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Atlantic White Cedar Wetlands

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Water Quality Studies of Six Bogs on the Inner Coastal Plain of Maryland

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Abstract. Weekly samples of surface and/or interstitial water were collected from six bogs and contiguous forested wetlands between 24 June and 26 August 1980, and at five of the sites between 26 August and 2 December. The sampling strategy was developed to determine what changes in eight water quality parameters occurred as water moved into and through the upstream forested wetland and into and through the bogs. Discriminant function analysis was used to determine differences between bogs and subsites within each bog. Correlation coefficients for each discriminant analysis were used to suggest which water quality parameters would be most suitable to monitor to assess negative impacts due to upstream watershed development. Calcium was chosen to distinguish subsites at three bogs, pH at three others, and phosphate plus inorganic nitrogen at one highly eutrophic site.

Key words: bogs, forested wetlands, Inner Coastal Plain, Maryland, water quality

Introduction

A study was conducted to characterize chemical and biological parameters in six bogs and contiguous forested wetlands in Anne Arundel County, Maryland. A map indicating the locations of the study sites is in Hull and Whigham (this volume). Only one of the sites, Cypress Creek, contained *Chamaecyparis thyoides* (Atlantic white cedar). The other bogs developed in areas that were anthropogenically altered. Forested wetlands were contiguous with the bogs at all sites. The forests were dominated by *Acer rubrum* (red maple), *Magnolia virginiana* (sweet bay), and *Nyssa sylvatica* (black gum) (Hull and Whigham this volume). Typical bog species occurred in the nonforested habitats, and *Sphagnum* sp. dominated the herb stratum in all bogs.

The project consisted of a quantitative vegetation study (Hull and Whigham this volume), a comparative analysis of nutrients in both vegetation and substrates (Whigham 1981; Whigham and Richardson in press), and a water quality study. In this paper, I present a summary of the water quality study that was designed with the following objectives: (1) determine concentrations of selected water quality parameters as surface and/or shallow interstitial water flowed into and through contiguous forested and bog habitats; (2) identify water quality parameters that could be used to monitor potential changes that might occur in the bogs as a result of upstream watershed development. Additional details of the water quality study can be found in Whigham (1981).

Methods

Water samples were collected at several locations at each site; sampling locations were chosen with objective 1 as a guideline. Weekly surface or shallow interstitial water samples were collected from 24 June to 2 December 1980, except at one site where sampling was discontinued on 26 August. Samples were collected in acid washed polyethylene bottles, acidified in the field, placed on ice, and taken to the laboratory within 4 hours. Filtered samples were analyzed by the Maryland Water Resources Laboratory for pH, ammonia, nitrate, nitrite, phosphate, calcium, potassium, and dissolved organic matter.

Summary of Results

When all sites were compared for all water quality parameters, it was not possible to clearly differentiate any of the six sites (Whigham 1981). Analysis of data from each site, however, provided patterns such as shown for the Cypress Creek site that contained Atlantic white cedar (Fig. 1). The four sampling stations formed a continuum. Water quality at bog station 3 was most similar to water quality in the tidal wetland. The station in the middle of the bog, location 2, was intermediate and the station at the bog-forested wetland interface, location 1, was distinctly different from the tidal wetland station. Data on pH, the water quality parameter with the highest canonical coefficient in the discriminant analysis, for the four Cypress Creek stations are shown in Figure 2. Data on pH were always lowest at the bog-forested wetland interface, and there were only minor differences between the tidal wetland and lower bog stations. The station in the middle of the bog was intermediate and appeared to be influenced by downstream flow from the upper part of the bog and by intrusion of brackish water from the downstream tidal wetland.

Conclusions

It was possible to differentiate sampling locations within each of the six bogs using discriminant analysis. We used results from this study to recommend water quality parameters which could be monitored at each of the six sites to determine if upstream watershed development was having any impact on the bogs. Calcium and pH were important at three sites (Table 1). Three forms of inorganic nitrogen were important at Angel's Bog, the most eutrophic site, while phosphorus and ammonia were important at Eagle Hill. The water quality study demonstrated that the forested wetlands act as a buffer between the upland watersheds and the bogs (Whigham 1981).

Acknowledgments

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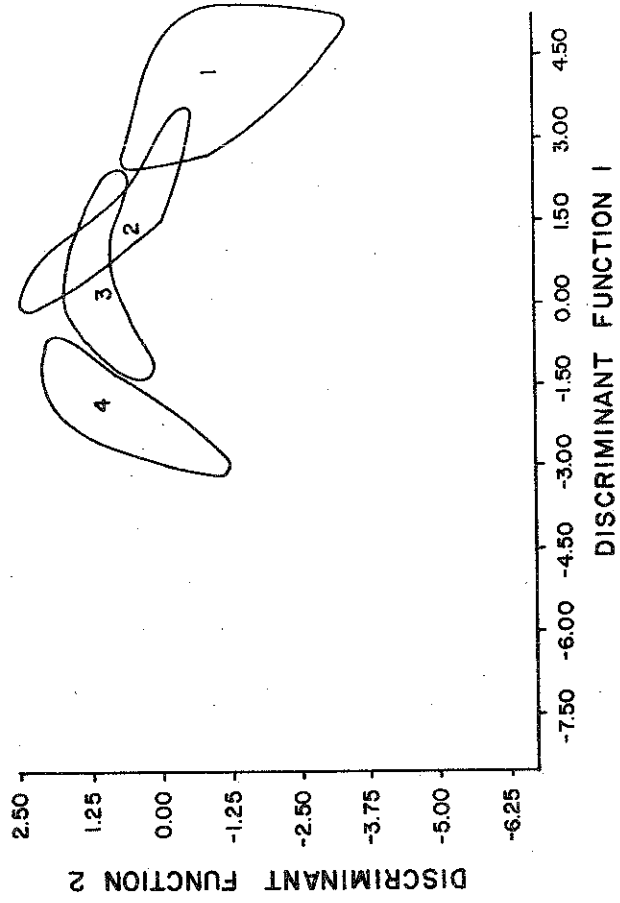


Figure 1. Results of discriminant analysis of water quality data from Cypress Creek. Refer to summary for description of sampling locations 1-4.

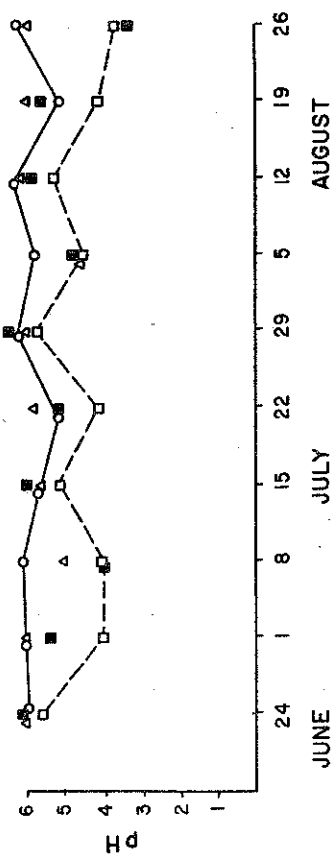


Figure 2. pH data for 4 sampling locations in Cypress Creek. Refer to summary for description of sampling locations 1-4.

TABLE 1
 Recommendations made as a result of discriminant analysis of water quality
 data.

Site	Parameter to be measured
North Grays Creek	Calcium, pH
South Grays Creek	pH
Round Bay	Calcium
Angel's Bog	Ammonium, Nitrate, Nitrite
Eagle Hill	Calcium, Phosphate, Ammonia
Cypress Creek	pH