

Plant Community Diversity at Hegg Lake
Wesley Braker
2017 July 18

Introduction

Managing and protecting native and restored prairies is important to maintain a diverse and thus healthy prairie. While common native and non-native species are easily recognized and noted as being present, others may go unnoticed because of a short flowering period, scattered individuals, and phenotypic similarities between common species. Hegg Lake State Wildlife Management Area is an area of mixed unbroken prairie, restored prairie, and abandoned agricultural land, making it a suitable candidate to compare plant community diversity between the two. While Hegg Lake has been under DNR management for many years, a full plant community list has yet to be compiled. The research proposed will attempt to compile a species list for those at Hegg Lake while also investigating plant community composition and diversity across the property. Prairie communities with a large variety of plant species are, in terms of genetic variability and resource availability, healthy communities. Building a species list and investigating community diversity will provide Hegg Lake land managers with information on the overall health of the ecosystem. Additionally, this research will look for correlation between plant community diversity and Echinacea population fitness in order to hypothesize on what sorts of community diversity may be favorable to Echinacea wellbeing. Finally, this research will compile a list of species from which seed could be collected at Hegg Lake without damaging the parent population, thus promoting a sustainable and local source of seeds from which restorations can be repopulated from.

Background

This proposed research will investigate all species of plant life growing within the study sites to determine the level of community diversity. Echinacea will be especially looked for, as information on the density of Echinacea plants in various vegetative makeups could be useful for future Echinacea Project research.

This research will take place at Hegg Lake, which is composed of unbroken prairie, restored prairie, and Echinacea experimental plots. Unbroken prairie is a valuable resource as a source of diversity and health, a seed collecting locale, and an educational and research opportunity. Restored prairies are of specific interest because they are seeded to model unbroken prairie with diversity of species (Wagenius et al. 2012). Despite attempts to create community diversity, restorations typically have many nonnative species that thrive after restoration construction disturbance and many restorations lack strong community diversity to replicate virgin prairie. Additionally, the introduction of outside genetic material to be introduced into native populations, which may affect the diversity and resilience of native communities (Herman 2014). Hegg Lake has a well-recorded history within the last twenty years of burns and dramatic land changes that have occurred. The Echinacea experimental plots can provide data on Echinacea well-being based on many years of individual-specific data collection.

Research Questions

- What species exist at Hegg Lake?
- How does the make-up of plant communities change throughout Hegg Lake?
 - H_0 : Plant community composition and diversity do not differ among management units at Hegg Lake.
 - H_A : Plant community composition and diversity differ among management units at Hegg Lake.
- What relationships exist between plant community diversity and Echinacea fitness?
 - H_0 : Plant community diversity is not associated with Echinacea fitness.
 - H_A : Plant community diversity and Echinacea fitness are correlated to one another.
- Does land use history influence plant community diversity?
 - H_0 : Land use history is not associated with plant community diversity
 - H_A : Land use history does affect plant community diversity.
- What species are available to collect seed from this year?

Research plan

Objective: The overall objectives of this research plan is to create a species list of plant communities at Hegg Lake, quantify plant community diversity at Hegg Lake, hypothesize favorable plant community makeup for Echinacea, and propose species for seed collection this year.

Methods and Procedures: To build a species list and maximize my ability to find plants, multiple transects will be taken across various areas of Hegg Lake to cover all management areas. Transects will be chosen to pass through areas of known populations to find the most possible species. Species will be recorded based on their group (legume, forbe, grass) and family, genus, and/or species, depending on reliability of identification.

To quantify plant community diversity, plots will be located within known remnants, restorations, and unrestored agricultural land. Within each area 30 points will be randomly selected using the Universal Transect Mercator system. The first three points that fall within each area, are in dry prairie, and are not within 2 meters of a road will be selected. Each selected point will be the southwest corner of a 1x4 meter quadrat, with the long distance running north. Within each of these plots, species will be recorded and flowering stalks will be counted. Cover class of grasses, legumes, and forbes will be approximated twice: at the beginning and end of the season. Counts of flowering stalks within quadrants will be repeated every two weeks to investigate change over time in plant communities. Investigating a plant community-Echinacea relationship will be aided by searching for and counting the number of Echinacea within each quadrat.

A list of plants from which seed could be obtained will be constructed by looking for populations from which seeds could be removed without significantly impacting the reproductive capacity of the population in question. A population will be considered large enough for collecting if there are at least three independent populations throughout Hegg Lake that exceed 30 flowering heads. Populations that qualify will be marked by GPS in the approximate center of the population.

Projected Outcomes: I predict that a species list for Hegg Lake that is representative of the overall community and is independent of density will be produced. Additionally, I predict that there will be notable differences in both community diversity and flowering plant densities between sampling areas at Hegg Lake. Finally, I predict that this research will be able to provide a list of plants from which the DNR could effectively source seeds from.

Significance

Intellectual Merit: This research will provide information on the plant communities that can be reliably found at Hegg Lake, which is useful information for the DNR for seed collecting and prairie health management. This research quantifies the plant communities near Echinacea Project plots, allowing comparison based on vegetative communities in plots. This research will potentially give a quantifiable argument for what plant communities Echinacea prefer. This research is also important for conservation because it will hopefully give more evidence that increased plant community diversity improves the overall health of prairie ecosystems.

Broader Impacts: My proposed research project will work to provide a list of plant species that exist at Hegg Lake, which has never been produced. Additionally, this project will provide information to the DNR on what species are in enough abundance to collect seeds from. Finally, this project will provide me with research, field, and plant identification experience that I can apply to future research and management endeavors.

References

- Herman, B., S. Packard, C. Pollack, G. Houseal, S. Sinn, J. Fant, A. D. Lewis, S. Wagenius, D. Gustafson, K. Hufford, B. Allison, K. Shaw, S. Haines, and C. Daniels. 2014. Decisions . . . Decisions . . . How to Source Plant Material for Native Plant Restoration Projects. *Ecological Restoration*:236-238.
- Nascimbene, J., H. Mayrhofer, M. Dainese, and P. O. Bilovitz. 2017. Assembly patterns of soil-dwelling lichens after glacier retreat in the European Alps. *Journal of Biogeography* **44**:1393-1404.
- Wagenius, S., A. B. Dykstra, C. E. Ridley, and R. G. Shaw. 2012. Seedling Recruitment in the Long-Lived Perennial, *Echinacea angustifolia*: A 10-Year Experiment. *Restoration Ecology* **20**:352-359.

Timeline for the proposed research

This research will take place over the course of Summer 2017 during the work period of the Echinacea Project. Plant community analysis in plots will be conducted once at the beginning of this research and once at the end to account for any above-ground changes. Observations of flowering individuals in transects and quadrats will be taken biweekly in the same locations.

Data management plan

Materials needed:

- Remnant, restoration, and agricultural area maps from Hegg Lake
- Collection permit for Hegg Lake for herbarium specimens
- Measurement data on Echinacea from experimental plots
- Access to GPS unit for initial transect and quadrat marking and seed collection candidate marking

Data to be collected:

- Species list
- Species in plots
 - Flowering
 - Basal
- Seed collection candidate numbers

Management and Analysis Plan:

- Quadrats will be marked out with flags to maintain consistency
- Plant community and flowering plant data will be analyzed using:
 - β -diversity values to normalized species diversity data
 - Compare species spread across Hegg Lake

Storage/dissemination Plan:

- Photos can be taken of herbarium specimens to save space
- All quadrat flags will be removed from Hegg Lake
- A copy of raw data will be left with the Echinacea Project for future use

Environmental impacts

The largest environmental impact that this research will have is that of trampling the area directly around the study sites and removing individuals for herbarium specimens. Trampling can be mitigated by standing only on one side of the quadrat to induce a large amount of traffic in only one area. Traveling to the study site may also cause trampling, but the amount of disturbance can be lowered by taking a separate path to the study site for each visit. Herbarium specimens will only be taken if there are at least 30 other individuals seen throughout Hegg Lake to reduce the loss from an individual's death. Auto emissions should not amount to much since all data will be collected from the same locale. When the project is finished, all flags used will be removed from Hegg Lake WMA. Seed collection will be mitigated by only suggesting populations with at least 30 individuals in at least 3 locations as possible seed collection candidates.