Assessing insect assemblages at natural and constructed ridge-top wetlands in the Cumberland Ranger District of the Daniel Boone National Forest, KY

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Introduction

Wetlands are important ecosystems and support high amounts of biodiversity and provide critical habitats for many organisms, while providing numerous ecosystem services. In Kentucky, 80% of original wetlands have been lost (Dahl 1990) so preservation efforts for remaining wetlands are a high priority. In Kentucky, ridge-top wetlands provide an even more unique habitat because of their upland location. Natural ridge-top wetlands are ephemeral and provide an important habitat for many amphibian and bat species.

Around 400 ridge-top wetlands have been constructed in the Daniel Boone National Forest (DBNF) in Kentucky in the past 23 years for game wildlife management (Denton and Richter 2013). Little research has been done on these constructed wetlands until recent years. These constructed wetlands do not function hydrologically or ecologically as natural ridge-top wetlands. Bat activity research is currently being conducted to compare activity at natural and constructed wetlands. In order to fully understand the importance of these wetlands for bat forage and why difference in bat activity may be seen between constructed and natural wetlands, insect communities should be evaluated as all bat species in Kentucky are insectivorous.

To date, no research has been done to evaluate the insect assemblages at the ridge-top wetlands in the DBNF. The objective of this study was to evaluate insect assemblages at natural and constructed ridge-top wetlands. I hypothesized there would be differences in abundance and diversity of insects between natural and constructed wetlands due previous research indicating differences in hydroperiod, vegetation, and canopy cover. I also hypothesized there would be a decrease in abundance and diversity in insects the greater the distance from the center of the wetland.

Methods

Four wetlands were selected in the Cumberland Ranger District in the DBNF, two constructed and two natural wetlands (Fig. 1). The wetlands were selected based on a previous study in 2018 evaluating bat activity at these locations (McNamara et al. 2019), the four wetlands selected had high bat calls in the study.

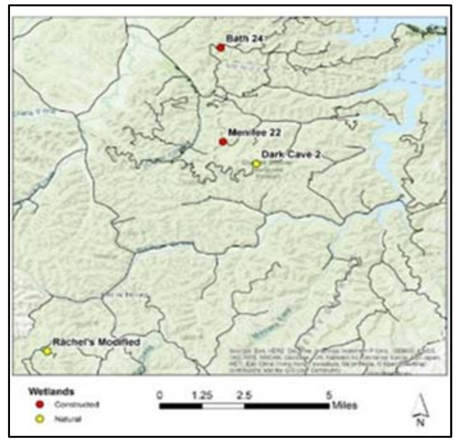

Figure 1. *GIS map of studied wetlands.*

Two malaise traps were set at each of the wetland edges, side by side. Malaise heads were collected once a week for four weeks. The insects from one malaise trap were identified to order and counted. Insects form the second malaise trap were set aside for bomb calorimetry to be done at a later date.

In addition to malaise traps, sticky traps were also used to evaluate insect assemblages at each of the wetlands. Sticky traps were used to evaluate possible differences in insect communities and abundance based on proximity to the wetlands. Three sticky traps were hung at the wetlands for one twenty-four-hour period at the beginning of each collection week. Sticky traps were placed over, adjacent to, and away from the wetland. One trap was strung over the wetland on a rope so that it hung just above the water (Fig. 2). A random azimuth was used to identify a tree at the edge of the wetland and one trap was hung on a branch 2m above the ground. The third trap was hung on a tree branch 2m above the ground and 5m away from the tree on the edge of the wetland in the same azimuthal direction as the tree at the edge of the wetland. Insects caught by the sticky traps were also identified to order and counted.

Figure 2. *Insects from malaise traps separated into petri dishes.*

Figure 3. *Sticky trap and malaise trap set up on wetland edge at a large natural wetland in the Cumberland Ranger District of the Daniel Boone National Forest.*

Abundance, ordinal richness, and the Shannon Weaver Diversity Index were calculated in excel to evaluate data. Analysis, including a Kruskal-Wallis Test, and graphs comparing calculations to wetland type were created in RStudio.

Results and Discussion

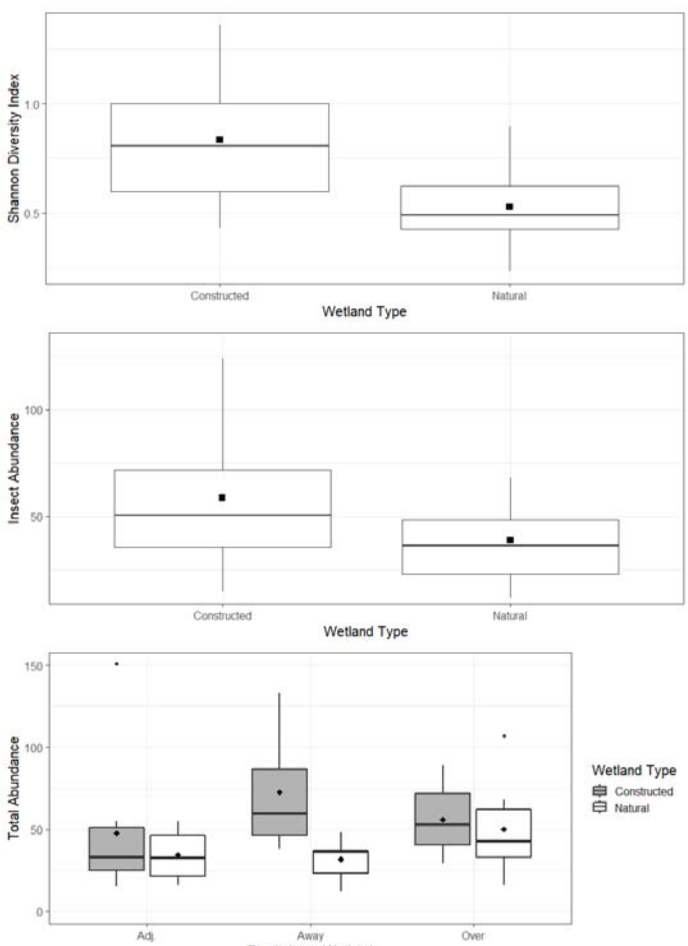

Figure 4. *Diversity of insects collected in malaise traps at constructed and natural wetlands (top), insect abundance at collected on sticky traps at constructed and natural wetlands (middle), insect abundance compared to proximity to wetland collected on sticky traps at constructed and natural wetlands (bottom).*

Total abundance, ordinal richness, and diversity were calculated for both malaise trap and sticky trap data. A Shannon Weaver Diversity Index was used to calculate diversity. A Kruskal Wallis test was used to compare these calculations for malaise traps at constructed and natural wetlands. The Kruskal Wallis test run for malaise trap data yielded a p-value of 0.5286 for total abundance, 0.046 for diversity, and 0.2629 for ordinal richness. Figure 3 shows Shannon Weaver Diversity Index calculations at the constructed and natural wetlands. The Kruskal Wallis test run for sticky trap data yielded a p-value of 0.02589 for total abundance, 0.1802 for diversity, and 0.9398 for ordinal richness. A Kruskal Wallis test run to compare abundance, diversity, and richness to proximity of sticky trap to wetland yielded a p-value of 0.1721 for total abundance, 0.5524 for diversity, and 0.7578 for ordinal richness.

Conclusions

There was significant difference in diversity of insects between constructed and natural wetlands in malaise trap data. There was also a significant difference between total abundance between constructed and natural wetlands in sticky trap data. The two different sampling methods trapped different communities of insects which may be indicative of the variance of significant results. There were also several instances of tree frogs inside the malaise heads, presumably eating the insects. This could cause some error in the data. There was more than one instance of this at each of the natural wetlands. This could account for some the difference seen between the natural and constructed wetland data. Future research could increase the number of wetlands studied as well as identify insects to a lower taxonomic level.

No significant data were found for the other two calculations in malaise and sticky trap data. There was also no significance in any of the proximity to wetland data. This indicates that there is not differences in abundance, diversity or ordinal richness up to a 5 m radius from the edge of the wetland. Future studies could increase the distance from wetland or vary the height of the sticky traps.

References:

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