

# Pollinator Fidelity in Burned and Unburned Remnant Prairies

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## Introduction

Periodic prescribed burns in remnant Minnesota prairies increase the reproductive fitness of *Echinacea angustifolia* [1]. However, it is unknown how the pollinators of *E. angustifolia* respond to these changes in flowering phenology. Here, I investigate whether there are any differences in pollinator fidelity, or a pollinator's specialization on a particular plant species during a foraging bout [2], of three common bee taxa in sites that were burned in the spring and sites that were not burned in the spring.



*E. angustifolia*

### Objectives:

- I. To determine whether there were differences in proportion of *E. angustifolia* pollen carried on bees' scopae and body in burned and unburned sites.
- II. To determine whether abundance of flowering *E. angustifolia* differed in burned and unburned sites.
- III. To determine whether heterospecific co-flowering species richness differed in burned and unburned sites.

## Methods

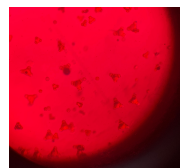
**Collecting pollinators and pollen:** Pollinators of *Augochlorella aurata*, *Agapostemon virescens*, and *Halictus* spp. were collected as they foraged on *E. angustifolia* heads in 26 remnant prairies (8 were burned, 18 were left unburned). Their scopae and bodies were scraped of pollen, which was then placed on microscope slides in fuchsin jelly with a mesh grid.



Chilled *Halictus* spp.

**Microscope slide analysis:** I haphazardly selected three sections of the grid and counted and identified the pollen present. I used this data to estimate proportion of *E. angustifolia* pollen each bee carried.

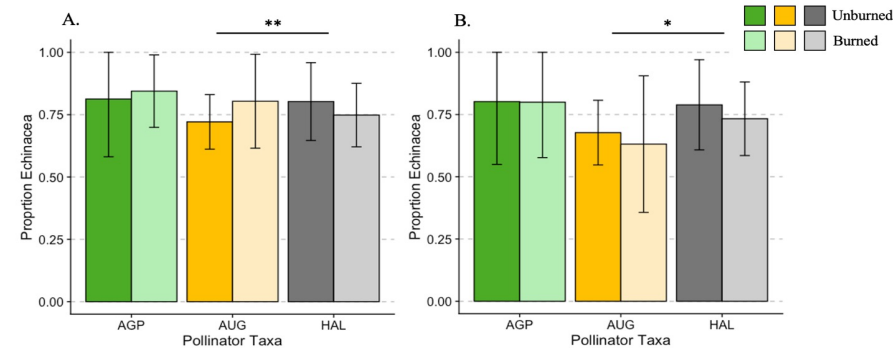
**Making a pollen reference library:** Co-flowering plants were noted in each site and a representative sample was collected. Pollen from these plants were used to create a pollen library for morphological comparison.



Pollen grains under the scope

## Results

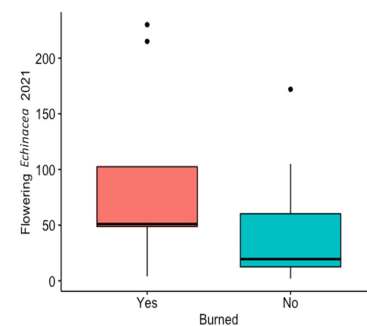
**I. Bees carried proportionally less *E. angustifolia* pollen in burned sites ( $p = 0.03$ ) and *Halictus* spp. carried significantly more *E. angustifolia* pollen than *A. aurata* ( $p = 0.017$ ) on their body.** The scopal pollen included a significant interaction between pollinator taxa and burn status, with *Halictus* spp. carrying 8% higher proportion *E. angustifolia* pollen and *A. aurata* carrying 5% less in burned sites ( $p = 0.008$ ).



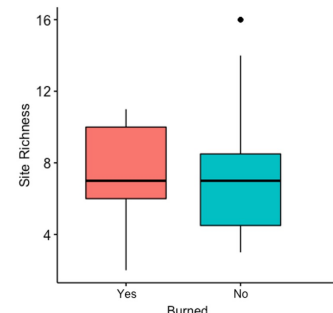
Proportion of *Echinacea* Pollen Found on Bee Taxa on Both Their Scopae (A) and Body (B). Bees carried proportionally less pollen in burned sites than in unburned sites. There was a significant interaction between pollinator taxa (HAL and AUG) and burn status in the scopal pollen and *Halictus* spp. carried proportionally more conspecific pollen in burned sites than *A. aurata* did.

**II. There was no significant difference in flowering *E. angustifolia* abundance in burned and unburned sites ( $p = 0.14$ ).**

**III. There was no significant difference in heterospecific co-flowering species richness in burned and unburned sites ( $p = 0.19$ ).**



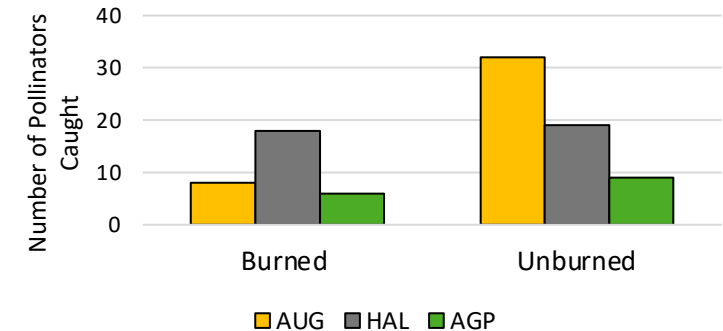
There is no significant difference between abundance of flowering *Echinacea angustifolia* in burned (Yes) and unburned (No) sites in the 2021 field season ( $p = 0.14$ ).



The median of both burned (Yes) and unburned (No) richness is the same, which is supported by the result that there was no significant difference between the abundance of co-flowering species in the study sites ( $p = 0.1856$ ).

## Discussion

- The results suggest that pollinators had significantly lower fidelity in burned sites than in unburned sites.
- Some studies suggest that heterospecific pollen deposition is correlated with plant reproductive success [3], but others have found that heterospecific pollen introduces barriers that inhibit successful plant reproduction [4].
- The lack of a significant difference in floral species richness and *E. angustifolia* abundance in burned and unburned sites was surprising because previous studies suggest that periodic fires support plant species richness [5] and floral abundance [6].
- Future studies should evaluate plant seed set in relation to heterospecific pollen as well as sampling pollen from the stigma rather than from the bee.**



*Augochlorella aurata* (AUG), *Halictus* spp. (HAL), and *Agapostemon virescens* (AGP) Caught in Burned and Unburned Sites.

## Literature

[1] Wagenius, S., Beck, J., & Kieffer, G. (2020). *Proceedings of the National Academy of Sciences* 117. [2] Brosi, B. J., & Briggs, H. M. (2013). *Proceedings of the National Academy of Sciences* 110. [3] Lopes et al. (2021). *Oikos*. [4] Ashman, T. L. & Arceo-Gómez, G. (2013) *American Journal of Botany* 100. [5] Palmquist et al. (2014) *Journal of Vegetation Science* 25. [6] Pilon et al. (2018) *Plant Ecology & Diversity* 11.

## Acknowledgements

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