Research Interest

I seek to study the abundance and diversity of vegetation present at stormwater sites and its impact on the local mosquito and zooplankton population.

Abstract

Stormwater habitats are man-made structures that hold rainwater. These structures are commonly used as breeding sites for mosquitos and zooplankton. Many abiotic and biotic factors influence the mosquito and zooplankton population size in these habitats, including certain species of vegetation that have been known to increase mosquito population by serving as a refuge from predators. Our lab sampled thirty-one stormwater structures to identify and quantify the vegetation present at each site. The sites were grouped based on hydroperiod, or how often water was found in them. We found the alpha diversity and alpha richness of the vegetation at each site, looking for trends among hydroperiods. Neither richness nor diversity among hydroperiods were significant. In the upcoming semester, I hope to compare the vegetation findings with mosquito and zooplankton counts as well as place the findings in a broader context by factoring in managerial impacts on the vegetation.

Introduction

As human development increases, stormwater ponds have become more abundant in the changing landscape. These structures vary in design, but are made to retain or detain water. Due to the differing purpose and build of these structures, they vary greatly from natural bodies of water. Ecologically, we do not have a good understanding of the biodiversity these structures harbor (Walsh et al. 2009).

In order to minimize pests and health hazards such as mosquitos, these sites are commonly designed to exclude species that are associated with larger mosquito populations. Studies have found that pools of water with dense floating vegetation and woody plants have a more abundant mosquito population. In particular, the plants found to have a positive correlation with mosquitoes-- specifically those in the *Culex* genus-- are water hyacinth, duckweed, filamentous algal mats, cattails, and black willow. Of these, duckweed, cattails, and black willow are found in Champaign County. The reason that certain vegetation results in greater mosquito populations can be attributed to an increase in refuge habitat from predators (Metzger 2004) or chemical cues (Knight et al. 2003).

The vegetation communities may be dependent on the ability of a pond to hold water. To this end, I spent this summer characterizing vegetation communities across a hydroperiod gradient in a set of 31 stormwater ponds in Champaign County, Illinois. Specifically, I wanted to address the following questions:

1. How does taxonomic diversity and richness differ between structures of varying hydroperiod?

2. How to characterize vegetation communities in stormwater habitats across varying hydroperiods in Champaign, IL.

Methods:

This summer, I was able to examine 31 sites in Champaign County and characterize the vegetation communities in and around each site. Sampling took place between July 21 and July 29, 2016. Sites were sampled using three 50 cm by 50 cm (square) quadrats that were randomly placed at the interface of water and land. To account for rare taxa that may have not been in the sampled quadrats, I also did a visual scan and noted other species that were present. However, these were not included in diversity measures, but were included in measures of richness. Species identities and abundances were quantified for each quadrat. To identify taxa, I used taxonomic identification keys provided by UIUC Extension (http://www.illinoiswildflowers.info/grasses/grass_index.htm) and GoBotany.com. These websites provided me with lists of plants that are native Illinois as well as plants that are known to be found around drainage ditches. For taxa that were difficult to identify, I used the software "Garden Answers" provided by "TeamSOA".

Figure 1: One of three quadrats placed in a site labeled IDOT 2

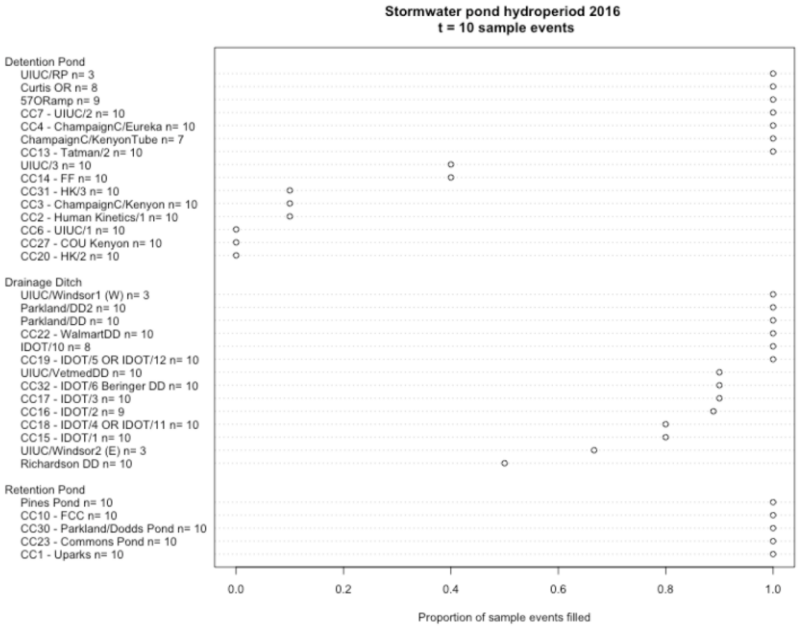

Figure 2: Graph details each site and the proportion of times water was present

Given that these ponds varied in their hydroperiods, not all sites contained water at the time of sampling. As a result, ponds that were dry were sampled at locations where water had been in the past. Using hydroperiod data I collected from 10 time points this year, I created three groupings of hydroperiod: permanent sites, medium sites, and temporary sites. Permanent sites contained water at all sample periods, medium contained water from 20 – 80%, and temporary sites had water less than 20% of the times we sampled them.

Results

Through my extensive sampling of these 31 stormwater ponds, I was able to successfully identify 66 distinct taxa. The dominant taxa were cattails (Typha latifolia), rough blue grass (*Poa trivialis)*, and fall panicum (*Panicum dichotomiflorum)* which were found in 15, 11 and 10 sites, respectively. On average, a stormwater pond contained 7 distinct taxa. Average alpha richness was 2.43 and not significant (p=0.10). Alpha diversity was 0.228 and also not significant (p=0.79).

Future Directions

To go along with the vegetation identified, I will examine the living organisms found in the aquatic habitat. Last year, water samples were taken from each site and the mosquitos and zooplankton in them were counted. This semester, I plan to compare my findings of the vegetation present at each site with the mosquito and zooplankton abundance, looking for trends in population size. The most common plants found at these sites are Cattails and Rough Bluegrass. Once I examine the mosquito count, I will be able to note whether the absence of either or both of these plants results in fewer mosquitos. I also want to inspect trends in zooplankton population in the presence of the vegetation that is known to aid mosquitos. I'm particularly interested in whether the zooplankton that compete with mosquitos benefit just as much from the plants.

I also seek to examine how maintenance and care affect the types of vegetation that grows. Some privately owned stormwater structures seem to be better maintained than the park district owned ones. If mosquitos are positively correlated with vegetation that is more abundant in public stormwater structures, that is a potential health hazard that requires better maintenance.

References:

Apperson, C.S., W.F. Hunt, S. Kennedy, and B.A. Harrison. 2005. Occurrence and relative abundance of mosquitoes in stormwater BMP facilities in North Carolina. *Journal of the American Mosquito Control Association*

Knight, R.L., W.E. Walton, G.F. O'Meara, W.K. Reisen, and R. Wass. 2003. Strategies for effective mosquito control in constructed treatment wetlands. *Ecological Engineering*. 21: 211-232.

Marco E. Metzger. Managing Mosquitoes in Stormwater Treatment Devices. University of California, Division of Agriculture and Natural Resources 2004. http://ipm.ucanr.edu/PDF/MOSQ/mosquitostormwater.pdf

McLean, J. 2000. Mosquitoes in constructed wetlands: A management bugaboo? In T. R. Schueler and H. K. Holland, eds., The practice of watershed protection. Ellicott City, MD: Center for Watershed Protection. 29-33.

Santana, F.J., J.R. Wood, R.E. Parsons, and S.K. Chamberlain. 1994. Control of mosquito breeding in permitted stormwater systems. Project #P179. Southwest Florida Water Management District, Brooksville, Fla

Walsh, C., Fletcher, T. and Ladson, A. 2009. "Retention Capacity: A Metric to Link Stream Ecology and Storm-Water Management." Journal of Hydrologic Engineering. 10.1061/ASCE. 399-406.