

Introduction

Climate change poses a large challenge to restoration practitioners and researchers that have been attempting to determine proper seed sourcing guidelines for ecological restoration. Predictive provenancing, or preferentially sourcing seed from relatively southern latitudes or elevations, has been one strategy proposed to foster resilient plant populations experiencing environmental conditions associated with climate change¹. However, it may not be suitable to rely on latitude or elevation alone when choosing seed sources, as there are many different factors that will affect survival and overall fitness. Here we examined the suitability of using such a strategy by comparing reproductive fitness in plants sourced from across a latitudinal gradient in a common environment.

Allium cernuum, or commonly known as 'nodding onion', is a member of the Amaryllidaceae family that can be found in the Midwest. We obtained seeds of *Allium cernuum* from three regional zones: northern, local, and southern, and grew these in a common garden to quantify certain characteristics of each *Allium* population, such as number of inflorescences and seed count, and compare them to one another to determine overall fitness.

Objectives

- Determine if source affects the number of seeds produced per plant
- Quantify the number of seeds that were able to establish between all three sources
 - Compare establishment to number of inflorescence and the average amount of seeds
- Determine if a certain population out of the tree managed the best

Acknowledgements

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Methods

I used two sieves stacked on top of one another to separate the chaff from the seedlings.

To remove excess chaff from the collected seeds, I used a column blower to separate unwanted materials from the seeds

I used the seed counter or just counted by hand.

Northern Source
Carver County, MN

Common Garden Site
Grayslake, IL

Local Source
Cook County, IL

Southern Source
Franklin County, MO

Discussion

Southern-sourced

- Displayed the lowest overall fitness amongst all three sources
- Reasons for this could be poor quality of seeds, not well adapted to colder climates, lack of sufficient precipitation, and perhaps an excessive stratification period
- Possibly due to the fact that the southern-sourced *Alliums* were nursery-produced, while northern and local sources were collected from wild populations

Northern vs. local source

- Local-sourced *Allium* displayed both a higher seedling establishment and a greater number of seeds per inflorescence
- Northern-sourced *Allium* produced greater number of inflorescences, as well as a greater number of seeds
- The northern-sourced seeds produced about **1.5 times more times the number of inflorescences**, resulting in them producing a greater number of total seeds, thereby having a higher overall fitness
- The year 2017 experienced a drier fall than usual, perhaps favoring northern-sourced plants that are adapted to drier seasons.

Results

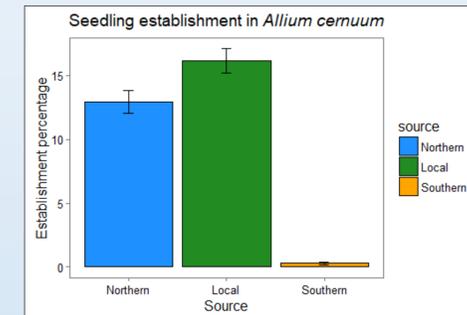


Figure 1. Seedling survival was found to be significantly affected by source ($X^2 = 345.2$ on 2 and 4498 degrees of freedom, $P < 0.001$).

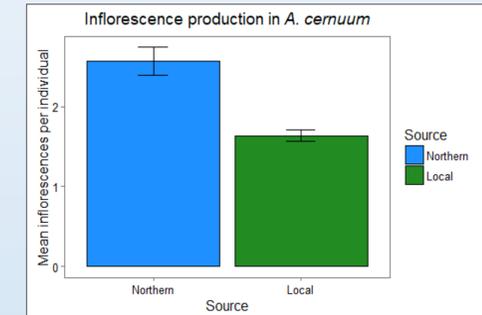


Figure 2. Inflorescence production was affected by source ($X^2 = 15.1$ on 1 and 145 degrees of freedom, $P < 0.001$).

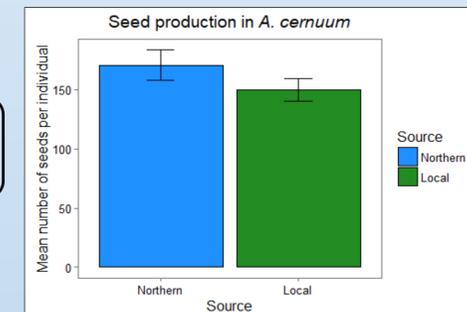


Figure 3. Seed production per individual was found to be significantly affected by source ($X^2 = 111.8$ on 1 and 151 degrees of freedom, $P < 0.001$).

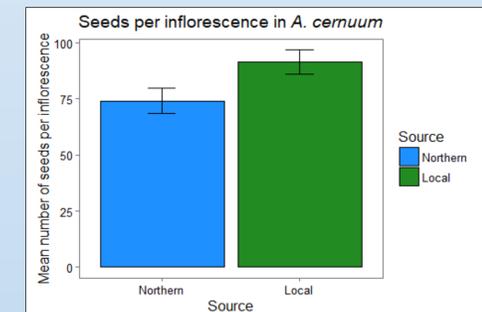


Figure 4. The number of seeds per inflorescence was found to be significantly affected by source ($X^2 = 132.2$ on 1 and 145 degrees of freedom, $P < 0.001$).

Future Research

Multiple growing seasons/larger sample size

- The weather every growing season will never be consistent. You may have a cooler/warmer spring/fall than normal which could influence results.

Evaluate mechanisms

- Due to the inconsistency of weather, a controlled environment could be beneficial. Evaluating the different sources at the predicted weather conditions.

Other plant species

- Different plant species and functional groups can differ in their response to being moved across latitudes.

References

¹Bucharova, A., Durka, W., Hermann, J., Hölzel, N., Michalski, S., Kollmann, J., & Bossdorf, O. (2016, May 23). Plants adapted to warmer climate do not outperform regional plants during a natural heat wave. Retrieved from <https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.2183>

²Breed, M. F., Stead, M. G., Ottewill, K. M., Gardner, M. G., & Lowe, A. J. (2012, November 02). Which provenance and where? Seed sourcing strategies for revegetation in a changing environment. Retrieved from <https://link.springer.com/article/10.1007/s10592-012-0425-z>

³Bischoff, A., Steinger, T., & Müller-Schärer, H. (2008, October 06). The Importance of Plant Provenance and Genotypic Diversity of Seed Material Used for Ecological Restoration. Retrieved from <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1526-100X.2008.00454.x>