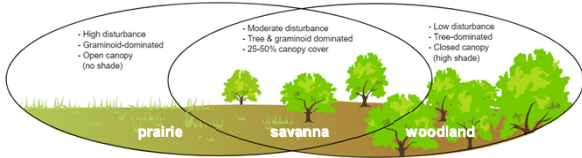


Testing Environmental Heterogeneity as a Driver of Understory Vegetation Composition in Midwestern Oak Savannas

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Introduction

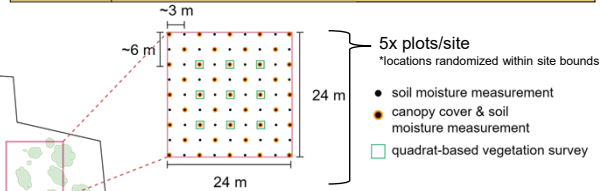


- Midwestern oak savannas are highly threatened with an estimated <0.01% of pre-colonial range remaining¹
- Savannas are a biodiversity hotspot and even host savanna-specific species. A frequently hypothesized driver of this concentration of biodiversity is the high environmental heterogeneity (EH) and/or habitat patchiness present in savannas

Core research question: Does environmental heterogeneity in these savannas have a relationship with species richness or presence of desired species?

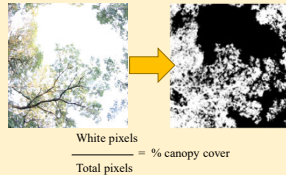
Methods

Study Sites	Description
Ottawa Bluffs (OB)	Long-term project on partial remnant. Rural setting. Some disturbance from retired gravel operation. High topographical variance. Several soil types (44.364, -93.935).
Rapids Lake Unit (RL)	~5-year restoration project over remnant. Agricultural setting. Little to no topographic variation. Moderate-to-dry sandy soils (44.734, -93.634).
Terrace Oaks Park (TO)	~8-year restoration project over partial remnant. Suburban setting. Moderate topographic variation. Moderate-to-dry sandy soils (44.771, -93.245).
Helen Allison Savanna (HA)	Long-term management project on savanna remnant. Rural setting. Some localized topographic variation. Dry, sandy soil (45.382, -93.165).



Canopy Cover (cc)

Taken via fisheye lens imagery, summarized in ImageJ



Vegetation Survey

0.5 x 1.0 m vegetation survey indicating all species and approximate abundance (estimated quadrat cover as a %). Unknown species were identified to the genus level when possible. Remaining unknowns were tabulated to include in species richness counts.

- Nested study design allows for the observation of study variables at multiple scales
- Horizontal EH was summarized using a modified Shannon's index and spatial heterogeneity/clustering with a weighted Moran's I index over a regular matrix based on study plots

Results

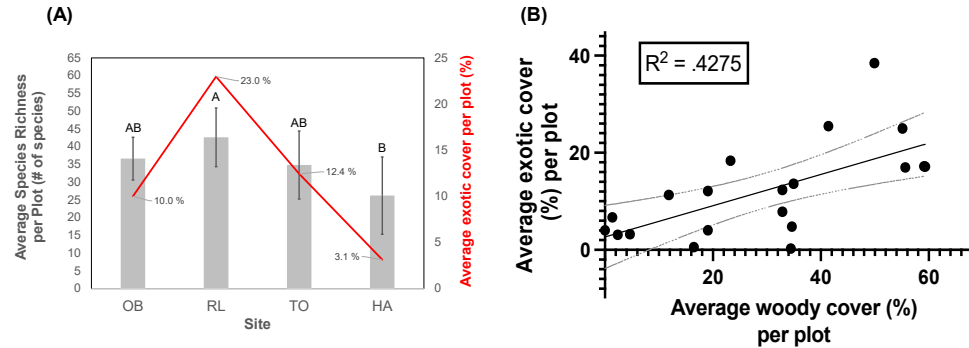


Figure 1. Major population trends within Ottawa Bluffs (OB), Rapids Lake Unit (RL), Terrace Oaks Park (TO) and Helen Allison Savanna (HA) study sites. Trends for species richness per plot match those for exotic cover and may not be a suitable metric for evaluating project success (A). Exotic cover (%) increases with average woody cover (B).

- Preliminary results show no significant correlations between plot-averaged native cover and plot-level EH metrics using the smallest kernel size (3 x 3 m² for soil moisture, 6 x 6 m² for canopy cover).

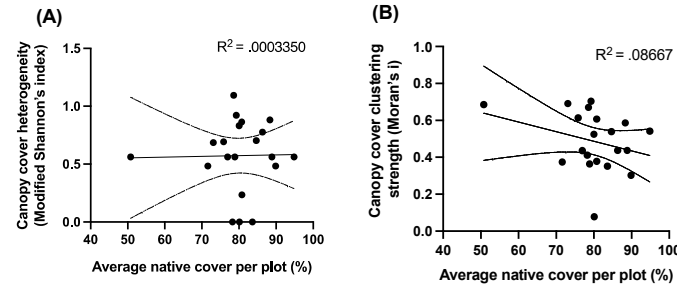


Figure 3. Correlation of EH variables and exotic cover. Horizontal heterogeneity (A) and clustering (B) of canopy cover and horizontal heterogeneity soil moisture have little correlation with native cover. Unpictured soil moisture results were also non-significant.

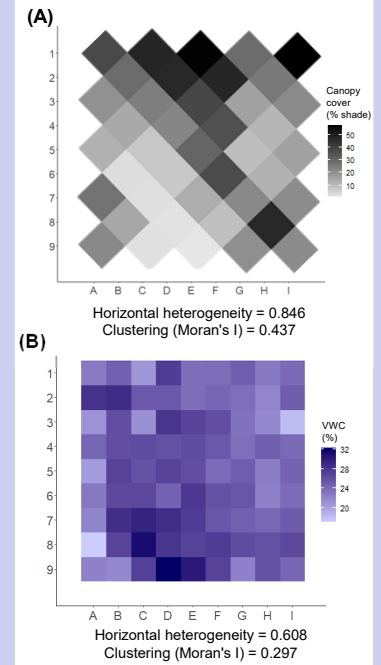


Figure 2. Excerpt of results from Ottawa Bluffs site. Canopy cover values (A) and soil moisture values (B) from OB plot 5. Horizontal heterogeneity was calculated using a modified Shannon's index. Clustering strength was calculated with Moran's I index.

Take Home Messages

- Species richness may be a poor metric of success in savanna management efforts
- Results confirm previous hypothesis that woody cover strongly increases presence of exotics in these environments
- Preliminary results show little correlation between heterogeneity metrics and native cover

References & Acknowledgements

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¹ Nuzzo, V. 1994. Extent and status of Midwest oak savanna: presettlement and 1985. [republished version of Nuzzo 1986] in: J.S. Fralish, R.C. Anderson, J.E. Elinger, and R. Szafoni (eds.), Proceedings of the North American Conference on Barrens and Savannas. U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, Illinois. Pp. 1-24.

Study Sites

