CYPRESS CREEK SAVANNA: A HISTORY OF VEGETATIVE CHANGES

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Abstract-- Atlantic white cedar (AWC) and associated peatland species have been reported at Cypress Creek Savanna in Severna Park, Maryland for one hundred years. Historical records of site vegetation indicate a relatively recent significant decline in AWC and other locally rare plant species, along with an increase in *Phragmites australis*. The decline in the AWC population was first recorded in 1988 and has continued through 2006. We compared AWC count data collected in 1997, 2003 and 2006 to predict the fate of the AWC population. It is likely that all of the rare species will be extirpated unless there are dramatic efforts to restore the site. We concluded that increases in salinity at the site were most likely the main cause of the loss of AWC and other peatland plants.

Keywords: Atlantic white cedar, *Chamaecyparis thyoides*, Cypress Creek Savanna, salinity, invasive, brackish, *Phragmites*, propagules, Maryland

INTRODUCTION

Cypress Creek Savanna is located on the east side of Maryland Route 2 at a tidal interface of the Magothy River in Severna Park, Maryland. The site has been characterized as a sea level fen (Sipple 1999). Over one hundred years of historical accounts of the site report the presence of rare plant species, including an AWC (*Chamaecyparis thyoides* (L.) BSP) population.

In 1904, Dr. Charles Plitt began describing Cypress Creek Savanna and recording his observations of the plant species occurring at the site (Sipple 1999). Dr. Plitt described "many" white cedar and a "large" sphagnum swamp that contained three orchid species, pitcher plants, and "great patches" of the native cranberry (*Vaccinium macrocarpon* Ait.) in 1907 (Sipple 1999).

During the twentieth century the Cypress Creek area became highly developed, with many new roads and buildings. Located at the narrowest part of the peninsula separating the Severn and Magothy Rivers, development separated the AWC population into 4 current sites (Cypress Creek Swamp, Cypress Creek Savanna, Dill Road, and Sullivan Cove) as identified by Sheridan and others (1999). Other sites were eliminated, such as the AWC on the North Fork of (or Big) Cypress Creek, which received runoff from large impervious areas associated with roads and shopping centers.

Beginning in 1977, William S. Sipple and others conducted a series of studies at Cypress Creek Savanna. In 1977, Sipple (1977) stated that the number of cedar trees probably easily exceeded one hundred, although many were small saplings and most of the larger ones were only 3 to 6 inches diameter at breast height (dbh). Sipple and Klockner (1980) described the site as a two-acre wetland with an open savanna, surrounding AWC swamp, deciduous swamp and tidal marsh. The open savanna was dominated by *Cladium mariscoides* and *Rhynchospora alba* with small (one to six feet tall) AWC scattered throughout, and the AWC swamp included a few specimens up to 1 foot dbh (Sipple and Klockner 1980). Unlike the other AWC sites in Maryland, Cypress Creek Savanna contained many vigorous AWC seedlings (Sipple and Klockner 1984).

Sipple visited the Cypress Creek site in 1982, 1983, 1986 and 1987 and did not notice any problems with the cedars (Sipple 1999). On July 9, 1988, however, Sipple (1999) was disappointed that almost all of the AWC appeared dead

and there was no evidence of *Drosera*, *Sarracenia*, *Eleocharis flavescens*, orchids, and other interesting plants that he had previously found. On June 10, 1992 Sipple noted that many of the small cedars had died and that he did not see any sundews or orchids. Similarly, his June 18, 1993 report indicated that much of the AWC was dead, particularly the smaller trees. He did find one remaining yellow-fringed orchid (formerly *Habenaria ciliaris*, now *Platanthera ciliaris*) on August 13, 1998 (Sipple 1999).

In 1997, a census of AWC in Anne Arundel County, Maryland quantified the number and diameters of AWC trees at ten sites (Sheridan and others 1999). The Cypress Creek Savanna site included 501 dead trees, 125 living trees and 24 seedlings. Of the ten sites sampled, the Cypress Creek Savanna had the fourth largest number of living trees and the fourth largest number of seedlings.

The purpose of this study was to resample AWC at Cypress Creek Savanna in an effort to continue the long-term evaluation of changes that are occurring at the site. We compared AWC count data collected in 2003 and 2006 to the 1997 data to predict the fate of the AWC population. We also considered some of the possible reasons for the decline of the population.

METHODS

Site visits were made in April and May 2003 and in May and June 2006 to count the number of living AWC trees and seedlings at Cypress Creek Savanna. We used the same protocol as in the 1997 census (Sheridan and others 1999). Live cedars measuring over 1.2 m in height were recorded as trees and individuals measuring less than 1.2 m were recorded as seedlings. Salinity measurements were taken in ten shallow pools of standing water dispersed around the Savanna and in the adjacent tidal creek on May 17, 2006 using a Model REF211ATC Salinity Refractometer from Mannix Testing & Measurement.

RESULTS

A total of 650 AWC were counted in 2003, but most of them were dead - only 85 living trees and 23 seedlings were found. In 2006, the number of live trees and seedlings had declined to 56 and 7, respectively. Figure 1 shows the changes that have occurred since the 1997 census. The number of living AWC has declined from 149 to 63 between 1997 and 2006. There has been a continuous decline in the number of living trees from 125 in 1997 to 85 in 2003 and to 56 in 2006. The number of seedlings was similar in 1997 and 2003, but there was a sharp decline between 2003 and 2006 (from 23 to 7).

Salinity measurements within the Savanna ranged from five to six parts per thousand, compared to eight parts per thousand in the adjacent tidal creek. Seven pools of water had salinity readings of five parts per thousand, and three pools had readings of six parts per thousand.

DISCUSSION

Long-term records of AWC at the Cypress Creek Savanna clearly demonstrate that dramatic changes have occurred. While not specifically sampled in this study, historical records demonstrate that almost all of the locally rare acidophilic bog/fen species (e.g., *Drosera, Platanthera, Sarracenia*) have been eliminated. The site has also been invaded by common marsh species that can tolerate higher pH and brackish conditions, especially the invasive common reed (*Phragmites australis*), which is expanding rapidly in mid-Atlantic brackish wetlands. AWC and perhaps a few individual orchids or cranberries are the last of the rare species remaining. The decline of the AWC population and the disappearance of the other rare species indicate a change in the ecosystem, probably related to long term changes to the hydrology of the site (Sheridan and others 1999).

Cypress Creek Savanna is occasionally exposed to tidal water from adjacent estuarine areas (Whigham 1981, Whigham and Richardson 1988, Sipple 1999). Hull and Whigham (1987) predicted that sea level rise and the subsequent rise in salinities threatened the future existence of AWC in Anne Arundel County, Maryland. The 2006 salinity measurements clearly demonstrate that brackish water has entered the site, and increasing evidence shows that AWC can be killed by exposure to high salinities (Personal communication. George Zimmermann. 2006. Richard Stockton College of New Jersey. P.O. Box 195. Pomona, NJ 08240-0195). Increased frequencies of tidal flooding in the future as a result of sea level rise will likely continue to stress and kill the remaining cedars.

Competition from common species that invade the site as a result of changes in soil salinity may be another possible contributing cause of the decline of AWC. AWC recruitment generally occurs in habitat formed over open water as grasses and deadfalls create hummocks in sunlit areas. Common reed and other species invade this habitat and will compete with AWC. For example, a large number of AWC that had established on hummocks along a tidal pond edge at Sullivan Cove in 1996 were out-competed by common reed over the subsequent two years (Personal communication. Keith Underwood. 2003. Ecologist, 1753 Ebling Trail, Annapolis, MD 21401). At Cypress Creek Savanna, Sipple and Klockner (1984) considered the common reed to be restricted to two small areas and doing poorly in 1977 and 1978. In his June 18, 1993 journal notes, Sipple (1999) noted that the patches of common reed had spread, but he did not give an indication of the extent of the spread.

CONCLUSIONS

Extinction of the Cypress Creek Savanna AWC population would occur within the next 5 to 10 years if the rate of decline between 1997 and 2006 continues. Although the definitive reasons for the decline of rare plants cannot be determined without extensive monitoring, the increase in salinity is likely the most important factor. Increasing competition from common reed may also be important, especially for seedlings and saplings.

Hull and Whigham (1987) concluded that, because of their age and natural origins, the Cypress Creek sites were the main source of propagules for colonization of five other, younger, man-influenced bogs studied. As the historic main source of propagules of rare species for the nearby peatlands (Hull and Whigham 1987), Cypress Creek Savanna should be preserved and restored. Hull and Whigham (1987) and Sipple (1999) argued for the acquisition and preservation of the peatlands on the western shore of Maryland, including Cypress Creek Savanna. There has been significant progress in purchasing some of the peatlands and in regulatory protections (Broersma-Cole 2005), but Cypress Creek Savanna is still declining in quality. It seems likely that all of the rare species will be extirpated unless there are dramatic efforts to restore the site. The portion of the property encompassing the Cypress Creek Savanna could be purchased, or a stewardship agreement could be formed with the private landowner. A successful project could then be conducted that would restore the native peatland biota by recreating a fresh water system and seeding and planting the site with propagules from the Savanna and other local sites.

For existing populations of rare fresh water plant species that occur just above sea level to persist as sea level rises, these species must be able to move to suitable habitat available at adjacent higher elevations, or brackish waters must be physically kept at bay. Projects to enhance and create suitable habitat for these species can make significant contributions to preserving and increasing local and regional native biodiversity (Underwood and others 2005).

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Figure 1—Living Atlantic white cedar trees and saplings by year.