Huston-Brumbaugh Nature Center
Environmental Science Outreach STEM Program
Tuesday, June 16

POND ECOLOGY & EUTROPHICATION at HBNC

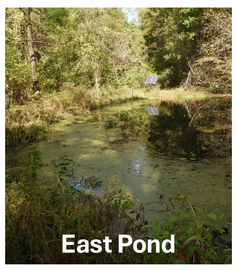
Introduction

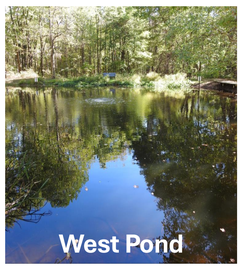
Eutrophication is a process in which nutrient enrichment (nitrogen and phosphorus) increases primary productivity and alters aquatic community structure. Cultural eutrophication, driven by agricultural and urban runoff, accelerates this process and often reduces dissolved oxygen, leading to shifts in species composition.

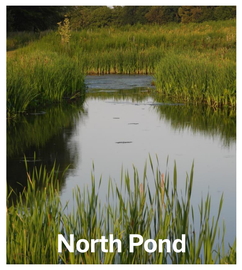
Macroinvertebrate communities are widely used as bioindicators because different taxa vary in their tolerance to low oxygen and pollution. Oligotrophic systems typically support higher diversity and more sensitive taxa, while eutrophic systems are often dominated by tolerant organisms.

In this study, we compared macroinvertebrate communities from two ponds—one expected to be oligotrophic and one eutrophic—to assess differences in diversity, evenness, and community composition as indicators of eutrophication stage.

In addition to the two-pond study, students also collected samples to analyze from the large pond on the North side of the property. This is a newly restored wetland, and samples were analyzed to determine the biodiversity found. This data will be used for comparison studies in the future.


East Pond


West Pond


North Pond

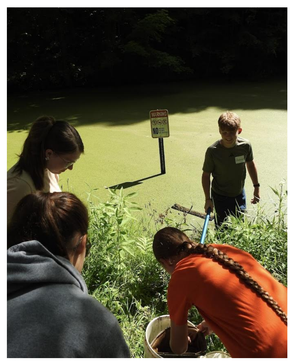
The East Pond was created by the former landowners by damming a small marsh and creek located at the bottom of a valley. The surrounding area has been used for agricultural purposes, which has contributed nutrient inputs to the pond through runoff from nearby fields. Consequently, the East Pond is in an advanced stage of eutrophication and supports abundant growth of algae and duckweed.

The West Pond, in contrast, was constructed after agricultural activity on the property had ceased and is situated in slightly elevated terrain. As a result, it receives minimal runoff from the surrounding landscape. Due to the limited inflow of nutrients, the West Pond remains oligotrophic.

Seven acres surrounding the North Pond had been row-cropped with a rotation of corn, soybeans, and wheat for several decades. In 2023, wetland depressions were established with the North Pond being the largest of these ponds. The remainder of the area has been revegetated with wildflower seed. There is interest in monitoring the biodiversity of this pond due to being newly established.

Hypothesis

We hypothesized when comparing macroinvertebrates from the East and West Ponds that the eutrophic pond (East Pond) would show lower diversity and dominance by pollution-tolerant taxa, while the oligotrophic pond (West Pond) would exhibit higher diversity and more even species distribution.



Methods

1. Three ponds were sampled using identical sampling effort (standardized area or time)
2. Benthic macroinvertebrates were collected using a 500 µm D-net
3. Samples were rinsed, sieved, and organisms were isolated and identified.
4. Individuals were counted by taxon for each pond
5. Community metrics calculated:
   a. Species richness (S)
   b. Shannon Diversity Index (H)
   c. Evenness (E)
6. Statistical comparison: Hutcheson's t-test used to compare diversity between ponds

Results

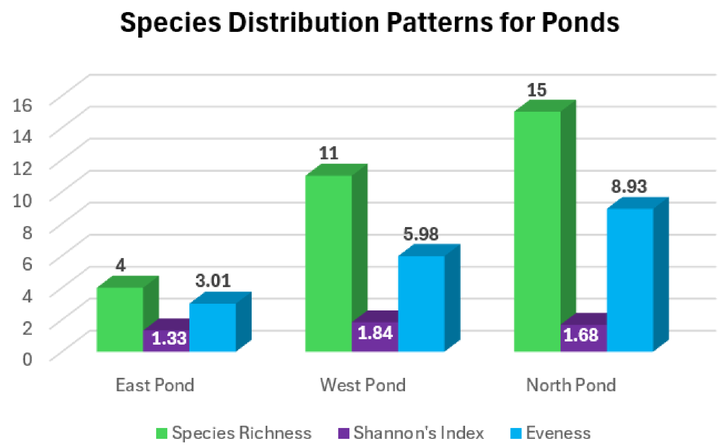


Table 1. Comparison of species richness, evenness, and diversity of the three studied ponds for better understanding of species distribution patterns between the habitats.

Conclusion

Macroinvertebrate community metrics clearly distinguished eutrophic and oligotrophic conditions between the East and West Ponds. The East Pond showed the lowest species richness (S = 4), diversity (H = 1.33), and evenness (E = 3.01), indicating a simplified community dominated by a few pollution-tolerant taxa—consistent with eutrophic conditions driven by high nutrient inputs and reduced oxygen availability.

In contrast, the West Pond exhibited higher richness (S = 11), diversity (H = 1.84), and evenness (E = 5.98), reflecting a more balanced and complex community typical of an oligotrophic system with lower nutrient loading and greater habitat stability. Higher richness and evenness together indicate a broader range of taxa and more equitable distribution of individuals, supporting greater ecological health.

The North Pond, with richness (S = 15), diversity (H = 1.68), and evenness (E = 8.93), represents a newly established system and serves as baseline data. Its current community structure likely reflects early colonization rather than a stable trophic state, providing a reference point for future succession and eutrophication monitoring.

References & Acknowledgements

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*Poster created by Amy Miller. Text assistance provided by Microsoft Copilot (AI); content reviewed and approved by program staff.