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PROJECT REPORT
Testing Vegetation Sampling Methods of Central Pine Barren Freshwater Wetlands in Preparation of the Wetland Protocol[1]

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Abstract

Testing Vegetation Sampling Methods of Central Pine Barren Freshwater Wetlands in Preparation of the Wetland Protocol. EMILY EFSTRATION (University of Delaware, Newark, DE 19717) ARIANA BREISCH, MS, Mentor, (Foundation for Ecological Research in the Northeast at Brookhaven National Laboratory, Upton, NY 11973).

The current health of the freshwater wetlands of the Long Island Central Pine Barrens is unknown. In order to determine the health of the wetlands, a protocol must be established to determine a baseline. The baseline will then aid in monitoring future wetland conditions. Several bioassemblages of the wetland community will be examined because each element has an affect on the overall health of the wetland. Vegetation is an element that plays a major role in determining the health of the wetlands. It is the primary source of energy flow in the wetland ecosystem and forms the foundation of the wetland food chain. No other life forms are able to exist without the presence of vegetation. Plants, both dead and alive, form a structural habitat for many species to live and thrive in. Not only does vegetation affect taxonomic groups, but it also has a major impact on the wetland's water and soil quality. Therefore, vegetation is very important for the survival of the entire wetland community and must be closely monitored. By reading bioassessment case studies of Florida, Michigan, Minnesota, North Dakota, Oregon, Wisconsin and Maryland, different methods for analyzing wetland vegetation were collected and examined. Information on how to carry out various analytical techniques of vegetation was gathered and organized. The techniques that best suited our purpose, along with the necessary equipment, were taken into the Pine Barren Wetlands to be tested. Many different methods for analyzing the wetland vegetation was carried out in and around the wetland ponds of Long Island. The procedures that were the most practical and informative for the wetlands being assessed were noted. Many methods that were tested did not apply to the Pine Barren wetlands being examined because many of the case studies established permanent plots. Since the wetlands being studied will be on public lands, permanent plots were not a viable option. Upon investigating different methods of vegetative analysis, it was found that the case studies were very helpful, but many of the procedures were altered in order to accommodate the ponds being studied. Further investigation must be conducted in order to determine the precise vegetative methods that will be used to examine plants of the freshwater wetlands in the Long Island Pine Barrens.

Introduction

Little is known about the current health of the Long Island Central Pine Barrens freshwater wetlands because there has not been much research conducted in the area. Currently, there is no wetlands protocol established in the state of New York to help address this issue. The health of the freshwater wetlands is critical because it has an affect on the health of the aquifer of Long Island. This aquifer provides most of Suffolk County Long Island with drinking water [1]. Therefore, unhealthy freshwater wetlands could potentially have a bad affect on the quality of Long Island's drinking water.

Another factor that must be considered is that fact that Long Island is home to many threatened and endangered species. All animals rely on water as a source of nutrients and some of these endangered animals, such as the Eastern Tiger Salamander (*Ambystoma tigrinum*), live in and near the water. Fish as well as many amphibians and reptiles rely on water to reproduce and raise their offspring. An unhealthy freshwater wetland could not only affect the human population, but it could be devastating to a rare native species.

An organization that has realized this problem and is putting forth an effort to construct a freshwater wetlands protocol is the Foundation of Ecological Research in the Northeast (FERN). One of the main purposes of FERN is to establish a step-by-step freshwater wetland protocol in order to monitor the health of the wetlands on Long Island [1]. This protocol will be composed of many parts, all of which have an affect on the overall health of the wetland. Much of the wetland assessment will be based strictly on observations, but there will be aspects that yield empirical data. Analyzing water quality, soil quality and macroinvertebrates will yield quantitative data while the vegetation, reptile, amphibian, bird and mammal sections will consist of observations.

There are seven different freshwater wetland community types on Long Island that will be studied. These wetland types are the Coastal Plain Ponds/Pondshores, Coastal Plain Poor Fen, Highbush Blueberry/Bog Thicket, Pine Barrens Shrub Swamp, Coastal Plain Atlantic White Cedar Swamp, Emergent Marsh and Red Maple-Black Gum Swamp. Each of the wetlands are different and contain a variety of different flora and fauna. One of the main ways to tell these communities apart is by the vegetation that is present in the area.

Vegetation is a very important part of the wetland community. It is used to identify the wetland community itself, the boundary of the wetland, and it also contributes many different features to the wetland community [2]. Vegetation forms the base of the food chain and therefore is the

primary source of energy. Plants contain the highest amount of energy in the entire wetland community and are crucial for the wetlands survival. It was discovered that although primary production in wetlands vary, some herbaceous wetland communities have very high levels of productivity and rival the productivity of rainforests [3].

Plants provide a habitat for many different taxonomic groups including macroorganisms and invertebrates. Many different species of vegetation help to promote biodiversity in these groups [3].

There is a very strong link between vegetation and water chemistry because plants uptake nutrients from the soil and release them into the surrounding water. Vegetation can potentially improve water quality by up taking nutrients, metals and other contaminants that may be in the wetland [3]. They serve as a filter system for the wetland by taking up not only nutrients, but also contaminants that may be present.

Plants are an excellent indicator of wetland conditions because they have high levels of species richness, rapid growth rates and a high response to changes in the environment. The sedge species, *Carex*, is an excellent indicator of wetland conditions because it is very sensitive to particular changes in environmental conditions. They have very specific habitat requirements so if conditions are not perfect, they will not survive [4]. Because plants are primarily immobile (besides some floating aquatic species) they can indicate any long-term, chronic stress a wetland undergoes.

A great diversity of species exists with differing responses to human disturbance. Ecological tolerances are known for many species, and thus changes in community composition might be used to diagnose the stressor responsible. For example, plant responses to changing hydrology are reasonably predictable.

Materials and Methods

The first step in establishing the vegetation aspect of the Long Island Central Pine Barrens wetland protocol was to research different methods of analyzing wetland vegetation. By reading case studies from other states that had established wetland protocols, procedures and methods on how to analyze and test wetland vegetation was gathered and organized. Information on the techniques and procedures that other states had used was found in the United States Environmental Protection Agency's Methods for Evaluating Wetland Conditions [5]. Once procedures were found that seemed to fit our needs, they were tested out in the field.

After the vegetative analysis aspect of the wetlands protocol was completed, data sheets were constructed that fit the information that was to be collected. The data sheets include a Wetland Sketch data sheet, Photographic Record data sheet and Vegetation data sheet. These three data sheets can be found in Appendices 1-3.

The first step out in the field was to draw a thorough sketch of the wetland. Distinct features of the wetland and surrounding area were noted on the sketch. Different vegetative communities (i.e. grasses, rushes and sedges) were also drawn on the sketch. Points where photographs were taken were noted on the sketch to ensure pictures were taken from the same locations when revisited. The water and soil sample locations were also drawn on the sketch. Roads and hiking paths were noted on the sketch as well as invasive species, cattails, phragmites, hardwood trees, pitch pine trees and shrubs. Symbols in the legend were used when marking features on the sketch. An example of this data sheet can be found in Appendix 1.

The next step was to take photographs of the wetland using a waterproof camera and a compass. Photo points were set up and panoramic shots of the wetland were taken from that location. The points were marked electronically by GPS and manually on the wetland sketch to make them easy to locate again. Panoramic pictures were taken from areas that best represented the overall wetland community. The number of photographic points varied with the size of the wetland. A large wetland required more photographic locations to obtain an accurate visual of the wetland. The file number of the photograph was noted for future observation and comparison. The bearing at which the picture was taken was also written down on the data sheet. Noting the bearing on the data sheet ensures that pictures will be taken from the same direction when the wetland is revisited in the future.

Photographs were also used when a plant or animal species could not be identified in the field. If a picture was taken of the species, it was helpful

in its identification when returning to the laboratory. All pictures that were taken (panoramic pictures of the wetlands and otherwise) were recorded on the Photographic Record data sheet, seen in Appendix 2.

The next step was to note the estimated surface area of emergent vegetation. Emergent vegetation types include sedges, grasses, rushes, waterlillies, shrubs and trees. The surface area estimations of each type of emergent vegetation was approximated into five different groupings; 0%, 1-25%, 25-50%, 50-75% or 75-100%. A complete list of all vegetation encountered in the wetland area was compiled and written down on the Vegetation data sheet (Appendix 3). Freshwater wetland vegetation includes both aquatic and terrestrial species.

Alternate means of gathering vegetative data was investigated. One way was establishing a baseline and running parallel and perpendicular transects from the baseline. Data was then collected from the transects [3]. Another means was making four transects total, each from one of the cardinal point directions, and meeting in the middle of the wetland. Data was collected from points along the four transects [6].

Finally, other information that was gathered when researching vegetation in the area was a comprehensive species list, cover estimate of each species, cover class, relative cover of each plant species, relative density of the species, stems per unit area, basal area, importance values, standing biomass, DBH of living plants, dead plants and shrubs, length and state of downed logs, abundance of a species and dominant species present in the wetland. The DBH of the plants was determined by using DBH measuring tape and the length of the downed logs was measured with a tape measure. Most other information was determined by estimations done by two or more crewmembers.

Results

Vegetation Sampling by State [3]

State	OH	OR	MN	MI	MD	FL
Plot Size and Description	transects	Quadrats - no more than 9	Releve plots 10mX10m in emergent and open water submergent zones	2 transects per bird census plot for all elevations of wetland	Transects	4 cardinal transects intersecting at center of plot
Comprehensive Species List	X		X	X	X	X
Cover Estimate	X					
Cover Class	X		X			
Relative Cover	X					
Relative Density	X					
Stems per Unit Area	X					
Basal Area	X					
Importance Values	X					
Standing Biomass	X					
DBH				Living, dead, shrub		
Downed Logs				Length, state of decomposition		
Abundance					X	X
Dominance		X			X	X

Discussion and Conclusion

Although many procedures and methods were tested out in the field, it was found that most of the procedures were hard to conduct in all Long Island Central Pine Barren freshwater wetland community types. Line transects, quadrats and permanent plots were all tested in the wetlands, but none of the methods worked well for all communities. A major concern was the fact that a large percentage of the freshwater wetlands are ponds, many of which are too big and too deep to cross in waders. Since there are many species of vegetation in and on the water, the vegetation in the water must be analyzed in some manner. One system of analyzing the wetland by means of line transects was to establish a baseline on the edge of the wetland and run transects parallel and perpendicular to the baseline [3]. Without a boat, line transects through the wetland would be impossible to set up and analyze.

If a permanent plot was established on the shores of the wetland community, an overall representation of the wetland would not be met because some species of vegetation could be present outside of the plot. An established plot would give information as to the dominant species of plants that were present in the wetland, but it would not give an accurate representation of the entire community [3]

The idea of setting up a series of quadrats was discussed, but it was dismissed. To obtain data that best represented the wetland community as a whole, quadrats did not seem like a viable option.

Certain vegetation and plant species are hard to identify when they are not flowering so it was decided that vegetative analysis of the wetland communities would be conducted in the summertime. Crewmembers would note the emergent vegetation in the wetland and document the estimated surface area of each vegetation type. Multiple crewmembers (two or more) will determine the estimation so that the information recorded on the data sheets is the most accurate. Other than the emergent vegetation, an overall species list of all vegetation encountered in the wetland area is to be noted on the Vegetation data sheet (Appendix 3). The overall species list will include an estimated surface area that the species covers. This estimation will help to determine the dominant species when analyzing the data (i.e. the plant species with the largest surface area coverage will be the most dominant species of its plant type). During the fall, winter and spring seasons, crewmembers will note whether they observe any abnormal vegetative characteristics in the wetland area, such as invasive species.

A major concern when establishing the freshwater wetlands protocol was the issue of time. Multiple components of the wetlands are going to be analyzed including the water, soil, macroinvertebrates, amphibians, reptiles, birds, mammals, the area around the wetland and the vegetation. To analyze all of these aspects of the wetland will be very time consuming so the method chosen needs to give the best data in the least amount of time. After much review, it was decided that an overall estimation of the vegetation would be ideal. It would give us information as to what types of emergent vegetation are dominant as well as which specific plant species is most abundant. This form of vegetative analysis was not decided before testing out other analytical methods in the field, which were presented in different state case studies [3].

Panoramic pictures of the wetland location will be taken each time it is visited. The location where the pictures were taken and the bearing at which the pictures were taken will be recorded on the Photographic Record data sheet as well as the Sketch of the Wetland data sheet (Appendices 1 and 2). The location and bearing of the photographs must be recorded so that pictures can be taken from the same angles and from the same points in the wetland when it is revisited. Panoramic pictures are important in seeing the changes that the wetland undergoes throughout the seasons. Pictures are a way to visualize the wetland communities without actually visiting the wetland. They can be printed out and laid side-by-side for a visual comparison.

The sketch of the wetland is one of the most important factors when visiting the wetland. The sketch will documents where roads and paths are, where the photo points and water sample points are located, any defining features of the wetland as well as other characteristics that must be documented. Having the sketch when returning to the wetland will be very helpful in seeing the changes that have taken place from one season to another. Invasive species are to be drawn on this sketch. By comparing sketches from different seasons or time periods, conclusions can be made about whether invasive species control or native community restoration will be necessary or not.

Acknowledgments
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[1] Foundation of Ecological Research in the Northeast. 2007. Freshwater Wetland Health and Biodiversity Monitoring. http://fern-li.org/Index.htm

[2] Tiner, R. W. 1999. Wetland Indicators: A Guide to Wetland Identification, Delineation, Classification, and Mapping. CRC Press, London.

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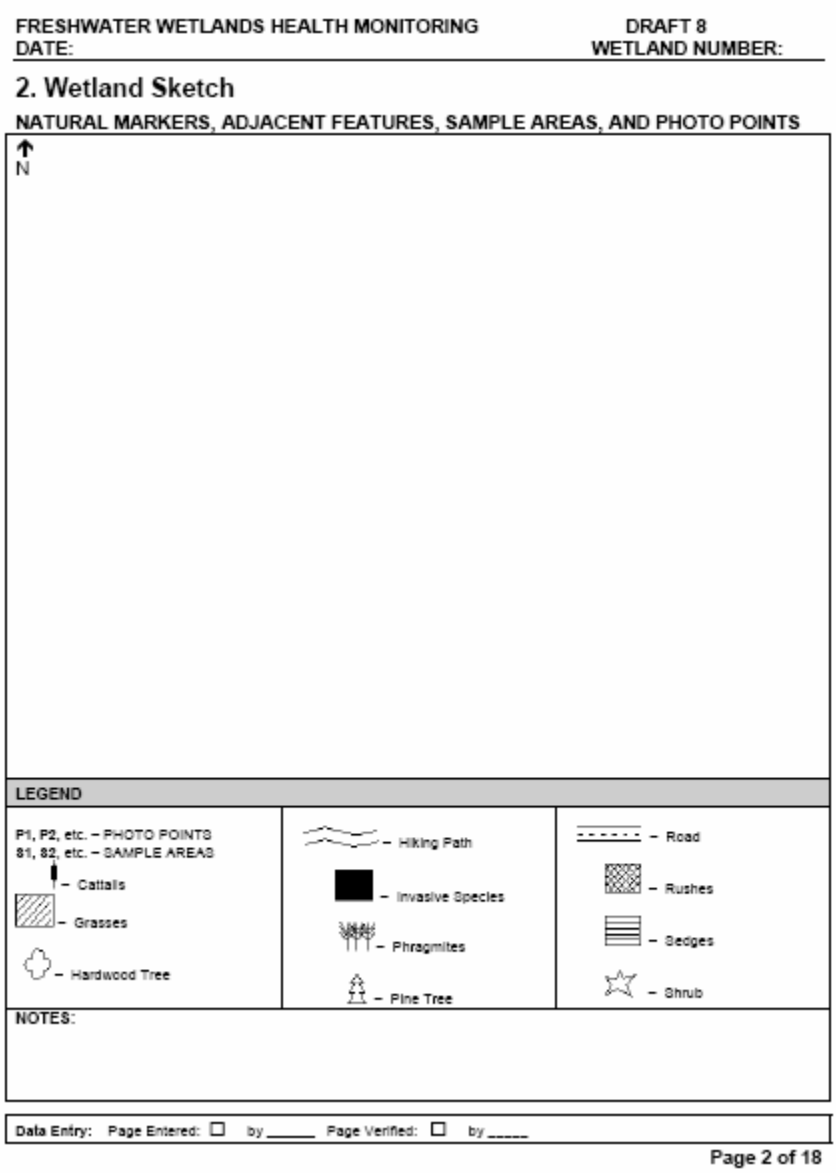
[5] EPA Methods for Evaluating Wetland Conditions. Mar 2002. http://www.epa.gov/waterscience/criteria/wetlands/

[6] United States Environmental Protection Agency. March 2006. Florida Wetland Bioassessment Projects-Ctr for Wetlands, Univ. of FL-Assemblages Monitored: Sampling Methods and Analysis. http://www.epa.gov/owow/wetlands/bawwg/case/fl1.html

Appendix 1



FRESHWATER WETLANDS HEALTH MONITORING DRAFT 8
DATE: WETLAND NUMBER:

2. Wetland Sketch

NATURAL MARKERS, ADJACENT FEATURES, SAMPLE AREAS, AND PHOTO POINTS

N

LEGEND

P1, P2, etc. – PHOTO POINTS
S1, S2, etc. – SAMPLE AREAS
– Cattails
– Grasses
– Hardwood Tree
– Hiking Path
– Invasive Species
– Phragmites
– Pine Tree
– Road
– Rushes
– Sedges
– Shrub

NOTES:

Data Entry: Page Entered: ☐ by _____ Page Verified: ☐ by _____

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Appendix 2

FRESHWATER WETLANDS HEALTH MONITORING Draft 8
DATE: WETLAND NUMBER:

3. Photographic record

SITE PHOTOGRAPHS

Photos				
Point	Number	Photo File Number	Direction (degrees)	Description/Notes

Data Entry: Page Entered: ☐ by ______ Page Verified: ☐ by _____

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Appendix 3

FRESHWATER WETLANDS HEALTH MONITORING Draft 8
DATE: **WETLAND NUMBER:**

7. Vegetation

EMERGENT VEGETATION

Type present	Estimated percent of cover (%)				
	0	1-25	26-50	51-75	76-100
Sedges	☐	☐	☐	☐	☐
Grasses	☐	☐	☐	☐	☐
Rushes	☐	☐	☐	☐	☐
Waterlilies	☐	☐	☐	☐	☐
Shrubs	☐	☐	☐	☐	☐
Trees	☐	☐	☐	☐	☐
Other: _____	☐	☐	☐	☐	☐

VEGETATION (SPECIES)

(Key: **N** – Nearly Absent, **S** – Sparse, **M** – Moderate, **E** – Extensive)

	Name	Estimated percent of cover (%)					Photo Number
		0	1-25	26-50	51-75	76-100	
1		☐	☐	☐	☐	☐	
2		☐	☐	☐	☐	☐	
3		☐	☐	☐	☐	☐	
4		☐	☐	☐	☐	☐	
5		☐	☐	☐	☐	☐	
6		☐	☐	☐	☐	☐	
7		☐	☐	☐	☐	☐	
8		☐	☐	☐	☐	☐	
9		☐	☐	☐	☐	☐	
10		☐	☐	☐	☐	☐	
11		☐	☐	☐	☐	☐	
12		☐	☐	☐	☐	☐	
13		☐	☐	☐	☐	☐	
14		☐	☐	☐	☐	☐	
15		☐	☐	☐	☐	☐	

NOTES (Use #s to reference item.)

MICROTOPOGRAPHY

Type	Present	Estimated cover (%)
Vegetative hummocks and tussocks	☐	
Coarse woody debris	☐	
Standing tree (>25cm)	☐	
Amphibian breeding habitat (e.g., vernal pools)	☐	

Data Entry: Page Entered: ☐ by _____ Page Verified: ☐ by _____