

Echinacea angustifolia fertility in fragmented prairies

Mindy Runge & Ale Mendoza
Biology Department, Lake Forest College

Background

The Echinacea Project is focused on finding ways to better preserve prairie plants. Prairies used to cover a large portion of the United States. As western expansion grew, farm land replaced much of the existing prairie ecosystem. Today the only remaining prairie ecosystems are in small isolated fragments. The goal of this project is to restore and preserve entire prairie ecosystems. The Echinacea Project takes place at a 25 square-mile study site in western Minnesota. The basic field work that is performed at the study site is mapping and giving individual plants an identification number as well as tagging individual *Echinacea* flower heads. Each season, the condition of *E. angustifolia* plants are recorded. The Echinacea Project's goal is to restore the tallgrass prairie to its original condition.

What is being investigated

- Limitations on pollination
- Pollinators
- Mating compatibility between *E. angustifolia*
- Phenology
- Impacts of prescribed burns

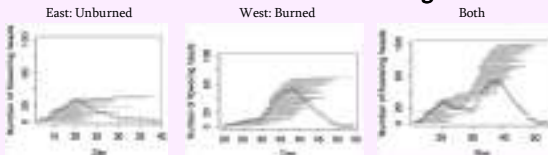


Echinacea angustifolia

- Family: Asteraceae
- Herbaceous perennial with both ray and disk flowers
- Native to tallgrass prairies of North America
- **Long-lived:** requires 3 years of growth before flowering
- **Self-incompatible:** fertilization requires pollen from an individual other than itself



Burned vs. Unburned Prairie Flowering Schedule



E. angustifolia from unburned site flowered sooner than burned site.

E. angustifolia from burned site also flowered concurrently.

Our Role in The Echinacea Project



- Cleaned Heads: Removed 30 achenes from the top of head and 30 from the bottom of head



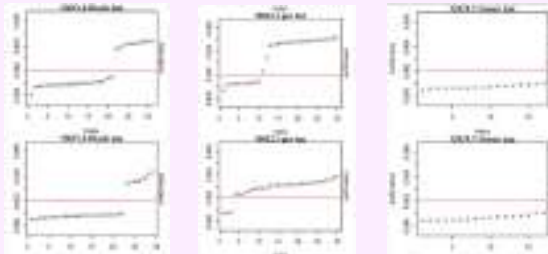
- Once removed from head, achenes were then weighed
- Looked at the flowering schedule data from the Echinacea Project and formulated a hypothesis to be explored.

Hypothesis

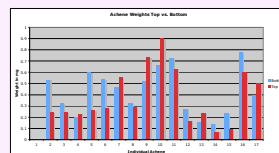
H1: The seed set of *E. angustifolia* will have a higher rate of fertility in the top portion of the head in comparison to the bottom portion.

H0: The seed set of *E. angustifolia* will have no difference in fertility between the top portion of the head and the bottom portion.

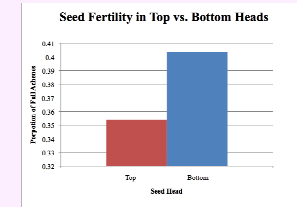
Results



*The red line represents the cut off between empty and full achenes, it is at 2 mg.



Results Continued



Total: 37.9% of achenes were full

Conclusion

With our sample size we found:

- A greater percentage of the achenes from the bottom of the head were full
- Less than 40% of the total achenes were full

Potential reasons for these results

- Flowering pattern in Echinacea
 - Pollen is present on the lower florets first
- Self-incompatibility
 - Distance to the nearest plant
- Some head may have been infected with a disease or damaged by an insect



Works Cited

- The Echinacea Project*. (2012). Retrieved from <http://echinaceaproject.org/>
- Wagenius, S. 2006. Scale dependence of reproductive failure in fragmented Echinacea populations. *Ecology* 87:931-941
- Wagenius, S. 2004. Style Persistence, Pollen Limitation, and Seed Set in the Common Prairie Plant *Echinacea angustifolia* (Asteraceae). *International Journal of Plant Sciences* Vol. 165, No. 4 (July 2004), pp.595-603

Acknowledgements

We would like to thank the Lake Forest College Biology Department and the Chicago Botanic Gardens. More specifically our mentor at the Botanic Gardens, Stuart Wagenius for his knowledge and guidance. We would also like to thank Team Echinacea for their data and previous findings from the Echinacea Project. Additionally thank you to our professor Lynn Westley and our peer teacher Victoria Jones.