently includes species such as *Viburnum recognitum* (5-10% cover) and *Ilex verticillata* (2-5% cover). Other notable taxa within this stratum include *Lindera benzoin, Viburnum nudum, Cornus amomum, Rhododendron viscosum, Vaccinium corymbosum, Rosa palustris, Leucothoe racemosa, Clethra alnifolia* and *Amelanchier canadensis.* Less frequent shrubs include *Ilex opaca, Alnus serrulata, Viburnum prunifolium, Lyonia ligustrina, Morella cerifera (=Myrica cerifera), Photinia pyrifolia (=Aronia arbutifolia), Cephalanthus occidentalis, Carpinus caroliniana* and *Itea virginica.* Lianas and herbaceous vines are common in multiple strata and include species such as *Dioscorea villosa, Toxicodendron radicans, Smilax rotundifolia,* and *Parthenocissus quinquefolia*. Other less abundant vines include *Mikania scandens, Bignonia capreolata, Smilax laurifolia, Smilax walteri, Clematis virginiana,* and *Mitchella repens.* In addition to these species, non-native species such as *Clematis terniflora* and *Lonicera japonica* can be locally abundant in light gaps and on stand edges bordering open marshes and rivers. High species richness in the herb layer can be contributed to flooding frequency and hummock-and-hollow microtopography. Regularly flooded hollows support many flood-tolerant swamp species such as *Impatiens capensis, Peltandra virginica, Polygonum arifolium, Polygonum punctatum, Saururus cernuus,* and sedges such as *Carex crinita, Carex bromoides,* and *Carex stricta.* In cases where tidal woodlands are transitional to open marshes, species such as *Zizania aquatica, Leersia oryzoides,* and *Acorus calamus* may intergrade. Elevated above normal high tides, hummocks provide habitat for *Viola cucullata, Cinna arundinacea, Cicuta maculata, Pilea pumila, Boehmeria cylindrica,* and ferns such as *Osmunda regalis* var. *spectabilis, Osmunda cinnamomea,* and *Thelypteris palustris.*

SUMMARY STATISTICS
Relative Basal Area: *Fraxinus profunda* (54.1% m^2/ha), *Nyssa biflora* (23.2% m^2/ha), *Acer rubrum* (15.5% m^2/ha)
Range of species richness of 23 sample plots is 34-54 species • 400 m^2.
Mean species richness of 23 sample plots is 43 species • 400 m^2.
Homoteneity = 0.733

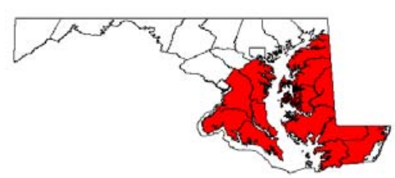
DIAGNOSTIC SPECIES
[none]

MOST ABUNDANT SPECIES

Stratum	Species
Tree	*Fraxinus profunda, Nyssa biflora, Acer rubrum*
Shrub	*Viburnum recognitum, Ilex verticillata, Lindera benzoin, Rhododendron viscosum, Viburnum nudum*
Vine	*Toxicodendron radicans, Smilax rotundifolia, Dioscorea villosa*
Herbaceous	*Osmunda regalis* var. *spectabilis, Polygonum arifolium, Impatiens capensis, Peltandra virginica*

NOTEWORTHY SPECIES
Rare or uncommon plant species that may or are known to occur within this community include *Alnus maritima, Arundinaria gigantea, Carex lacustris, Carex hyalinolepis, Carex mitchelliana, Chamaecyparis thyoides, Fraxinus profunda, Lysimachia hybrida, Melanthium virginicum, Morella heterophylla (=Myrica heterophylla), Pilea fontana, Sphenopholis pensylvanica,* and *Smilax pseudochina.*

DISTRIBUTION
Fraxinus profunda – Nyssa biflora / Ilex verticillata / Polygonum arifolium tidal woodlands are distributed throughout the coastal plain of Maryland, Delaware and Virginia. In Maryland, this community is supported by data from 21 vegetation sample plots, which are located from the Nanticoke (Barren Creek, Chicone Creek, Marshyhope Creek), Pocomoke (Nassawango Creek), Chester, Choptank (Kings Creek, Tuckahoe Creek), and Wicomico River drainages. Two additional plots were sampled along the Nanticoke River (Broad Creek) in Delaware supporting this type. Smaller occurrences of this vegetation type were also documented from the Potomac (Mattawoman Creek, Piscataway Creek) and Patuxent River drainages on the western shore of the Chesapeake Bay (SEE COMMENTS).



CONSERVATION RANK
S4

REFERENCE PLOTS (some plots may represent a single stand)
- BARR001, Barren Creek, Wicomico County (Zone 18 432262E, 4256002N)
- BARR002, Barren Creek, Wicomico County (Zone 18 431330E, 4256708N)
- BARR005, Barren Creek, Wicomico County (Zone 18 431787E, 4256467N)

- BARR006, Barren Creek, Wicomico County (Zone 18 431580E, 4256543N)
- BARR007, Barren Creek, Wicomico County (Zone 18 432287E, 4255753N)
- CC003, Chicone Creek, Dorchester County (Zone 18 428248E, 4263234N)
- CC004, Chicone Creek, Dorchester County (Zone 18 428420E, 4262911N)
- CHES001, Chester River, Kent County (Zone 18 424859E, 4345931N)
- CHES002, Chester River, Kent County (Zone 18 424839E, 4345782N)
- CHOP001, Choptank River, Caroline County (Zone 18 428137E, 4308613N)
- CHOP002, Choptank River, Caroline County (Zone 18 428058E, 4810075N)
- DORM001, Dorman Point, Sussex County, DE (Zone 18 440994E, 4269577N)
- KC009, Kings Creek, Talbot County (Zone 18 414924E, 4294515N)
- KC010, Kings Creek, Talbot County (Zone 18 415353E, 4294499N)
- MARS001, Marshyhope Creek, Dorchester County (Zone 18 429235E, 4271981N)
- MARS003, Marshyhope Creek, Dorchester County (Zone 18 429080E, 4272157N)
- MARS004, Marshyhope Creek, Dorchester County (Zone 18 428705E, 4273345N)
- MARS005, Marshyhope Creek, Dorchester County (Zone 18 429037E, 4276462N)
- PHIL001, Phillips Landing, Sussex County, DE (Zone 18 442325E, 4269264N)
- TUCK002, Tuckahoe Creek, Talbot County (Zone 18 417868E, 4304603N)
- TUCK003, Tuckahoe Creek, Talbot County (Zone 18 418384E, 4303742N)
- WICOM06, Wicomico River, Wicomico County (Zone 18 443071E, 4244020N)
- WICOM07, Wicomico River, Wicomico County (Zone 18 444412E, 4244027N)

COMMENTS
Acer rubrum - Fraxinus pennsylvanica / Polygonum spp. Woodland (CEGL006165) is the northern analog of this association. This association is differentiated from tidal swamps to the north by the presence of species of southern affinity, including *Magnolia virginiana, Nyssa biflora,* and *Pinus taeda*. In addition, *Fraxinus pennsylvanica* was found to be an unimportant component of *Fraxinus profunda – Nyssa biflora / Ilex verticillata / Polygonum arifolium* tidal woodlands thus supporting the case that this association may be endemic to portions of the Chesapeake Bay Lowlands Ecoregion of Maryland, Virginia, and Delaware. Representative stands observed on the western shore of the Chesapeake Bay are generally smaller and not as extensive compared to those on the eastern shore indicating slight geomorphological differences. For example, stands bordering Piscataway Creek are protected by an extensive natural levee system creating backswamp conditions. Although these swamps are subject to diurnal flooding, the tidal range is likely constricted through openings in levees.

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TIDAL BALD CYPRESS FORESTS/WOODLANDS

Community Descriptions

TAXODIUM DISTICHUM – NYSSA BIFLORA / BIGNONIA CAPREOLATA TIDAL FOREST
Bald Cypress – Swamp Blackgum / Cross-vine Tidal Forest

GLOBAL ELEMENT CODE CEGL006850

NATIONAL SYNONYM Related in part to *Taxodium distichum - Nyssa biflora* Chesapeake Bay Forest [CEGL006214] of the USNVC
Related in part to *Taxodium distichum* Tidal Forest [Placeholder] [CEGL006059]
Related in part to *Pinus taeda - Nyssa biflora - Taxodium distichum / Morella cerifera / Osmunda regalis* var. *spectabilis* Forest of the USNVC [CEGL004651]

TNC SYSTEM Terrestrial
PHYSIOGNOMIC CLASS Forest
PHYSIOGNOMIC SUBCLASS Deciduous Forest
PHYSIOGNOMIC GROUP Cold-deciduous Forest
PHYSIOGNOMIC SUBGROUP Natural/Semi-natural
FORMATION Tidal Cold-deciduous Forest
ALLIANCE *Taxodium distichum* Tidal Forest Alliance
ECOLOGICAL SYSTEM(S) Atlantic Coastal Plain Northern Tidal Wooded Swamp[CES203.282]
Atlantic Coastal Plain Southern Tidal Wooded Swamp[CES203.240]

ENVIRONMENTAL DESCRIPTION
Tidal forests bordering mid to upper portions of the Pocomoke River and associated tributaries. Habitats are predominately freshwater (< 0.5 ppt) and subject to periodic inundation by diurnal or irregular lunar tides. Stands are best developed on low floodplains forming a corridor between open tidal marshes and non-tidal habitats further inland. On the Pocomoke River, this community type primarily forms a large (> 40 hectares) continuous fringing stand. Smaller stands typically form physiognomically distinct pockets and points along tributaries. Microtopographic features include pronounced hummock-and-hollows with numerous protruding cypress knees. Hollows are regularly inundated by tidal water, whereas hummocks are less frequently flooded thus supporting the establishment of trees and mesophytic herbs. Soils are poorly drained slightly acidic tidal muck consisting of variable amounts of silt, clay and fine sands mixed with root-rich peats.

VEGETATION DESCRIPTION
Structurally diverse tidal forests best characterized by moderately dense (60-80% cover) to dense (80-100% cover) overstory canopies comprised of *Taxodium distichum* and *Nyssa biflora*. *Taxodium distichum* is strongly diagnostic of this type frequently attaining high cover and constancy. The canopy may also include in variable proportions species such as *Fraxinus profunda* (10-25% cover), *Acer rubrum* (10-25% cover) and occasional individuals of *Liquidambar styraciflua, Pinus taeda,* and *Chamaecyparis thyoides*. *Magnolia virginiana* and *Carpinus caroliniana* are frequent in the understory as trees or tall shrubs. Shrub diversity is exceptionally high within this community and similar in composition and structure to *Fraxinus* spp. dominated tidal wetland types. The most constant species in the shrub stratum include *Ilex verticillata, Ilex opaca, Clethra alnifolia, Rhododendron viscosum* and *Vaccinium corymbosum*. Other notable taxa within this stratum include *Viburnum recognitum, Rosa palustris, Leucothoe racemosa, Carpinus caroliniana, Lindera benzoin* and *Euonymus americana.* Lianas and herbaceous vines are also common and can be locally abundant within multiple strata, especially along forested edges and in light gaps caused by windthrow or other disturbances. The most consistent taxa include *Toxicodendron radicans, Smilax rotundifolia, Parthenocissus quinquefolia* and *Dioscorea villosa,* while other less frequent taxa include *Apios americana, Mikania scandens, Bignonia capreolata* (SEE COMMENTS)*, Campsis radicans, Smilax laurifolia, Smilax walteri, Clematis virginiana* and *Vitis labrusca.* Non-native vine species such as *Lonicera japonica* and *Clematis terniflora* were reported from many stands and tends to abound in light gaps and on stand edges

bordering the water's edge. An exceptionally diverse herb layer is characteristic of this type and can be contributed to several factors including; hummock-and-hollow microtopography, species recruitment from adjacent habitats, tidal frequency and duration. Regularly flooded hollows typically support flood-tolerant swamp species such as *Impatiens capensis, Peltandra virginica, Polygonum arifolium, Iris versicolor and Saururus cernuus.* Hummocks, which are slightly elevated above normal high tides, provide habitat for less flood tolerant species such as *Arisaema triphyllum, Thalictrum polygamum, Viola cucullata, Cinna arundinacea, Cicuta maculata, Boehmeria cylindrica, Carex seorsa, Carex bromoides*, *Carex stricta* and ferns such as *Osmunda regalis* var. *spectabilis, Osmunda cinnamomea, Woodwardia areolata* and *Thelypteris palustris.*

SUMMARY STATISTICS
Relative Basal Area: *Nyssa biflora* (37.7 m^2/ha), *Taxodium distichum* (21.7% m^2/ha), *Fraxinus profunda* (21.2% m^2/ha), *Acer rubrum* (11.4% m^2/ha)
Range of species richness of 9 sample plots is 36-57 species • 400 m^2.
Mean species richness of 9 sample plots is 46 species • 400 m^2.
Homoteneity = 0.775

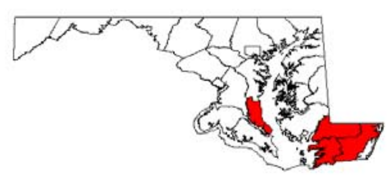
DIAGNOSTIC SPECIES
Taxodium distichum, Carpinus caroliniana, Carex seorsa, Bignonia capreolata

MOST ABUNDANT SPECIES

Stratum	Species
Tree	*Nyssa biflora, Taxodium distichum, Fraxinus profunda, Acer rubrum*
Shrub	*Ilex verticillata, Ilex opaca, Vaccinium corymbosum*
Vine	*Toxicodendron radicans, Smilax rotundifolia,*
Herbaceous	*Polygonum arifolium, Impatiens capensis, Thelypteris palustris*

NOTEWORTHY SPECIES
State rare (S2 to S3.1) plant species that may or are known to occur within this community include *Trillium pusillum* (G2T3, S2), *Fraxinus profunda, Smilax pseudochina, Chamaecyparis thyoides* and *Carex hyalinolepis.*

DISTRIBUTION
In Maryland, *Taxodium distichum – Nyssa biflora / Bignonia capreolata* tidal forests are supported by data from nine vegetation sample plots, which are located along the Pocomoke (Hickory Point, Dividing Creek and Nassawango Creek) River drainage. Although not sampled, similar vegetation may occur along Battle Creek, a tributary of the Patuxent River.



CONSERVATION RANK
S2

REFERENCE PLOTS (Some plots may represent a single stand)

- DIVI001, Dividing Creek, Worchester County (Zone 18 4525523E, 4215983N)
- HICK001, Hickory Point, Worchester County (Zone 18 444816E, 4211895N)
- HICK002, Hickory Point, Worchester County (Zone 18 444591E, 4211808N)
- HICK003, Hickory Point, Worchester County (Zone 18 444306E, 4211469N)
- NASS001, Nassawango Creek, Worchester County (Zone 18 460725E, 4225935N)
- POCO001, Pocomoke River, Worchester County (Zone 18 462734E, 4223414N)
- POCO002, Pocomoke River, Worchester County (Zone 18 456054E, 4218397N)
- POCO003, Pocomoke River, Worchester County (Zone 18 457742E, 4219328N)
- POCO004, Pocomoke River, Worchester County (Zone 18 460452E, 4221735N)

COMMENTS

Although low in cover and occurring in >50% of *Taxodium distichum* stands sampled, *Bignonia capreolata* was chosen as nominal based on high fidelity to this type. In Maryland, *Bignonia capreolata* has a limited distribution and is only known from the Pocomoke River drainage where it occurs in swamp habitats dominated by *Taxodium distichum.*

The Pocomoke River and Battle Creek (Patuxent River) represent the natural northernmost limit of extensive bald cypress forests in Maryland. Reports of scattered bald cypress throughout Maryland's coastal plain are frequent, thus supporting the case that this species was once more common in the Chesapeake Bay watershed. Present day bald cypress are believed to be descendants of trees that occupied the area following the retreat of Pleistocene glaciers approximately 5,000 to 15,000 years ago. Prehistoric fossilized records indicate that this species at one time found its way as far north as Maine and New Hampshire (Dennis 1986). In Maryland, bald cypress stumps have been recovered under the Patapsco River from Baltimore south along the western shore of the Chesapeake Bay (Dennis 1986). In 1905, Bibbins reported that the most extensive deposits appeared to be offshore in the Chesapeake Bay near Bodkin Point and the mouth of the Patapsco River (Dennis 1986). Other areas that this species have been found include Washington D.C. and the Baltimore Harbor.

The current distribution of bald cypress extends from the Chesapeake Bay Region southward through the coastal plain to southern Florida and west to south-central Texas; in the Mississippi Valley this species extends north from Louisiana to southeastern Missouri, southern Illinois, and southwest Indiana (Dennis 1986).

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TAXODIUM DISTICHUM / CAREX HYALINOLEPIS TIDAL WOODLAND
Bald cypress / Shoreline Sedge Tidal Woodland

GLOBAL ELEMENT CODE	CEGL006845
NATIONAL SYNONYM	Related in part to *Taxodium distichum – Nyssa biflora / Bignonia capreolata* Tidal Forest [CEGL006850] Related in part to *Taxodium distichum / Typha angustifolia* Woodland [CEGL004231] of the USNVC Related in part to *Pinus taeda - Nyssa biflora - Taxodium distichum / Morella cerifera / Osmunda regalis* var. *spectabilis* Forest [CEGL004651] of the USNVC
TNC SYSTEM	Terrestrial
PHYSIOGNOMIC CLASS	Woodland
PHYSIOGNOMIC SUBCLASS	Deciduous Woodland
PHYSIOGNOMIC GROUP	Cold-deciduous Woodland
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural
FORMATION	Tidal Cold-deciduous Woodland
ALLIANCE	*Taxodium distichum* Tidal Woodland Alliance
ECOLOGICAL SYSTEM(S)	Atlantic Coastal Plain Northern Tidal Wooded Swamp[CES203.282] Atlantic Coastal Plain Southern Tidal Wooded Swamp[CES203.240]

ENVIRONMENTAL DESCRIPTION
Small, discrete tidal woodlands bordering freshwater portions of the Pocomoke River near Hickory Point Cypress Swamp. Stands sampled are patchily distributed forming pockets and fringes along ecotones that are transitional to non-tidal habitats (i.e. Atlantic white cedar swamps) or uplands. Habitats are best developed on slightly elevated river floodplains frequent to diurnal or irregular lunar tides (SEE COMMENTS). Salinity of tidal waters is typically less than 0.5 ppt due to the dilution of tidal inflow from sufficient upstream freshwater sources; however, spring high tides or low river discharge may result in pulses of higher salinity. Substrates are firm, exhibiting moderate hummock-and-hollow microtopography with numerous cypress knees. Soils are characterized as poorly drained slightly acidic tidal muck containing sands and partially decomposed root-rich peats.

VEGETATION DESCRIPTION
Florisitically diverse tidal woodlands with open, mixed overstories dominated by *Taxodium distichum* (10-25% cover) and *Nyssa biflora* (5-10%). Canopy and subcanopy strata are not well developed attaining less than 20% and 50% cover respectively. Common associates include *Acer rubrum* (10-25% cover), *Liquidambar styraciflua* (5-10% cover), and *Fraxinus profunda* (2-5% cover). In addition, stands bordering extensive non-tidal swamps may include occasional individuals of *Chamaecyparis thyoides.* The shrub stratum is very diverse and variable in density. Shrubs of *Morella cerifera (=Myrica cerifera* 5-10% cover) and *Clethra alnifolia* (1-2% cover) represent the most constant species. Less frequent taxa include *Ilex opaca, Ilex verticillata, Vaccinium corymbosum, Decodon verticillata, Viburnum nudum, Rhododendron viscosum,* and tall shrubs of *Magnolia virginiana* (1-2% cover). Lianas and herbaceous vines are also common in multiple strata and include species such as *Smilax rotundifolia, Smilax laurifolia, Toxicodendron radicans, Dioscorea villosa, Campsis radicans, Parthenocissus quinquefolia, Clematis virginiana,* and *Mikania scandens.* The herbaceous layer is characterized by a nearly monospecific herb dominance of *Carex hyalinolepis.* In some stands, *Carex hyalinolepis* forms extensive dominance patches greater than 80% cover. Despite the high density of this rhizomatous sedge the herb layer is quite diverse. Low cover associates may include *Carex bromoides, Carex stricta, Carex lupulina, Leersia oryzoides, Thelypteris palustris, Peltandra virginica, Polygonum arifolium, Woodwardia virginica, Boehmeria cylindrica* and ferns of *Osmunda cinnamomea* and *Osmunda regalis.* Non-native species such as *Lonicera japonica* and *Microstegium vimineum* were reported from some stands.

SUMMARY STATISTICS
Relative Basal Area: *Nyssa biflora* (51.3% m^2/ha), *Acer rubrum* (17.0% m^2/ha), *Taxodium distichum* (15.1% m^2/ha), *Liquidambar styraciflua* (9.7% m^2/ha), *Fraxinus profunda* (6.9% m^2/ha)
Range of species richness of 4 sample plots is 34-49 species • 400 m^2.
Mean species richness of 4 sample plots is 39 species • 400 m^2.
Homoteneity = 0.705

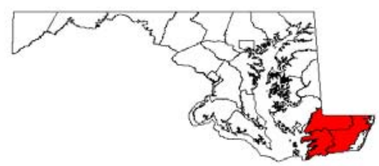
DIAGNOSTIC SPECIES
Taxodium distichum, Carex hyalinolepis

MOST ABUNDANT SPECIES

Stratum	Species
Tree	*Nyssa biflora, Acer rubrum, Liquidambar styraciflua, Taxodium distichum*
Shrub	*Morella cerifera (=Myrica cerifera), Clethra alnifolia*
Vine	*Toxicodendron radicans, Smilax rotundifolia*
Herbaceous	*Leersia oryzoides, Thelypteris palustris, Peltandra virginica, Polygonum arifolium, Osmunda cinnamomea*

NOTEWORTHY SPECIES
Rare or uncommon plant species that may or are known to occur within this community include *Alnus maritima, Carex hyalinolepis, Chamaecyparis thyoides, Fraxinus profunda,* and *Smilax pseudochina.*

DISTRIBUTION
Taxodium distichum / Carex hyalinolepis tidal woodlands are distributed along the Pocomoke River near Hickory Point Cypress Swamp. This community type is supported by data from 4 vegetation sample plots. Similar woodlands have been reported from the James, North Landing, and Northwest Rivers in Virginia (SEE COMMENTS).



CONSERVATION RANK
S1

REFERENCE PLOTS (Plots represent a single stand)
- HICK009, Hickory Point, Worchester County (Zone 18 444176E, 4210987N)
- HICK010, Hickory Point, Worchester County (Zone 18 444377E, 4210844N)
- HICK017, Hickory Point, Worchester County (Zone 18 444069E, 4210892N)
- HICK027, Hickory Point, Worchester County (Zone 18 443818E, 4210907N)

COMMENTS
Similar vegetation has been reported from the Northwest and North Landing Rivers in southeast Virginia and believed to occur in North Carolina (G. Fleming, pers. comm.). Although species composition is remarkably similar, these habitats are influenced by wind tides unlike stands in Maryland, which are strictly lunar tidal.

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TIDAL LOBLOLLY PINE WOODLANDS

Community Descriptions

PINUS TAEDA / MORELLA CERIFERA / SPARTINA PATENS TIDAL WOODLAND
Loblolly Pine / Wax Myrtle / Saltmeadow Cordgrass Tidal Woodland

GLOBAL ELEMENT CODE CEGL006849

NATIONAL SYNONYM [none]

TNC SYSTEM Terrestrial
PHYSIOGNOMIC CLASS Woodland
PHYSIOGNOMIC SUBCLASS Evergreen woodland
PHYSIOGNOMIC GROUP Temperate or subpolar needle-leaved evergreen woodland
PHYSIOGNOMIC SUBGROUP Natural/Semi-natural
FORMATION Tidal temperate or subpolar needle-leaved evergreen woodland
ALLIANCE *Pinus taeda* tidal woodland alliance [proposed]
ECOLOGICAL SYSTEM(S) Atlantic Coastal Plain Northern Tidal Salt Marsh[CES203.519]

ENVIRONMENTAL DESCRIPTION
Small, fringing tidal woodlands characteristic of diurnal to irregularly flooded mesohaline (5.0-18.0 ppt) systems. This community typically occurs along portions of tidal rivers and creeks, but may also occupy narrow ecotones between "high salt marshes" and adjacent uplands and islands in extensive non-riverine habitats. Frequency of tidal flooding is variable, often less than daily due to fluctuations in groundwater levels and landscape position. Substrates are firm relative to other tidal marsh communities and often lacking significant microtopographic features. Soils consist of mixture of silt, fine sands and decomposed organic peat underlain by dark gray, black or greenish-gray silty clay to clayey fine sands, and carbonaceous clay.

VEGETATION DESCRIPTION
Species poor, structurally open tidal woodlands dominated by *Pinus taeda* (25-50% cover) often forming a monospecific overstory. The subcanopy is poorly developed and primarily dominated by *Pinus taeda* but may include occasional members of *Juniperus virginiana, Acer rubrum, Diospyros virginiana, Quercus phellos*, and *Liquidambar styraciflua*. These woodlands have a relatively open shrub stratum with *Morella cerifera* (5-10% cover) most frequent. Other characteristic species in the shrub stratum include *Iva frutescens, Baccharis halimifolia, Ilex opaca, Prunus serotina, Acer rubrum,* and *Juniperus virginiana.* Lianas and herbaceous vines are also common and can be locally abundant within multiple strata. *Toxicodendron radicans* (5-10% cover) is the predominant vine found within these woodlands and in some cases can form dense shrub-like thickets. Less frequent vines include *Smilax rotundifolia, Smilax bona-nox, Mikania scandens, Campsis radicans* and *Parthenocissus quinquefolia*. Indicative of brackish conditions, species diversity in the herbaceous layer is quite low and chiefly comprised of halophytic vegetation. Most frequent and dominant of these include *Spartina patens* (25-50 % cover), *Panicum virgatum* (5-10%) and *Distichlis spicata* (5-10% cover). Other characteristic species include *Solidago sempervirens, Chasmanthium laxum, Pluchea foetidus, Hydrocotyle verticillatus, Schoenoplectus americanus, Polygonum punctatum* and *Ptilimnium capillaceum.* Non-native species such as *Phragmites australis* was reported to be abundant in some stands.

SUMMARY STATISTICS

Relative Basal Area: *Pinus taeda* (94.6% m^2/ha)
Range of species richness of 18 sample plots is 11-21 species • 400 m^2.
Mean species richness of 18 sample plots is 15 species • 400 m^2.
Homoteneity = 0.630

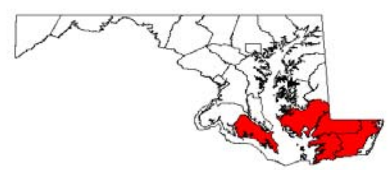
DIAGNOSTIC SPECIES
Pinus taeda, Panicum virgatum, Distichlis spicata, Spartina patens, Iva frutescens, Morella cerifera (=Myrica cerifera)

MOST ABUNDANT SPECIES

Stratum	Species
Tree	*Pinus taeda*
Shrub	*Morella cerifera (=Myrica cerifera), Iva frutescens*
Vine	*Toxicodendron radicans, Smilax rotundifolia*
Herbaceous	*Spartina patens, Distichlis spicata, Panicum virgatum*

NOTEWORTHY SPECIES
Rare or uncommon plant species that may or are known to occur within this community include *Smilax bona-nox* and *Eleocharis fallax.*

DISTRIBUTION
Pinus taeda / Morella cerifera / Spartina patens tidal woodlands are common in mesohaline systems on Maryland's coastal plain. This community type is supported by data from 18 vegetation sample plots, which are located on the Honga River, Blackwater River (Moneystump Swamp), Slaughter Creek (Taylor's Island WMA), Broad Creek (Ellis Bay WMA) and lower Potomac River (Point Lookout State Park).



CONSERVATION RANK
S5

REFERENCE PLOTS (some plots may represent a single stand)
- ELLI001, Ellis Bay WMA, Wicomico Co. (Zone 18 423842E, 4238341N)
- ELLI002, Ellis Bay WMA, Wicomico Co. (Zone 18 423875E, 4238410N)
- HONGA03, Honga River, Dorchester Co. (Zone 18 400373E, 4239434N)
- HONGA04, Honga River, Dorchester Co. (Zone 18 402591E, 4238706N)
- LOOK001, Point Lookout State Park, St. Mary's Co. (Zone 18 383577E, 4212778N)
- LOOK002, Point Lookout State Park, St. Mary's Co. (Zone 18 383530E, 4212717N)
- MONI001, Monie Bay – Deal Island WMA, Somerset Co. (Zone 18 423624E, 4226549N)
- MONI002, Monie Bay – Deal Island WMA, Somerset Co. (Zone 18 423694E, 4226648N)
- STUM001, Moneystump Swamp – Blackwater NWR, Dorchester Co. (Zone 18 396323E, 4255718N)
- STUM002, Moneystump Swamp – Blackwater NWR, Dorchester Co. (Zone 18 396543E, 4255775N)
- STUM003, Moneystump Swamp – Blackwater NWR, Dorchester Co. (Zone 18 396723E, 4255903N)
- STUM004, Moneystump Swamp – Blackwater NWR, Dorchester Co. (Zone 18 396900E, 4255446N)
- STUM005, Moneystump Swamp – Blackwater NWR, Dorchester Co. (Zone 18 398902E, 4255865N)
- TAYL001, Taylor's Island WMA, Dorchester Co. (Zone 18 390672E, 4254552N)
- TAYL002, Taylor's Island WMA, Dorchester Co. (Zone 18 390561E, 4254255N)
- TAYL003, Taylor's Island WMA, Dorchester Co. (Zone 18 387963E, 4257130N)
- TAYL004, Taylor's Island WMA, Dorchester Co. (Zone 18 389966E, 4256391N)
- TAYL005, Taylor's Island WMA, Dorchester Co. (Zone 18 389391E, 4256565N)

COMMENTS
Although this community type is common in brackish marshes, some have postulated that they are generally short-lived. These communities are believed to be an artifact of sea level rise (3.9 mm annually) and marsh subsidence or lack of critical vertical accretion, which subsequently allows for a higher frequency of tidal encroachment to the exposed, surrounding upland pine dominated communities. Due to the hydrologic shift within the subjugated landscape, the already established *Pinus taeda* stands are slowly being converted to regularly exposed marshland. Unfortunately, while the flood tolerance level of *Pinus taeda* is relatively high, signs of stress are becoming more apparent as frequency and length of tidal inundation increases in duration. Indicators of stress may include stunted growth, thinning crowns, and significant tree mortality.

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REFERENCE SITES

Upper Patuxent River — Prince Georges County, Maryland

USGS QUAD

Bristol, MD

PRIMARY REASON FOR SELECTION

Upper Patuxent River contains a high quality occurrence and one of Maryland's best examples of the *Fraxinus pennsylvanica - Acer rubrum / Polygonum spp.* tidal woodland (CEGL006165).

The term high quality occurrence is defined by four factors: 1) the site includes a very representative example of the vegetation type as defined in the Maryland Vegetation Classification, 2) the occurrence is in good to excellent condition -- the habitat supporting this community type is less degraded than other known occurrences --, 3) the occurrence has a good to excellent viability -- long term prospects for the continued existence of this occurrence are high -- and 4) the occurrence has good to excellent defensibility -- this occurrence can be protected from extrinsic human factors.

SITE DESCRIPTION

Upper Patuxent River contains a small (<10 hectares), but representative occurrence of the *Fraxinus pennsylvanica – Acer rubrum* / *Polygonum* ssp. tidal woodland community type. This reference site is located along Back Channel, a small tributary of the Patuxent River located just north of MD Route 4 and approximately 5.5 kilometers east of Upper Marlboro. Here, tidal woodlands dominated by *Fraxinus pennsylvanica* are adjacent to Back Channel and surrounded by mixed freshwater marshes dominated by species such as to *Pontederia cordata*, *Impatiens capensis*, *Polygonum punctatum* and *Leersia oryzoides*. This stand contains a somewhat firm substrate with considerable clay content and features subtle hummock-and-hollow microtopography. Although slightly elevated, stands are regularly flooded due to its proximity to Back Channel and a highly intricate network of small creek and guts. Salinity measurements reported during data collection indicate freshwater conditions at 0.0 ppt. Some areas may receive slightly dampened tidal inflows due to an extensive natural levee system bordering portions of the upper Patuxent River. The levees are narrow, discontinuous, and comprised of species such as *Platanus occidentalis* and *Betula nigra* in the canopy and an understory of *Salix nigra*, *Acer negundo*, *Ulmus americana* and *Carpinus caroliniana.*

Small scattered pockets of tidal shrublands dominated by *Alnus serrulata* and *Viburnum recognitum* are also typical throughout this portion of the Patuxent River. Additionally, a large occurrence of a *Salix nigra* tidal shrubland community is located two kilometers down river from this site, while large expansive stands of *Zizania aquatica* and *Nuphar lutea* ssp. *advena* emergent vegetation communities occur four kilometers south of the site, within the vicinity of Jug Bay.

At least four species considered rare, threatened or endangered in Maryland are known to occur within this community type. In addition, invasive species such as *Lonicera japonica* and *Clematis terniflora* were reported from this site. This site falls within Patuxent River Park system and is managed by the Maryland Department of Natural Resources. Land use within the system is limited to public recreational use. Uplands surrounding this site are primarily agricultural and residential. This reference site falls within the Chesapeake Bay Critical Area and is therefore subject to additional protection regulations.

COMMUNITY DESCRIPTION

Upper Patuxent River was chosen as a reference site primarily because it is habitat to one of the best examples of the *Fraxinus pennsylvanica – Acer rubrum* / *Polygonum* ssp. tidal woodland (CEGL006165) community association known in Maryland. This wetland community type is ranked S2, designating it as a rare community, with only 6 to 20 estimated occurrences in Maryland. This type may have few remaining acres in the state and is imperiled due to its rarity and vulnerability to become extirpated. This particular occurrence is part of a set of similar communities used to define and classify the community types for the Maryland Vegetation Classification, thus a type locality.

This occurrence is very typical of that defined in the Vegetation Description for *Fraxinus pennsylvanica – Acer rubrum* / *Polygonum* ssp. tidal woodland (CEGL006165). See the Vegetation Description section of this report for a precise definition of this community.

MANAGEMENT COMMENTS / MONITORING NEEDS

Wetlands such as *Fraxinus pennsylvanica – Acer rubrum* / *Polygonum* ssp. tidal woodlands are susceptible to many direct and indirect threats. These threats account for significant qualitative and quantitative changes in wetland community structure, composition, and function. Tiner and Burke (1995) summarize the major causes of wetland loss and degradation in Maryland by the following: 1) Discharges of materials (e.g., pesticides, herbicides, other pollutants, nutrient loading from domestic sewage, urban runoff, agricultural runoff, and sediments from dredging and filling projects, agricultural lands, and other land development) into waters and wetlands, 2) Filling for dredged spoil and other spoil disposal, roads and highways, and commercial, residential, and industrial development, 3) Dredging and stream channelization for navigation channels, marinas, flood protection, coastal housing developments, and reservoir maintenance, 4) Construction of dikes, dams, levees, and seawalls for flood control, shoreline protection, water supply, and irrigation, 5) Drainage for crop production, timber production, and mosquito control, 6) Alteration of wetland hydrology and disruption of natural river flows through diversion of fresh water for human uses (e.g., water supply, industry, and agriculture), 7) Flooding wetlands for creating ponds, waterfowl impoundments, reservoirs, and lakes, 8) Clearing of native vegetation and cultivation of agricultural crops, 9) Conversion of “natural” forested wetlands to pine silviculture plantations, 10) Sediment diversion by dams, deep channels, and other structures, and 11) Hydrologic alterations by canals, spoils banks, roads, and other structures. Natural threats such as droughts, subsidence/sea level rise, storm events, erosion, and mechanical damage by wildlife (e.g., Muskrats, Nutria) could also have severe impacts on forested wetlands systems.

PROTECTION COMMENTS

As part of the Patuxent River Park system, this reference site is managed by the Department of Parks and Recreation. In addition, *Fraxinus pennsylvanica – Acer rubrum* / *Polygonum* ssp. tidal woodlands found in the Upper portion of the Patuxent River occur entirely within the Chesapeake Bay Critical Area and are therefore subject to further protection regulations.

OCCURRENCE RANK

Supported by data from one vegetation sample plot (listed below), *Fraxinus pennsylvanica – Acer rubrum* / *Polygonum* ssp. tidal woodlands in the Upper portion of the Patuxent River rank as “A” or excellent, when compared to all other known Maryland examples of this community type. This community has also been located at three other sites in Maryland.

MANAGED AREA NAME / TRACT OWNERSHIP

Patuxent River Park, State of Maryland.

BEST INFORMATION SOURCE

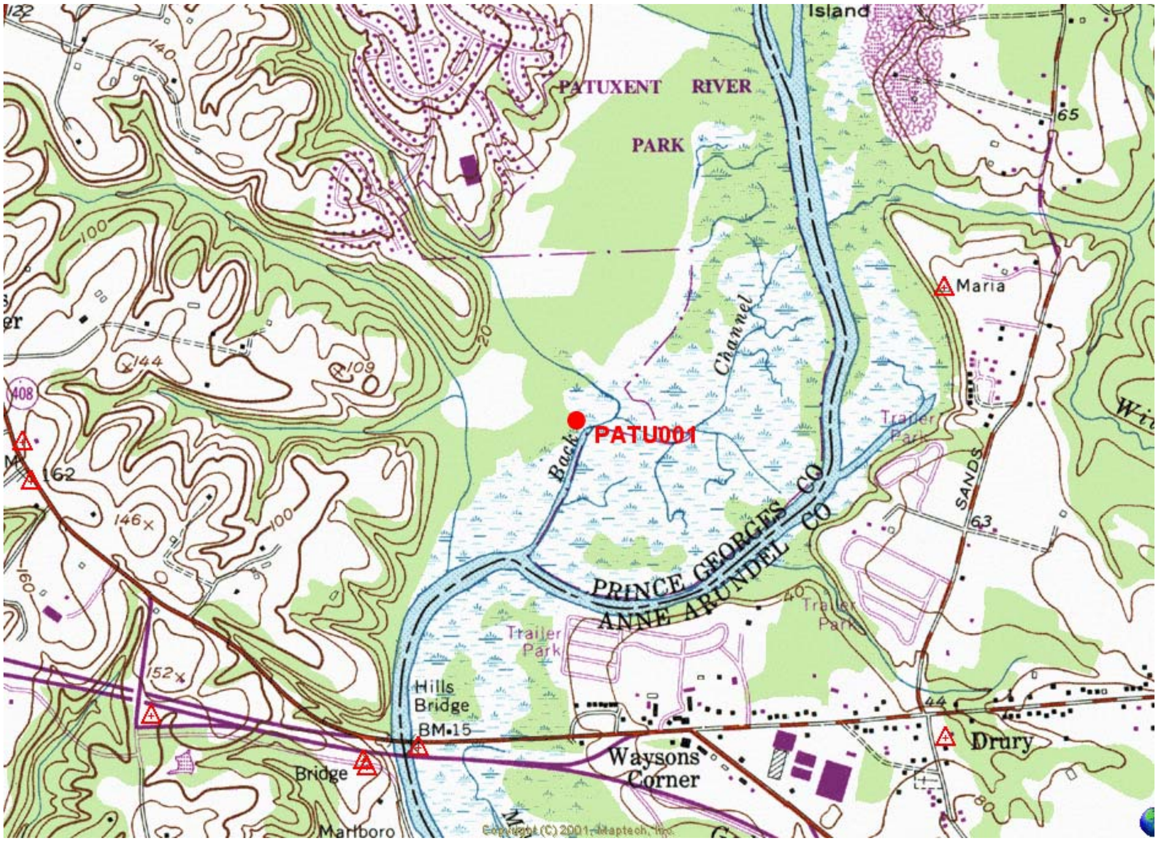
Maryland Natural Heritage Program, Maryland Department of Natural Resources

UTM COORDINATES

18 351904 E, 4298219 N (PATU001)

Fraxinus pennsylvanica - *Acer rubrum* / *Polygonum* spp. tidal woodland community

Upper Patuxent River
Prince Georges County, Maryland
Bristol, MD USGS Quad



PATU001 (18 351904 E, 4298219 N)- Precise coordinates for *Fraxinus pennsylvanica - Acer rubrum / Polygonum spp.* tidal woodland (CEGL006165) community at this site.

Marshyhope Creek — Dorchester County, Maryland

USGS QUAD

Rhodesdale, MD

PRIMARY REASON FOR SELECTION

Marshyhope Creek contains high quality occurrences and one of Maryland's best examples of the *Fraxinus profunda - Nyssa biflora / Ilex verticillata / Polygonum arifolium* Tidal Woodland (CEGL006287).

The term high quality occurrence is defined by four factors: 1) the site includes a highly representative example of the vegetation type as defined in the Maryland Vegetation Classification, 2) the occurrence is in good to excellent condition -- the habitat supporting this community type is less degraded than other known occurrences --, 3) the occurrence has a good to excellent viability -- long term prospects for the continued existence of this occurrence are high -- and 4) the occurrence has good to excellent defensibility -- this occurrence can be protected from extrinsic human factors.

SITE DESCRIPTION

Marshyhope Creek contains a large occurrence (>40 hectares) of *Fraxinus profunda - Nyssa biflora / Ilex verticillata / Polygonum arifolium* tidal woodland community bordering the main channel of Marshyhope Creek. This site is located from just north of Harrison Ferry Bridge to just south of Mill Creek and includes the lower portion of Puckum Branch. Mean salinity at time of study was 0.0 ppt. The *Fraxinus profunda - Nyssa biflora / Ilex verticillata / Polygonum arifolium* tidal woodland is expansive, often forming discontinuous linear tracts along the main channel of Marshyhope Creek, from below the town of Federalsburg to the creek's confluence with the Nanticoke River. This community type extends towards creek adjoining tidal herbaceous communities containing emergent species such as *Pontederia cordata, Zizania aquatica, Impatiens capensis,* and *Nuphar lutea* var. *advena*. Occasionally, tidal shrublands dominated by *Alnus maritima* occur along ecotones between tidal woodland and open marsh habitats. These shrublands are densely vegetated (often monotypic) and form a physiognomically distinct zone between woodland and marsh vegetation. At this site, the canopy structure is poorly developed contributing to a very diverse shrub and herbaceous layer. Hummock-and-hollow microtopography is also a contributing factor with species richness and is very pronounced at this site. Hollows consist of tidal muck and receive regular tidal inundation, while hummocks are elevated and may receive irregular flooding (less often than daily). Along Marshyhope Creek, this community type is bordered by and transitional to dry, sand ridges in the uplands that are comprised of oaks, pines, and hickories. Although natural sand ridge vegetation exists along Marshyhope Creek much of the surrounding land-use is agricultural or has been converted to pine plantations. Light residential development is sparse however, is more frequent along the creek near the city of Federalsburg.

Within the *Fraxinus profunda - Nyssa biflora / Ilex verticillata / Polygonum arifolium* tidal woodlands, invasive species such as *Lonicera japonica* and *Clematis terniflora* are minor components of the total vegetation composition.

At least 12 plant species considered rare, threatened or endangered in Maryland are known to occur within the tidal regions of the Marshyhope Creek. Furthermore, this community occurrence falls entirely within the Chesapeake Bay Critical Area and is subject to additional protection regulations.

COMMUNITY DESCRIPTION

Marshyhope Creek was chosen as a reference site primarily because it is habitat to one of the best examples of *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* tidal woodland (CEGL006287) community association known in Maryland. This wetland community type is ranked S4, designating it as a community apparently secure in Maryland. This designation indicates that more than 100 occurrences occur in the state; alternatively, fewer occurrences may occur but are of significant size. This community type is apparently secure under present conditions, although it may be restricted to only a portion of the state. This particular occurrence is part of a set of similar communities used to define and classify the community types for the Maryland Vegetation Classification, thus a type locality.

This occurrence is very typical of that defined in the Vegetation Description for *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* tidal woodland (CEGL006287). See Vegetation Description section of this report for a precise definition of this community.

MANAGEMENT COMMENTS / MONITORING NEEDS

Wetlands such as *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* tidal woodlands are susceptible to many direct and indirect threats. These threats account for significant qualitative and quantitative changes in wetland community structure, composition, and function. Tiner and Burke (1995) summarize the major causes of wetland loss and degradation in Maryland by the following: 1) Discharges of materials (e.g., pesticides, herbicides, other pollutants, nutrient loading from domestic sewage, urban runoff, agricultural runoff, and sediments from dredging and filling projects, agricultural lands, and other land development) into waters and wetlands, 2) Filling for dredged spoil and other spoil disposal, roads and highways, and commercial, residential, and industrial development, 3) Dredging and stream channelization for navigation channels, marinas, flood protection, coastal housing developments, and reservoir maintenance, 4) Construction of dikes, dams, levees, and seawalls for flood control, shoreline protection, water supply, and irrigation, 5) Drainage for crop production, timber production, and mosquito control, 6) Alteration of wetland hydrology and disruption of natural river flows through diversion of fresh water for human uses (e.g., water supply, industry, and agriculture), 7) Flooding wetlands for creating ponds, waterfowl impoundments, reservoirs, and lakes, 8) Clearing of native vegetation and cultivation of agricultural crops, 9) Conversion of “natural” forested wetlands to pine silviculture plantations, 10) Sediment diversion by dams, deep channels, and other structures, and 11) Hydrologic alterations by canals, spoils banks, roads, and other structures. Natural threats such as droughts, subsidence/sea level rise, storm events, erosion, and mechanical damage by wildlife (e.g., Muskrats, Nutria) could also have severe impacts on wetlands systems.

Marshyhope Creek is a high quality system; however it is not immune to invasive species or other environmental disturbances. Exotic herbaceous vines such as *Lonicera japonica* and *Clematis terniflora* frequently occur in canopy gaps and along edges of tidal woodlands and may be locally abundant in areas. Additionally, along the lower portion of Marshyhope Creek, small dense colonies of *Phragmites australis* have established within the marsh. While *Phragmites australis* may be slightly less threatening to tidal woodlands than to the neighboring tidal shrublands and marshes, monitoring and control of this species and other exotics is highly recommended since they ultimately impact the quality of the system as a whole.

PROTECTION COMMENTS

Wetlands such as *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* tidal woodlands bordering Marshyhope Creek occur entirely within the Chesapeake Bay Critical Area and therefore subject to particular protection regulations.

OCCURRENCE RANK

Supported by data from four vegetation sample plots (listed below), *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* tidal woodland community examples bordering the Marshyhope Creek rank as “A” or excellent, when compared to all other known Maryland examples of this community type.

MANAGED AREA NAME / TRACT OWNERSHIP

The Nature Conservancy owns portions of this area.

BEST INFORMATION SOURCE

Maryland Natural Heritage Program, Maryland Department of Natural Resources

UTM COORDINATES

18 429234 E, 4271980 N (MARS001)

Fraxinus profunda - Nyssa biflora / *Ilex verticillata* / *Polygonum arifolium* tidal woodland community

18 428923 E, 4272480 N (MARS003)

Fraxinus profunda - Nyssa biflora / *Ilex verticillata* / *Polygonum arifolium* tidal woodland community

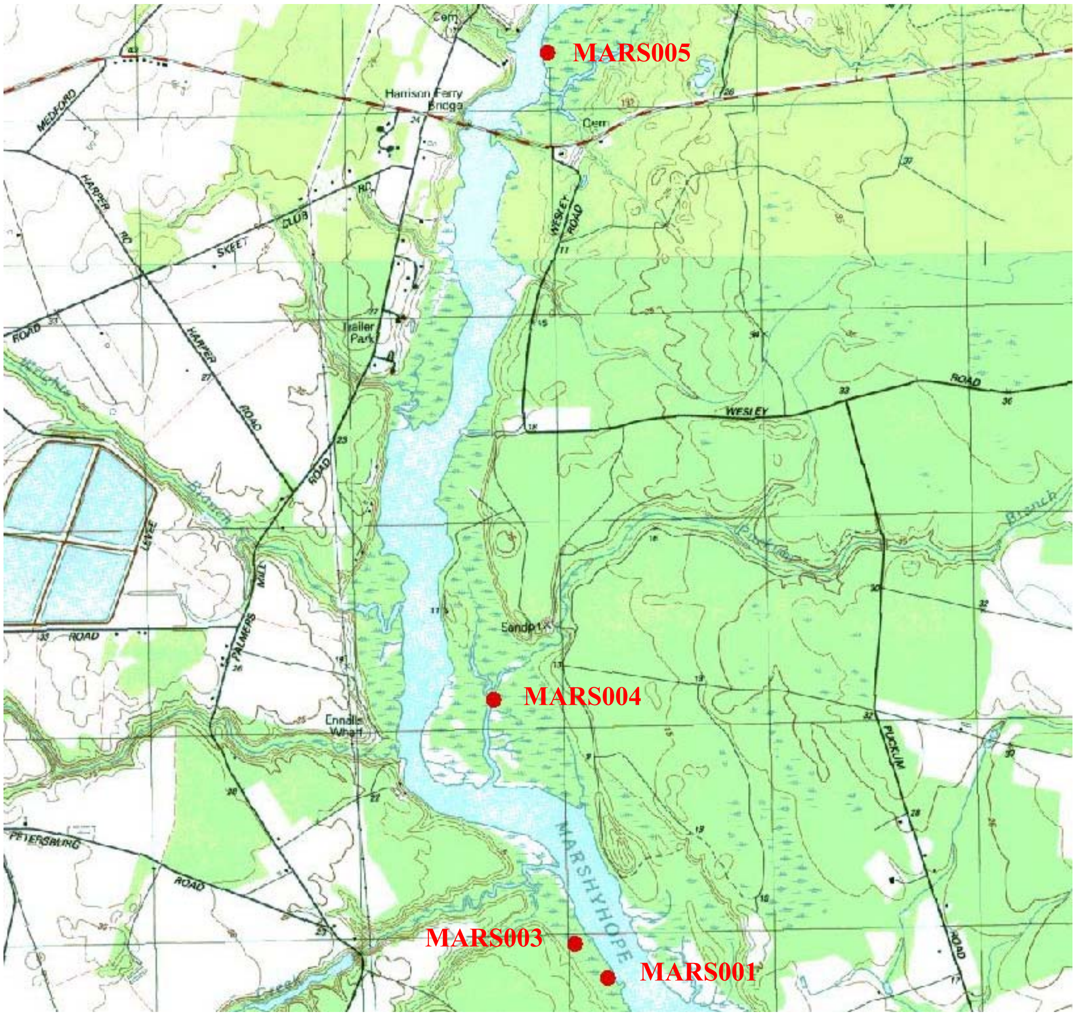
18 428706 E, 4273345 N (MARS004)

Fraxinus profunda - Nyssa biflora / *Ilex verticillata* / *Polygonum arifolium* tidal woodland community

18 429037 E, 4276462 N (MARS005)

Fraxinus profunda - Nyssa biflora / *Ilex verticillata* / *Polygonum arifolium* tidal woodland community

Marshyhope Creek
Dorchester County, Maryland
Rhodesdale, MD USGS Quad



MARS001 (18 429234 E, 4271980 N UTM) - Precise coordinates for *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* - *Viburnum recognitum* / *Polygonum arifolium* tidal woodland (CEGL006287) community at this site.

MARS003 (18 428923 E, 4272480 N UTM) - Precise coordinates for *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* - *Viburnum recognitum* / *Polygonum arifolium* tidal woodland (CEGL006287) community at this site.

MARS004 (18 428706 E, 4273345 N UTM) - Precise coordinates for *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* - *Viburnum recognitum* / *Polygonum arifolium* tidal woodland (CEGL006287) community at this site.

MARS005 (18 429037 E, 4276462 N UTM) - Precise coordinates for *Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* - *Viburnum recognitum* / *Polygonum arifolium* tidal woodland (CEGL006287) community at this site.

Pocomoke River — Worcester and Somerset Counties, Maryland

USGS QUADS

Snow Hill, MD
Pocomoke City, MD

PRIMARY REASON FOR SELECTION

Pocomoke River contains high quality occurrences and one of Maryland's best examples of the *Taxodium distichum - Nyssa biflora / Bignonia capreolata* tidal forest (CEGL006059).

The term high quality occurrence is defined by four factors: 1) the site includes a very representative example of the vegetation type as defined in the Maryland Vegetation Classification, 2) the occurrence is in good to excellent condition -- the habitat supporting this community type is less degraded than other known occurrences, 3) the occurrence has a good to excellent viability -- long term prospects for the continued existence of this occurrence are high, and 4) the occurrence has good to excellent defensibility -- this occurrence can be protected from extrinsic human factors.

SITE DESCRIPTION

Pocomoke River contains an expansive occurrence (>40 hectares) of *Taxodium distichum - Nyssa biflora / Bignonia capreolata* tidal forest community along its main channel and tributaries. This site is located from the mouth of Nassawango Creek to just north of Milburn Landing. Mean salinity at time of study was 0.0 ppt. The *Taxodium distichum - Nyssa biflora / Bignonia capreolata* tidal forest community occurs along much of the Pocomoke River. The total length of this occurrence spans from Porter's Crossing Bridge southwest to Hickory Point Cypress Swamp, including tributaries for approximately 42 kilometers. This community type is bordered by a mixture of tidal and non-tidal communities that includes a variety of emergent vegetation types, tidal shrublands, tidal woodlands, *Chamaecyparis thyoides* swamps, and dry, upland sand ridges dominated by pines and oaks. The microtopography within this community is composed of pronounced hummock-and-hollow formations with high concentrations of root material, woody/organic debris and cypress knees mixed throughout the mucky substrate. Canopy cover is closed due to the crown density of *Taxodium distichum*, however both shrub and herb layers are exceptionally diverse.

Emergent vegetation throughout the freshwater portion of Pocomoke River includes narrow zones of *Nuphar lutea* ssp. *advena* and scattered patches of dense *Zizania aquatica.* Small, but dense tidal shrubland communities dominated by *Alnus maritima* are scattered throughout the lower portion of Nassawango Creek. While these shrublands are generally found along the tidal forested community edge, *Alnus maritima* also has a tendency to form small dense island-like pockets surrounded by either open water or dense emergent vegetation such as *Nuphar lutea* ssp. *advena*.

Dry, upland forests dominated by oaks and pine are found throughout the region and border most of the lowlands adjacent to Pocomoke River, including the tidal forests. The width of the transition zone between the pine forests and the tidal forests can vary from narrow to broad, depending on the rate of increase in elevation between the lowland and the upland. The transition zone may include tree species such as *Chamaecyparis thyoides*, *Pinus taeda*, *Juniperus virginiana*, *Quercus* spp., *Liriodendron tulipifera* and *Betula nigra* and typically includes a dense evergreen shrub layer composed of a few species that include *Kalmia latifolia, Ilex glabra* and *Morella cerifera* (=*Myrica cerifera)* (Beaven & Oosting 1939).

Land-use in the surrounding uplands is primarily agricultural; the extensive tidal and upland forests serve as buffers between farmland and the Pocomoke River along most of its length.

Clematis terniflora and *Lonicera japonica* are two invasive species common in the Pocomoke River watershed.

At least seven species considered rare, threatened or endangered in Maryland are known to occur within the *Taxodium distichum – Nyssa biflora / Bignonia capreolata* tidal forest community at this site. As part of the Pocomoke State Forest system, this site is managed by the Maryland Department of Natural Resources. In addition, the site falls within the Chesapeake Bay Critical Area and is therefore subject to additional protection regulations.

COMMUNITY DESCRIPTION

Pocomoke River was chosen as a reference site primarily because it is habitat to one of the best examples of the *Taxodium distichum – Nyssa biflora / Bignonia capreolata* tidal forest (CEGL006059) community association known in Maryland. This wetland community type is ranked S3, designating it as a rare to uncommon community, with the number of occurrences typically ranging from 21 to 100 in Maryland (alternatively, this community may have smaller occurrences of significant size) and may be susceptible to large-scale disturbances. This is a watch list community; however, the Natural Heritage Program is not actively tracking it. These particular occurrences are part of a set of similar communities used to define and classify the community types for the Maryland Vegetation Classification, thus type localities.

This occurrence is very typical of that defined in the Vegetation Description for *Taxodium distichum – Nyssa biflora / Bignonia capreolata* tidal forest (CEGL006059). See the Vegetation Description section of this report for a precise definition of this community.

MANAGEMENT COMMENTS / MONITORING NEEDS

Wetlands such as *Taxodium distichum – Nyssa biflora / Bignonia capreolata* tidal forests are susceptible to many direct and indirect threats. These threats account for significant qualitative and quantitative changes in wetland community structure, composition, and function. Tiner and Burke (1995) summarize the major causes of wetland loss and degradation in Maryland by the following: 1) Discharges of materials (e.g., pesticides, herbicides, other pollutants, nutrient loading from domestic sewage, urban runoff, agricultural runoff, and sediments from dredging and filling projects, agricultural lands, and other land development) into waters and wetlands, 2) Filling for dredged spoil and other spoil disposal, roads and highways, and commercial, residential, and industrial development, 3)Dredging and stream channelization for navigation channels, marinas, flood protection, coastal housing developments, and reservoir maintenance, 4) Construction of dikes, dams, levees, and seawalls for flood control, shoreline protection, water supply, and irrigation, 5) Drainage for crop production, timber production, and mosquito control, 6) Alteration of wetland hydrology and disruption of natural river flows through diversion of fresh water for human uses (e.g., water supply, industry, and agriculture), 7) Flooding wetlands for creating ponds, waterfowl impoundments, reservoirs, and lakes, 8) Clearing of native vegetation and cultivation of agricultural crops, 9) Conversion of “natural” forested wetlands to pine silviculture plantations, 10) Sediment diversion by dams, deep channels, and other structures, and 11) Hydrologic alterations by canals, spoils banks, roads, and other structures. Natural threats such as droughts, subsidence/sea level rise, storm events, erosion, and mechanical damage by wildlife (e.g., Muskrats, Nutria) could also have severe impacts on forested wetlands systems.

Expansion of *Clematis terniflora* and *Lonicera japonica* may be of future concern to species diversity but is not presently an urgent threat. Continual monitoring of these species is recommended.

PROTECTION COMMENTS

As part of the Pocomoke State Forests, this site is managed by the Maryland Department of Natural Resources. *Taxodium distichum – Nyssa biflora / Bignonia capreolata* tidal forests found in this portion of the Pocomoke River occur entirely within the Chesapeake Bay Critical Area and are therefore subject to additional protection regulations.

OCCURRENCE RANK

Supported by data from four vegetation sample plots (listed below), *Taxodium distichum – Nyssa biflora / Bignonia capreolata* tidal forest examples in this portion of the Pocomoke River rank as "A", or excellent, when compared to all other known Maryland examples of this community type.

MANAGED AREA NAME / TRACT OWNERSHIP

Pocomoke State Forest, Maryland Department of Natural Resources / State of Maryland

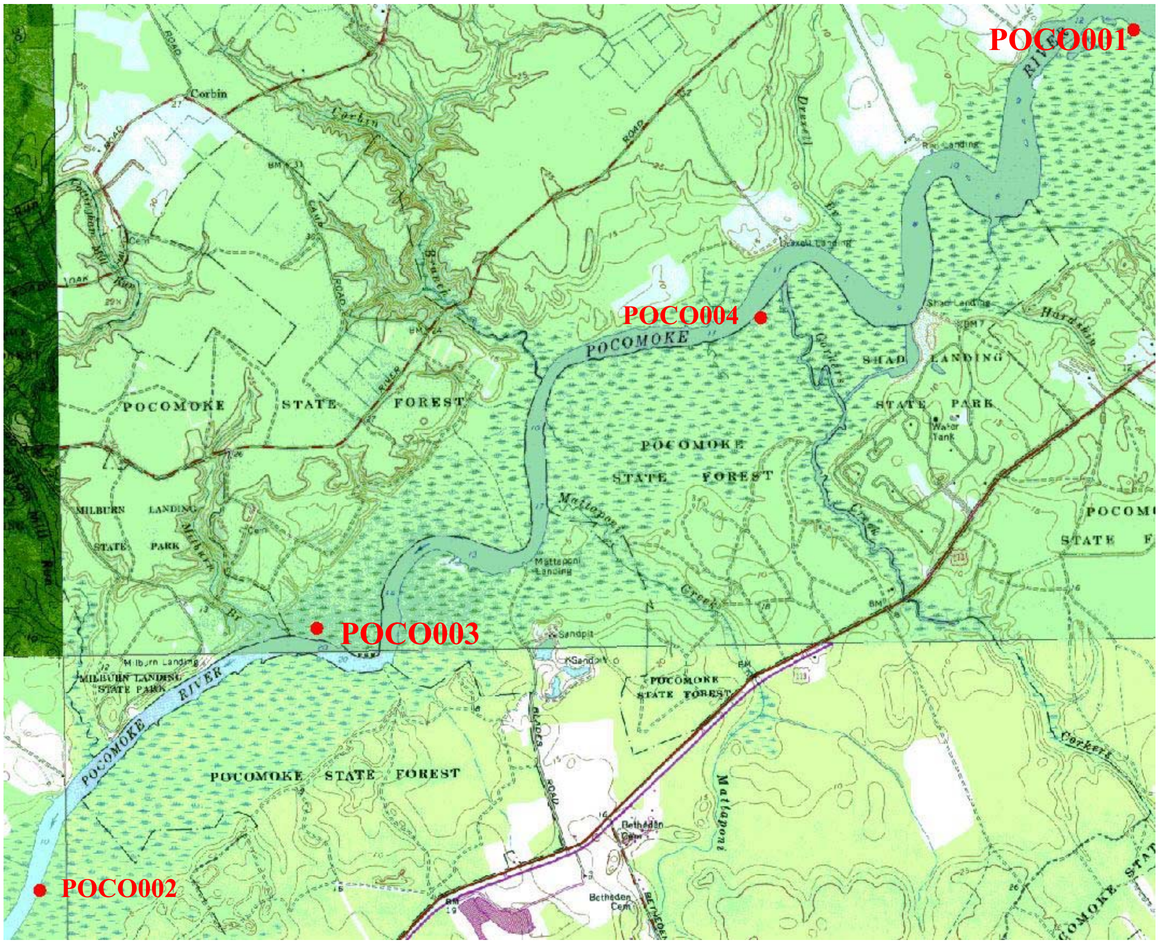
BEST INFORMATION SOURCE

Maryland Natural Heritage Program, Maryland Department of Natural Resources

UTM COORDINATES

18 462734 E, 4223414 N (POCO001)
Taxodium distichum - *Nyssa biflora / Bignonia capreolata* tidal forest community
18 456540 E, 4218397 N (POCO002)
Taxodium distichum - *Nyssa biflora / Bignonia capreolata* tidal forest community
18 457742 E, 4219928 N (POCO003)
Taxodium distichum - *Nyssa biflora / Bignonia capreolata* tidal forest community
18 460452 E, 4221735 N (POCO004
Taxodium distichum - *Nyssa biflora / Bignonia capreolata* tidal forest community

Pocomoke River
Worcester and Somerset Counties, Maryland
Snow Hill, MD USGS Quad
Pocomoke City, MD USGS Quad



POCO001 (18 462734 E, 4223414 N UTM) - Precise coordinates for *Taxodium distichum - Nyssa biflora / Bignonia capreolata* tidal forest (CEGL006059) community at this site.

POCO002 (18 456540 E, 4218397 N UTM) - Precise coordinates for *Taxodium distichum - Nyssa biflora / Bignonia capreolata* tidal forest (CEGL006059) community at this site.

POCO003 (18 457742 E, 4219928 N UTM) - Precise coordinates for *Taxodium distichum - Nyssa biflora / Bignonia capreolata* tidal forest (CEGL006059) community at this site.

POCO004 (18 460452 E, 4221735 N UTM) - Precise coordinates for *Taxodium distichum - Nyssa biflora / Bignonia capreolata* tidal forest (CEGL006059) community at this site.

Hickory Point Cypress Swamp — Worcester County, Maryland

USGS QUAD

Kingston, MD

PRIMARY REASON FOR SELECTION

Hickory Point Cypress Swamp contains high quality occurrences and some of Maryland's best examples of the *Taxodium distichum / Carex hyalinolepis* Tidal Woodland (CEGL006845).

The term high quality occurrence is defined by four factors: 1) the site includes a highly representative example of the vegetation types as defined in the Maryland Vegetation Classification, 2) the occurrences are in good to excellent condition -- the habitat supporting this community types is less degraded than other known occurrences --, 3) the occurrences have a good to excellent viability -- long term prospects for the continued existence of these occurrences are high -- and 4) the occurrences have good to excellent defensibility -- these occurrences can be protected from extrinsic human factors.

SITE DESCRIPTION

Bordering the Pocomoke River, the northern part of Hickory Point Cypress Swamp contain small (generally <2 hectares) occurrences of *Taxodium distichum* / *Carex hyalinolepis* tidal woodland vegetation. This area is located approximately 3.5 kilometers upriver from the mouth of Rehobeth Branch. The *Taxodium distichum* / *Carex hyalinolepis* tidal woodland community is predominately found in the freshwater-oligohaline transition zone of the Pocomoke River. This community type is a patchily distributed component within the *Taxodium distichum – Nyssa biflora / Bignonia capreolata* tidal forests and seems to favor landscapes that receive irregular tidal inundation. In addition, nontidal habitats dominated by *Chamaecyparis* thyoides bordering this community type. Within this community, the canopy is open allowing for *Carex hyalinolepis* to form an almost monospecific mat, giving it a savanna like appearance. The microtopography exhibits moderate hummock-and hollow features and because of the high root mass, the substrate is relatively firm.

Hickory Point Cypress Swamp is largely composed of expansive tidal oligohaline emergent marshes dominated by *Eleocharis (fallax*, *rostellata)* with patches of *Carex hyalinolepis, Typha angustifolia, Peltandra virginica, Sium suave* and *Hibiscus moscheutos* scattered throughout. The tidal oligohaline shrublands are typically found in small pockets, often along the ecotone between tidal woodlands and tidal emergent marsh. The shrubland community is dominated by *Morella cerifera*, with *Rosa palustris, Acer rubrum* and *Baccharis halimifolia* as common associates. Upland *Pinus taeda* dominated communities are found throughout the region and border most of the lowlands adjacent to Pocomoke River, including the tidal and non-tidal forests and woodlands.

Land-use in the surrounding uplands is primarily agricultural and silviculture: the extensive tidal and upland forests serve as buffers between agricultural fields and Pocomoke River along most of its length. Hickory Point Cypress Swamp is recognized as a Natural Heritage Area by the Maryland Department of Natural Resources.

At least seven species considered rare, threatened or endangered in Maryland are known to occur within this community type. Designated as a Natural Heritage Area by the Maryland Department of Natural Resources, Hickory Point Cypress Swamp receives conservation attention. In addition, Hickory Point Cypress Swamp falls within the Chesapeake Bay Critical Area and are therefore subject to additional protection regulations.

COMMUNITY DESCRIPTION

Hickory Point Cypress Swamp was chosen as a reference site primarily because it is habitat to one of the best examples of the *Taxodium distichum / Carex hyalinolepis* Tidal Woodland (CEGL006845) community association known in Maryland. This wetland community type is ranked S1, designating it as highly rare in Maryland. This community is critically imperiled because of extreme rarity (typically 5 or fewer estimated occurrences or very few acres in the state) or because some factor(s) make it especially vulnerable to extirpation. This particular occurrence is part of a set of similar communities used to define and classify the community types for the Maryland Vegetation Classification, thus type localities.

This occurrence is very typical of that defined in the Vegetation Description for *Taxodium distichum / Carex hyalinolepis* Tidal Woodland (CEGL006845). See the Vegetation Description section of this report for a precise definition of this community.

MANAGEMENT COMMENTS / MONITORING NEEDS

Wetlands such as *Taxodium distichum / Carex hyalinolepis* tidal woodlands are susceptible to many direct and indirect threats. These threats account for significant qualitative and quantitative changes in wetland community structure, composition, and function. Tiner and Burke (1995) summarize the major causes of wetland loss and degradation in Maryland by the following: 1) Discharges of materials (e.g., pesticides, herbicides, other pollutants, nutrient loading from domestic sewage, urban runoff, agricultural runoff, and sediments from dredging and filling projects, agricultural lands, and other land development) into waters and wetlands, 2) Filling for dredged spoil and other spoil disposal, roads and highways, and commercial, residential, and industrial development, 3) Dredging and stream channelization for navigation channels, marinas, flood protection, coastal housing developments, and reservoir maintenance, 4) Construction of dikes, dams, levees, and seawalls for flood control, shoreline protection, water supply, and irrigation, 5) Drainage for crop production, timber production, and mosquito control, 6) Alteration of wetland hydrology and disruption of natural river flows through diversion of fresh water for human uses (e.g., water supply, industry, and agriculture), 7) Flooding wetlands for creating ponds, waterfowl impoundments, reservoirs, and lakes, 8) Clearing of native vegetation and cultivation of agricultural crops, 9) Conversion of “natural” forested wetlands to pine silviculture plantations, 10) Sediment diversion by dams, deep channels, and other structures, and 11) Hydrologic alterations by canals, spoils banks, roads, and other structures. Natural threats such as droughts, subsidence/sea level rise, storm events, erosion, and mechanical damage by wildlife (e.g., Muskrats, Nutria) could also have severe impacts on forested wetland systems.

Small patches of *Phragmites australis* have invaded lower portions of Hickory Point Cypress Swamp, typically adjacent to tidal herbaceous vegetation occurrences. Within the forested wetland communities, invasive species such as *Lonicera japonica* and *Clematis terniflora* are minor components of the total vegetation composition and occur more frequently along the edges of the forested communities and in canopy gaps.

PROTECTION COMMENTS

Wetlands such as *Taxodium distichum / Carex hyalinolepis* tidal woodlands found on Hickory Point Cypress Swamp occur entirely within the Chesapeake Bay Critical Area and therefore subject to particular protection regulations.

OCCURRENCE RANK

Supported by data from four vegetation sample plots (listed below), *Taxodium distichum / Carex hyalinolepis* tidal woodland community examples on Hickory Point Cypress Swamp rank as “A” or excellent, when compared to all other known Maryland examples of this community type.

MANAGED AREA NAME / TRACT OWNERSHIP

Hickory Point Cypress Swamp Natural Heritage Area, Maryland Department of Natural Resources / State of Maryland

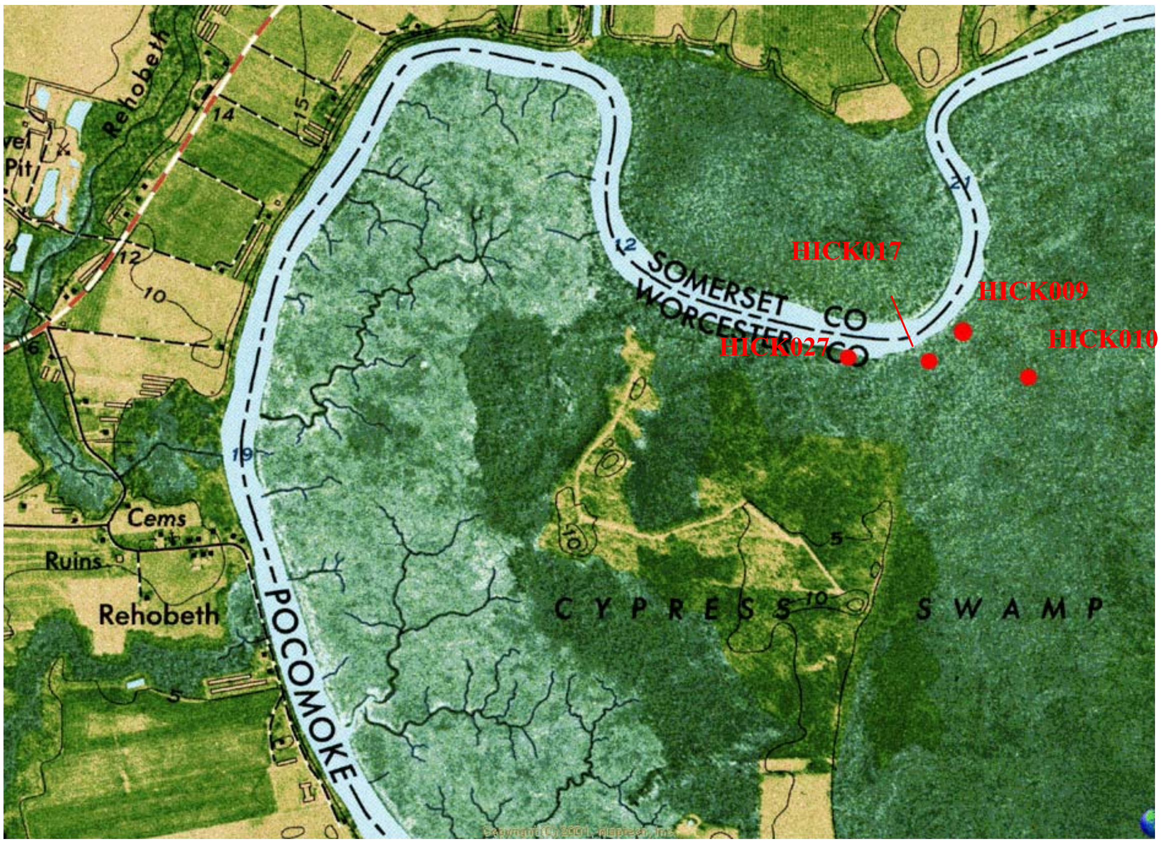
BEST INFORMATION SOURCE

Maryland Natural Heritage Program, Maryland Department of Natural Resources

UTM COORDINATES

18 444176 E, 4210987 N (HICK009)
Taxodium distichum / Carex hyalinolepis tidal woodland community
18 444377 E, 4210844 N (HICK010)
Taxodium distichum / Carex hyalinolepis tidal woodland community
18 444069 E, 4210892 N (HICK017)
Taxodium distichum / Carex hyalinolepis tidal woodland community
18 443818 E, 4210907 N (HICK027)
Taxodium distichum / Carex hyalinolepis tidal woodland community

Hickory Point Cypress Swamp
Worcester County, Maryland
Kingston, MD USGS Quad



HICK009 (18 444176 E, 4210987 N) - Approximate coordinates for *Taxodium distichum / Carex hyalinolepis* tidal woodland (CEGL006845) community at this site.

HICK010 (18 444377 E, 4210844 N) - Approximate coordinates for *Taxodium distichum / Carex hyalinolepis* tidal woodland (CEGL006845) community at this site.

HICK017 (18 444069 E, 4210892 N) - Approximate coordinates for *Taxodium distichum / Carex hyalinolepis* tidal woodland (CEGL006845) community at this site.

HICK027 (18 444160 E, 4210245 N) - Exact coordinates for *Taxodium distichum / Carex hyalinolepis* tidal woodland (CEGL006845) community at this site.

Moneystump Swamp – Blackwater River — Dorchester County, Maryland

USGS QUAD

Golden Hill, MD

PRIMARY REASON FOR SELECTION

Moneystump Swamp was chosen as a reference site because it contains high quality occurrences and one of Maryland's best examples of the *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands (CEGL006849).

The term high quality occurrence is defined by four factors: 1) the site includes a very representative example of the vegetation type as defined in the Maryland Vegetation Classification, 2) the occurrence is in good to excellent condition -- the habitat supporting this community type is less degraded than other known occurrences, 3) the occurrence has a good to excellent viability -- long term prospects for the continued existence of this occurrence are high, and 4) the occurrence has good to excellent defensibility -- this occurrence can be protected from extrinsic human factors.

SITE DESCRIPTION

Moneystump Swamp contains several stands of *Pinus taeda / Morella cerifera / Spartina patens* tidal woodland vegetation bordering brackish waters of the Blackwater River. These "fringing" stands are relatively small in size (generally <4 hectares), though numerous and scattered across the landscape. This site is located within the Blackwater National Wildlife Refuge on Wheatley Neck, approximately 3.5 aerial kilometers west of MD Route 335. Mean salinity at time of study was 0.0 ppt due in large part to excessive rainfall in 2003; however, salinity data collected at the same location the previous year indicated a mean of 11 ppt (Harrison & Stango 2003). This community type occurs in narrow, linear tracts adjacent to Blackwater River and its tributaries, adjacent to slightly elevated, seasonally flooded swamps or dry uplands dominated by *Pinus taeda.* Tidal herbaceous communities containing halophytic vegetation and tidal shrublands dominated by *Morella cerifera* (= *Myrica cerifera*) occur within close proximity to this community type. This community is structurally open allowing for a thick, often monospecific herbaceous layer composed of mainly halophytic species. Hummock-and-hollow formations are generally insignificant and substrate is firm.

Common taxa associated with the tidal marsh include *Spartina patens, S. cynosuroides, Typha angustifolia, Eleocharis fallax, Schoenoplectus americanus* and *Distichlis spicata,* with *Hibiscus moscheutos* as a common associate. Beyond the low marsh, tidal shrublands dominated by *Morella cerifera* (= *Myrica cerifera*) are typically found in patches situated along points, and in some instances adjoining the *Pinus taeda* tidal woodland. The upland community along the interior is similar in tree composition, however both the shrub and herb strata are often times open with little to no associated taxa.

Land-use within Blackwater National Wildlife Refuge is limited to public recreational use. Small, scattered occurrences of *Phragmites australis* have invaded portions of the surrounding tidal marshes. Nutria (*Myocastor coypus*), marsh subsidence, sediment starvation, saltwater intrusion and chronic sea-level rise pose a significant threat to this area. Wetland communities throughout the refuge are actively managed with fire.

At least two species considered rare, threatened or endangered in Maryland is known to occur within this community type. As part of Blackwater National Wildlife Refuge, Moneystump Swamp is under the jurisdiction of the United States Fish and Wildlife Service. In addition, this site also falls within the Chesapeake Bay Critical Area and is therefore subject to additional protection regulations.

COMMUNITY DESCRIPTION

Moneystump Swamp was chosen as a reference site primarily because it is habitat to one of the best examples of the *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands (CEGL006849) community association known in Maryland. This wetland community type is ranked S5, designating it as being demonstrably secure in Maryland under present conditions

This occurrence is very typical of that defined in the Vegetation Description for *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands (CEGL006849). See the Vegetation Description section of this report for a precise definition of this community.

MANAGEMENT COMMENTS / MONITORING NEEDS

Wetlands such as *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands are susceptible to many direct and indirect threats. These threats account for significant qualitative and quantitative changes in wetland community structure, composition, and function. Tiner and Burke (1995) summarize the major causes of wetland loss and degradation in Maryland by the following: 1) Discharges of materials, 2) Filling for dredged spoil and other spoil disposal, roads and highways, and commercial, residential, and industrial development, 3)Dredging and stream channelization for navigation channels, marinas, flood protection, coastal housing developments, and reservoir maintenance, 4) Construction of dikes, dams, levees, and seawalls for flood control, shoreline protection, water supply, and irrigation, 5) Drainage for crop production, timber production, and mosquito control, 6) Alteration of wetland hydrology and disruption of natural river flows through diversion of fresh water for human uses, 7) Flooding wetlands for creating ponds, waterfowl impoundments, reservoirs, and lakes, 8) Clearing of native vegetation and cultivation of agricultural crops, 9) Conversion of “natural” forested wetlands to pine silviculture plantations, 10) Sediment diversion by dams, deep channels, and other structures, and 11) Hydrologic alterations by canals, spoils banks, roads, and other structures. Natural threats such as droughts, subsidence/sea level rise, storm events, erosion, and mechanical damage by wildlife (e.g., Muskrats, Nutria, Swans and geese) could also have severe impacts on wetlands systems.

Marsh loses due to Nutria (*Myocastor coypus*) degradation pose a significant threat to the wetlands in this area, including the *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands. As a response to this growing threat, the U.S. Fish and Wildlife Service have initiated a Nutria eradication program. Other disturbances such as marsh subsidence, chronic sea-level rise, sediment starvation, and saltwater intrusion are also threatening to the viability of this community and the surrounding landscape and therefore, further monitoring, research and implementation of corrective management is highly recommended. Invasion of *Phragmites australis* is a minor threat at this time; however monitoring and control of this species is highly recommended to prevent further spread. (SEE COMMENTS: Community Description)

PROTECTION COMMENTS

As part of Blackwater National Wildlife Refuge, Moneystump Swamp is under the jurisdiction of the U.S. Fish and Wildlife Service. In addition, *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands found in Moneystump Swamp occur entirely within the Chesapeake Bay Critical Area and are subject to further protection regulations.

OCCURRENCE RANK

Represented by five vegetation sample plots (four are listed below), *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands found in Moneystump Swamp rank as “A”, or excellent, when compared to all other known Maryland examples of these community types.

MANAGED AREA NAME / TRACT OWNERSHIP

Blackwater National Wildlife Refuge, United States Fish and Wildlife Service

BEST INFORMATION SOURCE

Maryland Natural Heritage Program, Maryland Department of Natural Resources

UTM Coordinates

18 396324 E, 4255718 N (STUM001)

Pinus taeda / Morella cerifera / Spartina patens tidal woodlands community

18 396544 E, 4255775 N (STUM002)

Pinus taeda / Morella cerifera / Spartina patens tidal woodlands community

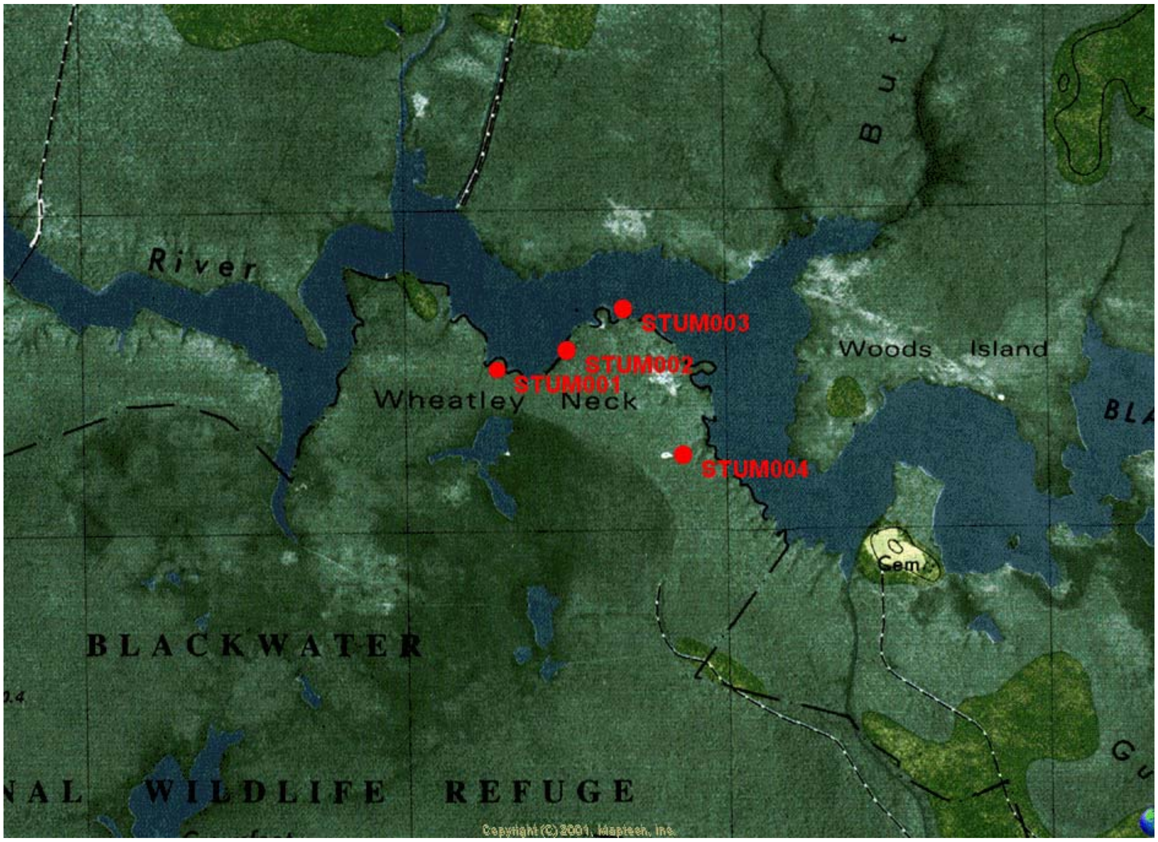
18 396723 E, 4255903 N (STUM003)

Pinus taeda / Morella cerifera / Spartina patens tidal woodlands community

18 396900 E, 4255446 N (STUM004)

Pinus taeda / Morella cerifera / Spartina patens tidal woodlands community

Blackwater River – Moneystump Swamp
Dorchester County, Maryland
Golden Hill, MD USGS Quad



STUM001 (18 396324 E, 4255718 N UTM)- Precise coordinates for *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands (CEGL006849) community at this site.

STUM002 (18 396544 E, 4255775 N UTM)- Precise coordinates for *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands (CEGL006849) community at this site.

STUM003 (18 396723 E, 4255903 N UTM)- Precise coordinates for *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands (CEGL006849) community at this site.

STUM004 (18 396900 E, 4255446 N UTM)- Precise coordinates for *Pinus taeda / Morella cerifera / Spartina patens* tidal woodlands (CEGL006849) community at this site.

PICTORIAL OVERVIEW

***Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* Tidal Woodland (CEGL006287)**
Marshyhope Creek, Dorchester County **Photograph by: Peter Stango III**

***Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* Tidal Woodland (CEGL006287)**
Marshyhope Creek, Dorchester County **Photograph by: Peter Stango III**

***Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* Tidal Woodland (CEGL006287)**
Barren Creek, Wicomico County Photograph by: Peter Stango III

***Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* Tidal Woodland (CEGL006287)**
Chicamacomico River, Dorchester County **Photograph by: Peter Stango III**

***Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* Tidal Woodland (CEGL006287)**
Choptank River, Caroline County **Photograph by: Jason W. Harrison**

***Fraxinus profunda* - *Nyssa biflora* / *Ilex verticillata* / *Polygonum arifolium* Tidal Woodland (CEGL006287)**
Kings Creek, Talbot County **Photograph by: Peter Stango III**

***Fraxinus pennsylvanica - Acer rubrum / Polygonum spp.* Tidal Woodland (CEGL006165)**
Tuckahoe Creek, Talbot County **Photograph by: Peter Stango III**

***Fraxinus pennsylvanica - Acer rubrum / Polygonum spp.* Tidal Woodland (CEGL006165)**
Tuckahoe Creek, Talbot County **Photograph by: Peter Stango III**

***Taxodium distichum* - *Nyssa biflora* / Bignonia capreolata Tidal Forest (CEGL006059)**
Pocomoke River, Worcester County Photograph by: Peter Stango III

Taxodium distichum - *Nyssa biflora* / *Bignonia capreolata* Tidal Forest (CEGL006059)
Pocomoke River, Worcester County Photograph by: Peter Stango III

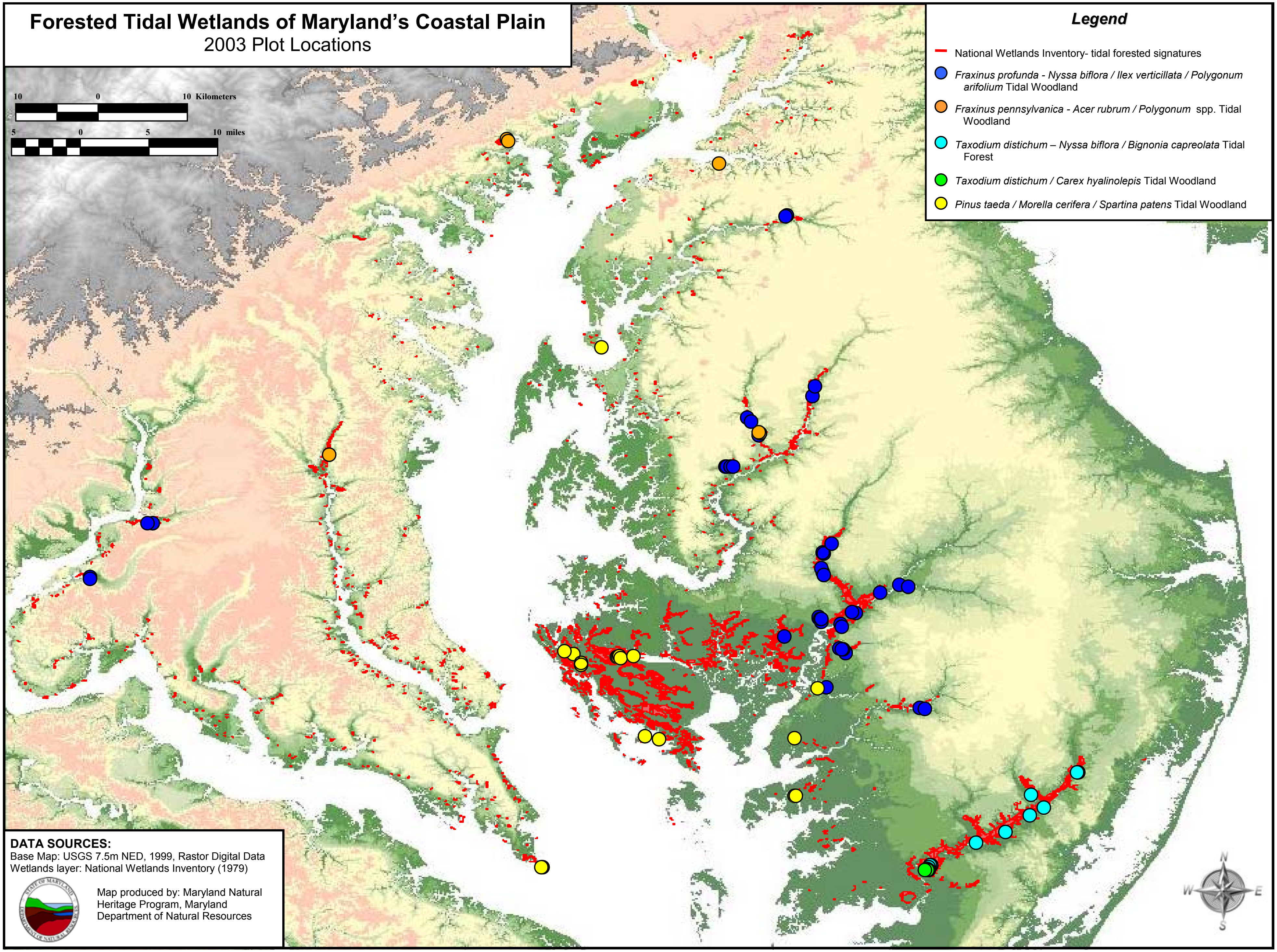
Taxodium distichum - *Nyssa biflora* / *Bignonia capreolata* Tidal Forest (CEGL006059)
Pocomoke River, Worcester County Photograph by: Peter Stango III

Taxodium distichum / Carex hyalinolepis **Tidal Woodland (CEGL004845)**
Hickory Point, Worcester County **Photograph by: Peter Stango III**

***Taxodium distichum / Carex hyalinolepis* Tidal Woodland (CEGL004845)**
Hickory Point, Worcester County **Photograph by: Peter Stango III**

Pinus taeda / Morella cerifera / Spartina patens Tidal Woodland (CEGL006849)
Moneystump Swamp, Dorchester County Photograph by: Peter Stango III

Pinus taeda / Morella cerifera / Spartina patens Tidal Woodland (CEGL006849)
Taylors Island, Dorchester County Photograph by: Peter Stango III



Forested Tidal Wetlands of Maryland's Coastal Plain
2003 Plot Locations
10 0 10 Kilometers
5 0 5 10 miles
Legend
National Wetlands Inventory- tidal forested signatures
Fraxinus profunda - Nyssa biflora / Ilex verticillata / Polygonum arifolium Tidal Woodland
Fraxinus pennsylvanica - Acer rubrum / Polygonum spp. Tidal Woodland
Taxodium distichum – Nyssa biflora / Bignonia capreolata Tidal Forest
Taxodium distichum / Carex hyalinolepis Tidal Woodland
Pinus taeda / Morella cerifera / Spartina patens Tidal Woodland
DATA SOURCES:
Base Map: USGS 7.5m NED, 1999, Rastor Digital Data
Wetlands layer: National Wetlands Inventory (1979)
Map produced by: Maryland Natural Heritage Program, Maryland Department of Natural Resources
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APPENDIX 1

The following pages are sample field forms used by the Maryland Natural Heritage Program for collecting quantitative data on the survey of natural communities.

Revision 6/2003

MARYLAND NHP COMMUNITY SURVEY FORM

Plot Code:

I. Plot Location / Habitat

Survey site Name:________________ Site Name:________________ Quad:____________
Managed Area Name:________________ State:________ County:____________
Surveyor(s):________________ Date:_____-_____-_____ Plot Size:________ sq. m
Plot dimensions ____ by ____ m ; ____ m radius Land Owner:________________ Phone #: (___)____-______

General Site Information:

Site Sketch Map
(include plot numbers and boundaries of community occurrences if known)

Cross sectional sketch map

Obs. Pt.________ Latitude ______° ______' _______" N Longitude _____° ______' _______" W UTM: __________ E | __________N EOSize:______________

Community Name: (use as many descriptive words as possible. ie. acidic, barren, circumneutral, depression, glade…) -

Description of Community:

Disturbances/Threats: (Circle) Logging, clearing, erosion, livestock grazing, stream entrenchment, excessive deer browse, ditching, pine bark beetle, gypsy moth, exotic plants, nutria damage, fire

Protection/Management Comments:________________

Overall EO Rank: (A) (B) (C) (D) **Comments:**________________

System	**Soil Moisture Regime**	**Avg. Organic Soil Text**	**Unvegetated Surface Substrate** (% cover)	**Soil Profile Description**
A – terrestrial B – palustrine C – estuarine D – marine E – riverine	A- Extremely dry B- Very dry C- Dry D- Well drained E- Somewhat moist F- Moist G- Somewhat wet H- Wet I- Permanently inundated J- Very wet K- Periodically inundated	A- Muck B- Peat	Bedrock Large rocks (>10 cm) Small rocks (.2-10 cm) Sand (0.1-2 mm) Bare soil Litter, duff Wood (> 1 cm) Water Other	Horizon | Depth(cm) | Texture,Structure,Consistence
Physiographic Province A – coastal plain (Upper) B – coastal plain (Lower) C – fall line D – piedmont E – blue ridge F – ridge and valley G – Appalachian plateau	**Soil Drainage Class** A- Rapidly drained B- Well drained C- Mod. well drained D- Somewhat poorly E- Poorly drained F- Very poorly drained	**Stoniness** A- Stonefree (<0.1%) B- Mod. stony (0.1-1%) C- Stony (3-15%) D- Very stony (15-50%) E- Exc. stony (50-90%) F- Stone piles (>90%)	**Min. Elevation ________ft. / _____ m** **Max. Elevation ________ft. / _____ m** **Community Patch Size** (circle one) Matrix Large Patch Small Patch Linear	
Topographic Position A – Interfluve B – High Slope C – High Level D – Midslope E – Backslope F – Step in slope G – Lowslope H – Toeslope I – Low Level J – Channel Wall K – Channel Bed L – Basin Floor M – Other	**Avg. Mineral Soil Text** A- Sand B- Loamy sand C- Loam D- Sandy loam E- Silt loam F- Sandy clay loam G- Clay loam H- Silty clay loam I- Silt J- Sandy clay K- Clay L- Silty clay	**Hydrological Regime** A- Semiperman. flooded B- Seasonally flooded C- Saturated D- Temporarily flooded E- Intermittently flooded F- Permanently flooded G- Tidal Irreg. flooded H- Tidal Reg. flooded I- Never inundated	**Slope** A – 0-3% (level or nearly so) B – 3-8 (gentle/undulating) C – 8-16 (sloping/rolling) D – 16-30 (moderately/hilly) E – 30-65 (steep) F – 65-75 (very steep) G – 75-100 (extremely steep) H – hummock and hollow microtopography I – irregular craggy/bouldery microtopography	**Environmental Comments:** (homogeneity, etc.)
		Salinity/Halinity A – Saltwater B – Brackish C – Oligohaline D – Freshwater _______ ppt	**Slope Aspect** F (flat) Var. N NE E SE S SW **Slope Degrees** ___________° **NWI signature**	

II. Vegetation Structure and Physiognomy

Note: Circle the code of each stratum present in the plot. Record all herbaceous species and woody species less than 0.5m tall in the herb stratum. Record woody vines and epiphytic herbs in the appropriate tree or shrub stratum.

Cover		Tree strata Height (m) ← 35	← 20	← 10	← 6	Shrub 0.5 – 6m	Herb aver. Height ____cm	Moss/ Lichen
	100%							
dense		35 – 80	20 – 80	10 – 80	6 – 80	S – 80	H – 80	M – 80
	80%							
somewhat open		35 – 60	20 – 60	10 – 60	6 – 60	S – 60	H – 60	M - 60
	60%							
open		35 – 40	20 – 40	10 – 40	6 – 40	S – 40	H – 40	M - 40
	40%							
very open		35 – 25	20 – 25	10 – 25	S – 25	S – 25	H – 25	M – 25
	25%							
sparse		35 – 5	20 – 5	10 – 5	6 – 5	S – 5	H – 5	M – 5
	5%							
very sparse		35 – 0	20 – 0	10 – 0	6 – 0	S – 0	H – 0	M – 0
	0%							
Physiognomy		D DE ED E	D DE ED E	D DE ED E	D DE ED E	D DE ED E	P F G ER	M LIC LIV

Visual Representation:

	(% cover) 5 –25	25 – 40	40 – 60	60 – 80	80 – 100
35 – 60m					
Tree 20 – 35m					
10 –20m					
6 – 10m					
Shrub 0.5 – 6m					
Herb					
Moss					

III. Species Composition and Cover Class by Stratum. Record species cover in the following cover classes: **1** = trace, **2** = a few (<1%), **3** = 1 – 2%, **4** = 2 – 5%, **5** = 5 – 10%, **6** = 10 - 25%, **7** = 25 – 50%, **8** = 50 – 75%, **9** = 75 – 100%. Starting with the uppermost stratum record all taxa and total plot cover (**TC**) for each stratum. Record **DBH** in column for woody stems >/= 2.5cm DBH in plot; record in 5cm classes in <40cm DBH; record to the nearest cm if DBH > 40cm.

Taxon	C	TC	DBH	Taxon	C	TC
				Species Richness **N=**		

APPENDIX 2

The following are definitions of the state and global rankings of rare species utilized in this report. Originally developed and instituted by The Nature Conservancy, an international conservation organization, the global and state ranking system is used by all 50 state Natural Heritage Programs and numerous Conservation Data Centers in other countries in this hemisphere. Because they are assigned based upon standard criteria, the ranks can be used to assess the range-wide status of a species as well as the status within portions of the species' range. The primary criterion used to define these ranks are the number of known distinct occurrences with consideration given to the total number of individuals at each locality. Additional factors considered include the current level of protection, the types and degree of threats, ecological vulnerability, and population trends. Global and state ranks are used in combination to set inventory, protection, and management priorities for species both at the state as well as regional level.

GLOBAL RANK

G1 Highly globally rare. Critically imperiled globally because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 Globally rare. Imperiled globally because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 Either very rare and local throughout its range or distributed locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; typically with 21 to 100 estimated occurrences.

G4 Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.

G5 Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery.

GH No known extant occurrences (i.e., formerly part of the established biota, with the expectation that it may be rediscovered).

GU Possibly in peril range-wide, but its status is uncertain; more information is needed.

GX Believed to be extinct throughout its range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? The species has not yet been ranked.

_Q Species containing a "Q" in the rank indicates that the taxon is of questionable or uncertain taxonomic standing (i.e., some taxonomists regard it as a full species, while others treat it at an infraspecific level).

_T Ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species.

STATE RANK

S1 Highly State rare. Critically imperiled in Maryland because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres in the State) or because of some factor(s) making it especially vulnerable to extirpation. Species with this rank are actively tracked by the Natural Heritage Program.

S2 State rare. Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated. Species with this rank are actively tracked by the Natural Heritage Program.

S3 Watch List. Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Species with this rank are not actively tracked by the Natural Heritage Program.

S3.1 A "Watch List" species that is actively tracked by the Natural Heritage Program because of the global significance of Maryland occurrences. For instance, a G3 S3 species is globally rare to uncommon, and although it may not be currently threatened with extirpation in Maryland, its occurrences in Maryland may be critical to the long term security of the species. Therefore, its status in the State is being monitored.

S4 Apparently secure in Maryland with typically more than 100 occurrences in the State or may have fewer occurrences if they contain large numbers of individuals. It is apparently secure under present conditions, although it may be restricted to only a portion of the State.

S5 Demonstrably secure in Maryland under present conditions.

SA Accidental or a vagrant in Maryland.

SE Established, but not native to Maryland; it may be native elsewhere in North America.

SH Historically known from Maryland, but not verified for an extended period (usually 20 or more years), with the expectation that it may be rediscovered.

SP Potentially occurring in Maryland or likely to have occurred in Maryland (but without persuasive documentation).

SR Reported from Maryland, but without persuasive documentation that would provide a basis for either accepting or rejecting the report (e.g., no voucher specimen exists).

SRF Reported falsely (in error) from Maryland, and the error may persist in the literature.

SU Possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the State. Uncertainty spans a range of 4 or 5 ranks as defined above.

SX Believed to be extirpated in Maryland with virtually no chance of rediscovery.

S? The species has not yet been ranked.

_B This species is a migrant and the rank refers only to the breeding status of the species. Such a migrant may have a different rarity rank for non-breeding populations.

FEDERAL STATUS
This is the status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CRF 17.

LE Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.

LT Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

PE Taxa proposed to be listed as endangered.

PT Taxa proposed to be listed as threatened.

C Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

STATE STATUS
This is the status of a species as determined by the Maryland Department of Natural Resources, in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

E Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.

I In Need of Conservation; an animal species whose population is limited or declining in the State such that it may become threatened in the foreseeable future if current trends or conditions persist.

T Threatened; a species of flora or fauna which appears likely, within the foreseeable future, to become endangered in the State.

X Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.

* A qualifier denoting the species is listed in a limited geographic area only.

APPENDIX 3

The following is a list of all vascular plants referenced in forested tidal wetland communities in Maryland. Scientific and common names follow Kartesz (1999) with synonyms.

Taxon	Common Name	Synonyms
Acer negundo	Box-elder	
Acer rubrum	Red Maple	
Acorus calamus	Sweet Flag	
Alisma subcordatum	Common Water Plantain	
Alisma triviale	Northern Water Plantain	
Alnus maritima	Seaside Alder	
Alnus serrulata	Smooth Alder	
Amaranthus cannabinus	Water-hemp	
Amelanchier canadensis	Canada Serviceberry	
Apios americana	Groundnut	
Apocynum cannabinum	Indian-hemp	
Arisaema triphyllum	Jack-in-the-Pulpit	
Asimina triloba	Common Pawpaw	
Asparagus officinalis	Garden Asparagus	
Aster vimineus	Small White Aster	
Atriplex prostrata	Halberd-leaf Orach	Atriplex patula var. hastata
Baccharis halimifolia	Groundsel-tree	
Bidens aristosa	Tickseed-sunflower	Bidens polylepis
Bidens coronata	Tickseed	
Bidens discoidea	Tickseed Sunflower	
Bidens frondosa	Stick-tight	
Bidens laevis	Beggarticks	
Bignonia capreolata	Cross Vine	
Boehmeria cylindrica	False Nettle	
Botrychium dissectum	Cutleaf Grape-Fern	
Calystegia sepium	Hedge Bindweed	
Campsis radicans	Trumpetvine	
Carex atlantica	Prickly Bog Sedge	
Carex bromoides	Brome-like Sedge	
Carex comosa	Comosa Sedge	
Carex crinita	Fringed Sedge	
Carex debilis	White-edge Sedge	
Carex digitalis	Slender Wood Sedge	Carex digitalis var. macropoda
Carex folliculata	Northern Long Sedge	
Carex hormathodes	Necklace Sedge	
Carex hyalinolepis	Shoreline Sedge	
Carex intumescens	Bladder Sedge	
Carex longii	Long's Sedge	
Carex lupulina	Hop Sedge	
Carex lurida	Sallow Sedge	
Carex seorsa	Separated Sedge	
Carex squarrosa	Spreading Sedge	
Carex stipata	Crowded Sedge	
Carex stricta	Tussock Sedge	
Carex venusta	Pleasing Sedge	
Carpinus caroliniana	Ironwood	
Cephalanthus occidentalis	Buttonbush	
Chamaecyparis thyoides	Atlantic White-cedar	
Chasmanthium laxum	Slender Spikegrass	
Chelone glabra	White Turtlehead	
Chionanthus virginicus	Fringe-tree	
Cicuta maculata	Southern Poison-hemlock	
Cinna arundinacea	Stout Woodreed	
Clematis terniflora	Sweet Autumn	
Clematis virginiana	Virgin's-bower	

Clethra alnifolia	Coastal Sweet-pepperbush	
Commelina communis	Swamp Dayflower	
Commelina virginica	Dayflower	
Cornus amomum	Silky Dogwood	
Cuscuta gronovii	Dodder	
Cyperus odoratus	Fragrant Galingale	
Decodon verticillatus	Swamp-loosestrife	
Dichanthelium acuminatum	Panicgrass	
Dichanthelium acuminatum var. fasciculatum	Coastal Plain Witchgrass	Dichanthelium lanuginosum
Dichanthelium clandestinum	Deer-tongue Witchgrass	
Dichanthelium dichotomum	Witchgrass	
Dioscorea villosa	Wild Yam	
Diospyros virginiana	Eastern Persimmon	
Distichlis spicata	Saltgrass	
Dulichium arundinaceum	Threeway Sedge	
Echinochloa walteri	Stout Barnyard Grass	
Eleocharis fallax	Creeping Spikerush	
Eleocharis palustris	Marsh Spikerush	
Elymus virginicus	Virginia Wild Rye	
Erechtites hieracifolia	Fireweed	
Euonymus americanus	American Strawberry-bush	
Fraxinus pennsylvanica	Green Ash	
Fraxinus profunda	Pumpkin Ash	
Galium aparine	Bedstraw	
Galium obtusum	Blunt-leaf Bedstraw	
Galium tinctorium	Clayton's Bedstraw	
Galium trifidum	Small Bedstraw	
Gaylussacia frondosa	Dangleberry	
Glechoma hederacea	Ground Ivy	
Glyceria striata	Fowl Mannagrass	
Hibiscus moscheutos	Eastern Rose-mallow	
Hydrocotyle verticillata	Whorled Pennywort	
Ilex glabra	Little Gallberry	
Ilex opaca	American Holly	
Ilex verticillata	Winterberry	
Impatiens capensis	Orange Jewelweed	
Iris versicolor	Blue Flag	
Itea virginica	Virginia-willow	
Iva frutescens	Maritime Marsh-elder	
Juncus coriaceus	Tough Rush	
Juncus effusus	Soft Rush	
Juncus roemerianus	Black Needlerush	
Juniperus virginiana	Eastern Red-cedar	
Leersia oryzoides	Rice Cutgrass	
Lemna minor	Lesser Duckweed	
Leucothoe racemosa	Swamp Doghobble	
Ligustrum vulgare	Privet	
Lilium superbum	Turk's Cap Lily	
Lindera benzoin	Northern Spicebush	
Liquidambar styraciflua	Sweetgum	
Liriodendron tulipifera	Tuliptree	
Lobelia cardinalis	Cardinal-flower	
Lonicera japonica	Japanese Honeysuckle	
Lycopus virginicus	Virginia Water-horehound	
Lyonia ligustrina	Fetterbush	
Lythrum lineare	Saltmarsh Loosestrife	
Magnolia virginiana	Sweetbay	
Melanthium virginicum	Virginia bunchflower	
Microstegium vimineum	Japanese stilt grass	
Mikania scandens	Climbing Hempvine	
Mitchella repens	Partridgeberry	
Monotropa uniflora	Indian Pipe	

Morella cerifera	Wax-myrtle	Myrica cerifera
Nuphar lutea ssp. advena	Broadleaf Pondlily	
Nyssa biflora	Swamp Blackgum	
Onoclea sensibilis	Sensitive Fern	
Osmunda cinnamomea	Cinnamon Fern	
Osmunda regalis var. spectabilis	Royal Fern	
Oxypolis rigidior	Common Water-dropwort	
Packera aurea	Ragwort	Senecio aureus
Panicum virgatum	Switchgrass	
Parthenocissus quinquefolia	Virginia Creeper	
Peltandra virginica	Green Arrow-arum	
Persea borbonia	Swampbay	
Phoradendron leucarpum	American Mistletoe	Phoradendron flavescens
Photinia pyrifolia	Red Chokeberry	
Phragmites australis	Common Reed	
Physostegia virginiana	Obedient Plant	
Pilea pumila	Richweed	
Pinus serotina	Pond Pine	
Pinus taeda	Loblolly Pine	
Platanthera clavellata	Small Green Wood Orchid	
Platanus occidentalis	Sycamore	
Pluchea foetida	Marsh-fleabane	
Pluchea odorata var. odorata	Salt-marsh Fleabane	Pluchea purpurascens
Poa autumnalis	Bluegrass	
Polygonum arifolium	Halberd-leaf Tearthumb	
Polygonum hydropiperoides	False Water-pepper	
Polygonum punctatum	Dotted Smartweed	
Polygonum sagittatum	Arrow-leaved Tearthumb	
Polygonum virginianum	Virginia knotweed	Tovara virginiana
Pontederia cordata	Pickerelweed	
Prunus serotina	Black Cherry	
Ptilimnium capillaceum	Mock Bishopweed	
Quercus alba	White Oak	
Quercus falcata	Southern Red Oak	
Quercus lyrata	Overcup Oak	
Quercus nigra	Water Oak	
Quercus palustris	Pin Oak	
Quercus phellos	Willow Oak	
Quercus rubra	Northern Red Oak	
Ranunculus hispidus var. nitidus	Bristly Buttercup	Ranunculus septentrionalis
Rhododendron viscosum	Swamp Azalea	
Rosa multiflora	Multiflora Rose	
Rosa palustris	Swamp Rose	
Rubus argutus	Southern Blackberry	
Rubus hispidus	Bristly Dewberry	
Rudbeckia laciniata	Coneflower	
Rumex verticillatus	Swamp Dock	
Sagittaria latifolia	Broadleaf Arrowhead	
Salix nigra	Black Willow	
Sambucus nigra ssp. canadensis	American Elder	Sambucus canadensis
Samolus valerandi ssp. parviflorus	Water Pimpernel	Samolus parviflorus
Saururus cernuus	Lizard's-tail	
Schoenoplectus americanus	Chairmaker's Bulrush	
Schoenoplectus tabernaemontani	Softstem Bulrush	
Scirpus cyperinus	Woolgrass Bulrush	
Scutellaria lateriflora	Mad-dog Scullcap	
Setaria parviflora	Yellow Foxtail Grass	Setaria geniculata
Sisyrinchium angustifolium	Pointed Blue-Eyed Grass	Sisyrinchium graminoides
Sium suave	Hemlock Water-Parsnip	
Smilax bona-nox	Fringed Greenbrier	
Smilax glauca	Whiteleaf Greenbrier	
Smilax laurifolia	Blaspheme-vine	

Smilax pseudochina	Long-Stalk Greenbrier	
Smilax rotundifolia	Common Greenbrier	
Smilax walteri	Coral Greenbrier	
Solidago rugosa	Wrinkleleaf Goldenrod	
Solidago sempervirens	Seaside Goldenrod	
Sparganium eurycarpum	Giant Bur-reed	
Spartina alterniflora	Saltmarsh Cordgrass	
Spartina cynosuroides	Giant Cordgrass	
Spartina patens	Saltmeadow Cordgrass	
Sphenopholis pensylvanica	Swamp oats	
Stellaria longifolia	Longleaf starwort	
Symphyotrichum novi-belgii var. novi-belgii	New York Aster	Aster novi-belgii
Symphyotrichum puniceum var. puniceum	Purple-stem Aster	Aster puniceum
Symplocarpus foetidus	Skunk Cabbage	
Taxodium distichum	Bald-cypress	
Teucrium canadense	Wild Germander	
Thalictrum pubescens	Tall Meadow Rue	Thalictrum polygamum
Thelypteris palustris	Marsh Fern	
Toxicodendron radicans	Poison-ivy	
Triadenum virginicum	Virginia Marsh St. John's-wort	
Trillium pusillum var. virginianum	Small Marsh Trillium	
Typha angustifolia	Narrowleaf Cattail	
Typha latifolia	Broadleaf Cattail	
Ulmus americana	American Elm	
Vaccinium corymbosum	Highbush Blueberry	
Veratrum viride	American False Hellebore	
Vernonia noveboracensis	New York Ironweed	
Veronica serpyllifolia	Water Speedwell	
Viburnum nudum	Wild Raisin	
Viburnum prunifolium	Smooth Black-haw	
Viburnum dentatum var. lucidum	Smooth Arrow-wood	Viburnum recognitum
Viola cucullata	Marsh Blue Violet	
Vitis aestivalis	Summer Grape	
Vitis labrusca	Wild Grape	
Woodwardia areolata	Netted Chainfern	
Woodwardia virginica	Virginia Chainfern	
Zizania aquatica	Indian Wild Rice	

State of Maryland

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