Investigating the relationship between restored woodland plant communities and landscape context

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CHICAGO BOTANIC GARDEN

Research Experiences For Undergraduates

Introduction

- Restoration prioritizes the revitalization of degraded ecosystems
- Currently, restoration outcomes are unpredictable due to the considerable amount of variation across restored sites.
- The surrounding landscape (i.e., landscape context) may contribute to this variation.
- Oak woodlands are currently being restored due to a long history of degradation.
- We lack an understanding of the factors that contribute to variation in woodland restoration outcomes.

Research Objectives

1. Assess how oak woodland restoration sites across Northeast Cook County, IL vary in richness, diversity, and composition.
2. Investigate how landscape context contributes to this variation.

Hypothesis

1. There are difference in richness, diversity and composition across five restored oak woodland sites in the same forest preserve.
2. There is a relationship between species richness and landscape context.

Materials and Methods

Understory plant community surveys:

- Five restored woodlands
- Three 50 m transects per site
- Ten 1x1 m plot along each transect

Landscape context analysis:

- ArcGIS, Fragstat, and NCLD land cover data to find the proportion of different land cover types (natural, developed, agricultural, other) within 500 m of each site.

Analysis:

- Calculated mean species richness, Shannon's Index of Diversity at each site
- Non-metric multi-dimensional scaling (NMDS) to analyze community composition
- Linear regression to analyze relationship between species richness and landscape context

ArcMap 10.8.1

Results: Richness, Diversity and Community Composition

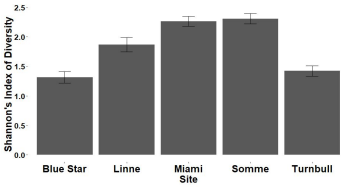

Figure 1. Mean Shannon's Index of Diversity per plot for 30 plots at Somme, Blue Star and Turnbull, 20 plots at Miami, and 10 plots at Linnes. Error bars represent ± one standard error. There are significant differences between sites ($p<0.05$).

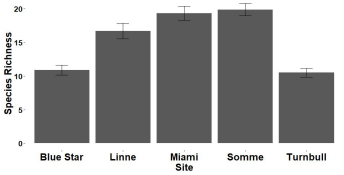

Figure 2. Mean species richness at each of the 5 sites. Error bars represent 1 standard error. There are significant differences between sites ($p<0.05$) but we did not test to see where those differences are.

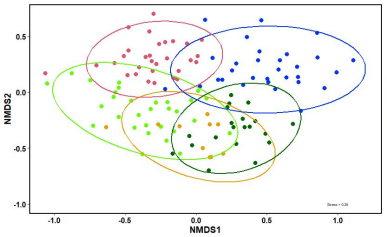

Figure 3. NMDS Non-metric multidimensional scaling (NMDS) of species abundances in 5 restored oak woodland site. Ellipses represent 95% confidence interval.

Results: Landscape Context

We found no significant relationship between species richness and the amount of 'agricultural', 'developed', 'natural', or 'other' land around each site.

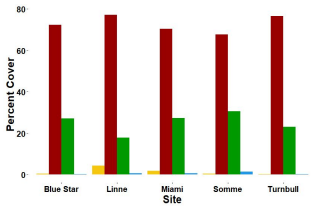

Figure 4. Proportion of four land cover types in a 500 m buffers surrounding each site. Land cover types are agricultural, developed, natural, and other (barren or open water).

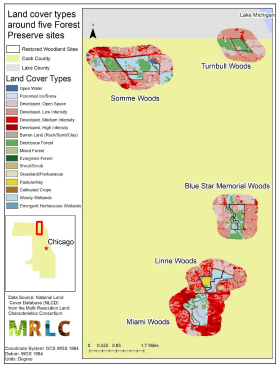

Figure 5. An ArchGIS map showing 500m buffers for each of the 5 sites with landscape context. The landscape context shows current land cover types.

Field Pictures

Discussion:

- There is significance in species diversity, composition and richness between each site.
- There is no significant relationship between landscape context and species richness that we could find.
- Further research could take into account bigger sample sizes and previous land use histories.
- The importance of this study is to begin to understand the relationship between species richness and landscape context.
- Restoration managers can use this data to inform their projects to not worry about controlling the surrounding areas of the preserves

Acknowledgments:

We'd like to thank NSF-REU grant DBI-1757800, Chicago Botanic Garden for support. I'd also like to thank Pantira, Fatima, Kyndall, Kyann, Helen, and Luc for helping us out in the field! As well as out great support system of those involved in the REU program.