

Introduction

Tallgrass prairies used to dominate central North America, but now face high extinction rates due to fragmentation and fire suppression (9).



Figure 6. *E. angustifolia*

Study species:

Echinacea angustifolia (Asteraceae)

- Alias: Narrow-leaved Purple Coneflower
- Common perennial prairie plant native in the central US
- Cannot self-fertilize

The **Echinacea Project** has studied the effects of habitat fragmentation on *E. angustifolia* since 1995.

- A recent study of theirs showed that fire improved mating potential by synchronizing reproductive effort (9).
- During summers, 2020 and 2021, *E. angustifolia* flower heads were collected at burned and unburned prairie remnants in western Minnesota.

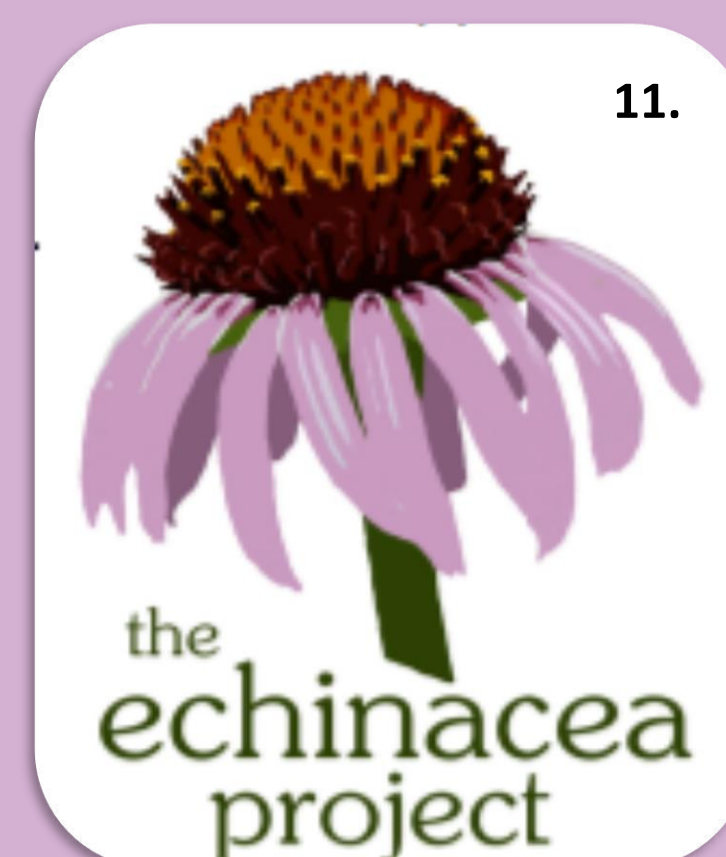


Figure 7. Echinacea Project Logo

Using that information, we wanted to see how fire affected the number of fruits* per head, which is one way to measure reproductive success.



Figure 8. Prescribed prairie fire

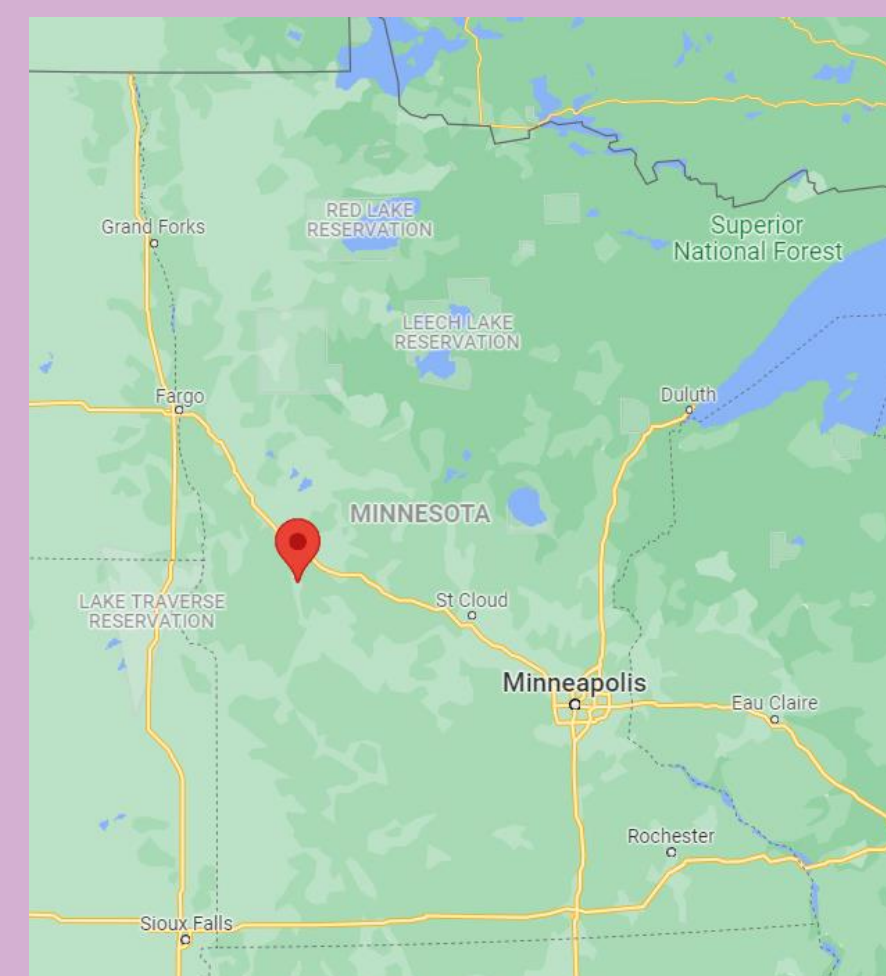


Figure 9. Study site in western Minnesota. Photo from location coordinates (11) entered on google maps.

*The technical botanical term for fruit in heads is **achene**.

Gap in Knowledge

Does fire affect the fruit count in *Echinacea angustifolia*?

Results

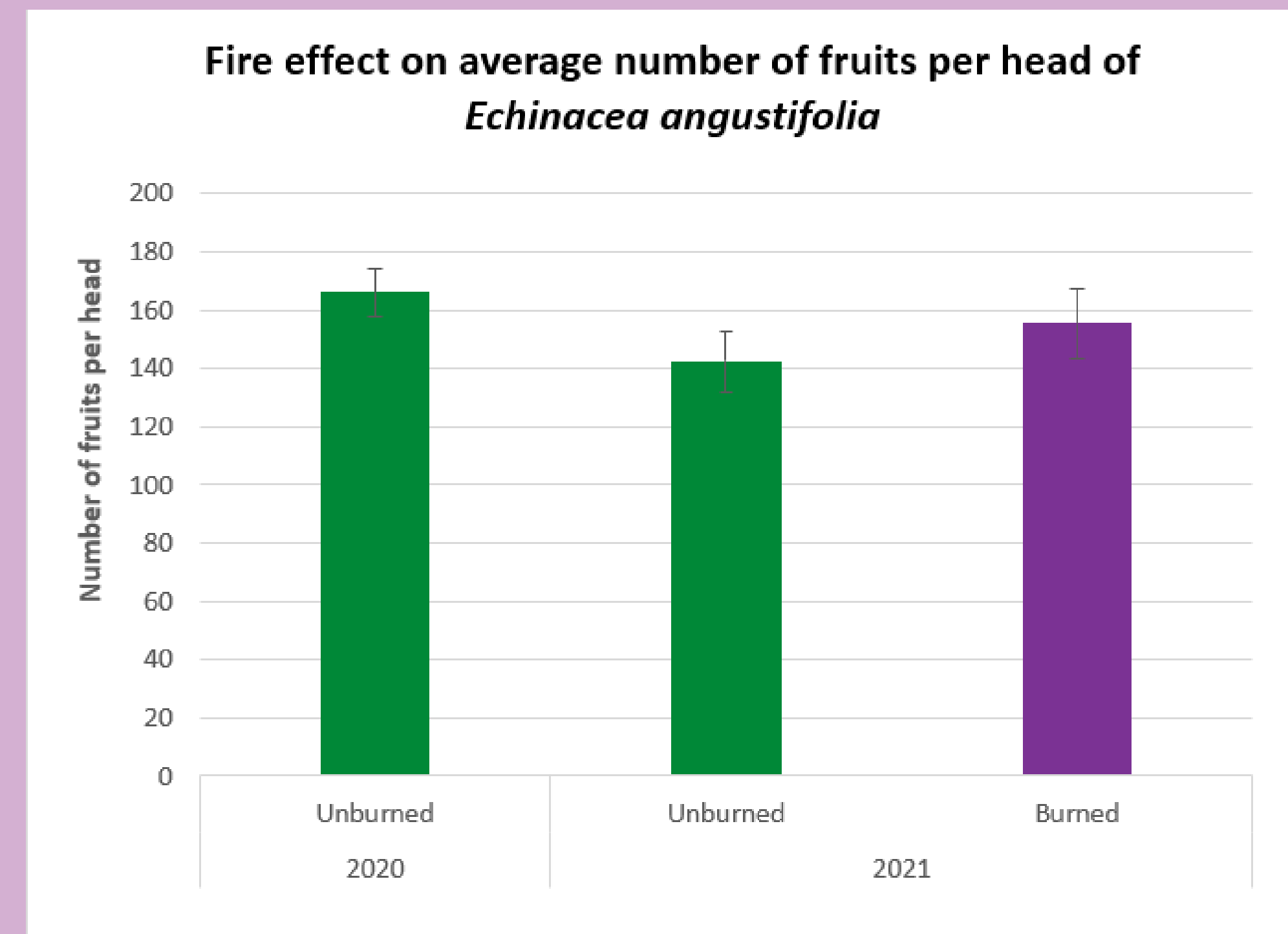


Figure 1. Average number of fruits per head of each *E. angustifolia* individual in burned (n=19, \bar{x} =155) and unburned (n=23, \bar{x} =142) plots of 2021 and the unburned plots (n=40, \bar{x} =166) of 2020. T. test statistical analysis for 2021 burned and unburned plots (df=41, p>0.05) shows that there was no significance in the average number of fruits per head of *E. angustifolia* individuals in 2021 for burned or unburned plot conditions.

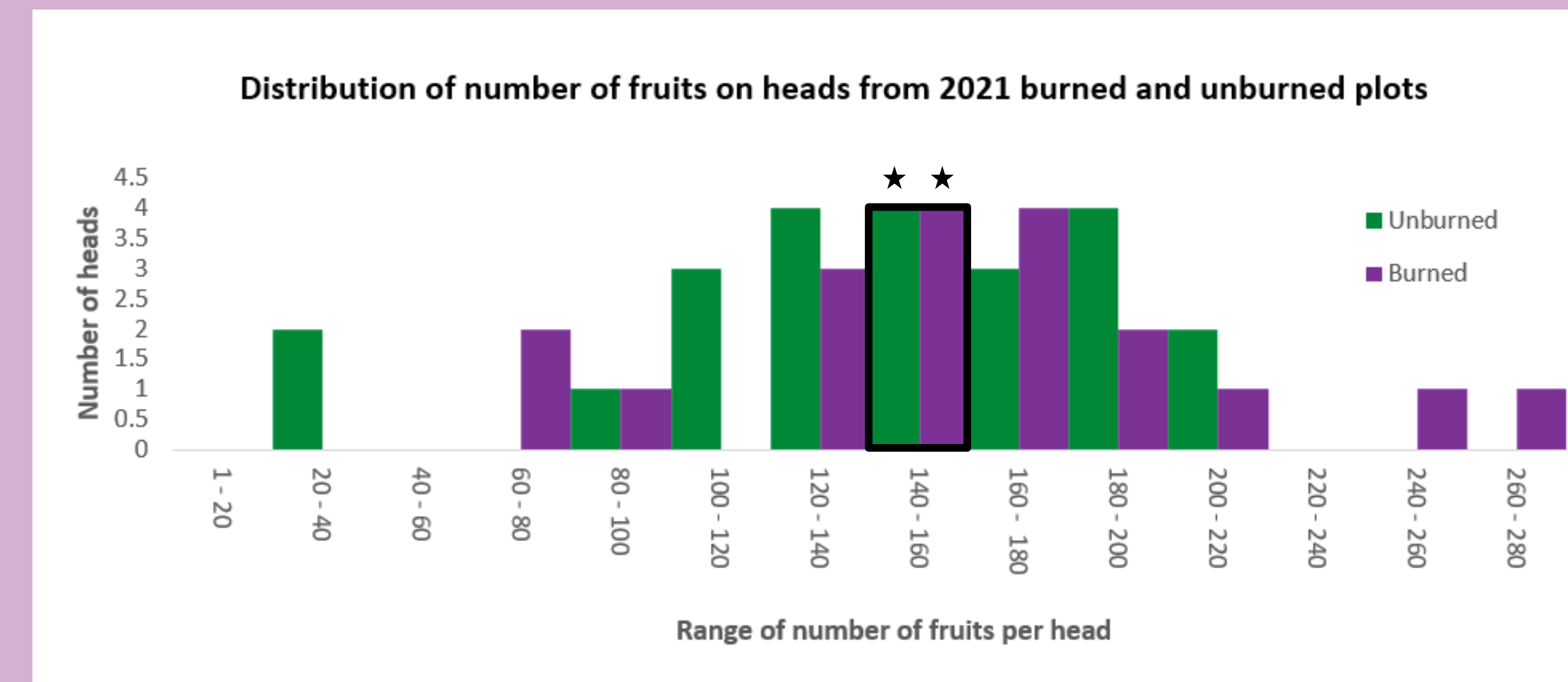


Figure 2. Histogram of number of fruits per head of each *E. angustifolia* individual in burned (n=19) and unburned (n=23) plots of 2021. Semblance of normal distribution is seen for both the burned and unburned plots. When compared, the normal distribution of individuals from burned plots had a more right-skewed distribution with a greater average number of fruits per head than those collected from burned plots. Starred and boxed bars denote range where burned and unburned averages were found for 2021.

Hypothesis

H₀: Average fruit count does not differ between burned and unburned plants.

H₁: Average fruit count in burned plants is greater than in unburned plants.

H₂: Average fruit count in burned plants is less than in unburned plants.

Methods and Materials

1. Cleaning heads



Figure 3

We removed achenes from flower heads by lightly crushing the head against the glass dish and picking out the rest. We separated the achenes from the extraneous plant material called the chaff (Figure 3). Each head and its chaff were rechecked to be sure all the achenes were separated.

2. Scanning



Figure 4

Next, we scanned the achenes from each head. We placed the achenes from each head onto a special glass scanning tray (Figure 4), scanned them, and saved them on the computer.

3. Counting



Figure 5

We counted the achenes of the scanned images by clicking on each one, which marked them with a colored dot (Figure 5).

Data analysis

We used Microsoft Excel to create our graphs.

Discussion

Results somewhat support our hypothesis that fire does affect the number of fruits produced in *E. angustifolia*.

We found that:

- In 2021, **burned plots had a greater average number of fruits** than unburned plots (Figure 1, p>0.05).
- **2020 heads had more average fruit production** than either burned and unburned 2021 plots (Figure 1). This may have been due to the drought observed in 2021, impacting fruit production.
- Heads from **burned plots had more fruits per head** (right skewed distribution) overall than from unburned plots (Figure 2).

Although burned plants yielded more fruits than unburned on average, insufficient evidence exists to reject the null hypothesis.

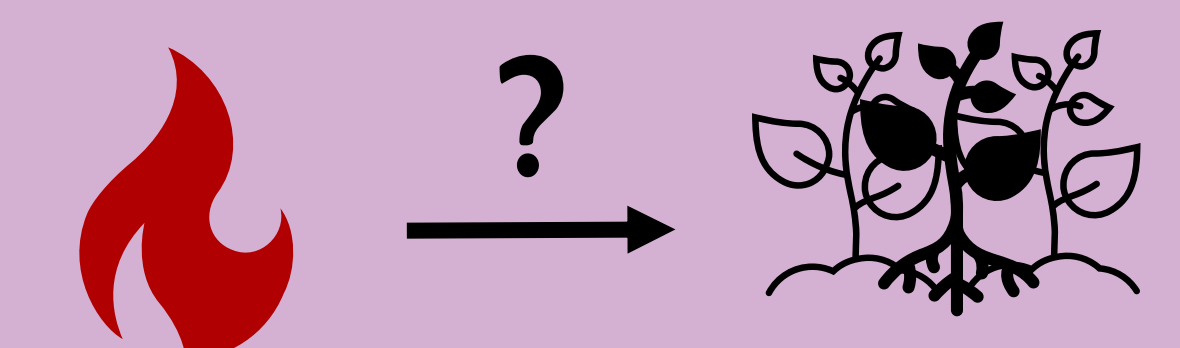
Implications and Importance:

- Greater understanding on the impact of fires on prairie plant reproduction and growth (9, 10).
- Implications of fire's role in native prairie plant conservation, which differs to fire's impact and use for control of invasive species (1, 7).

Future Studies:

Possible future questions of focus:

- Does *E. angustifolia* from smaller, fragmented prairie plots benefit more from burns than those from larger plots?
- How do different prairie plants respond to fires?
- Does the timing of fires affect *E. angustifolia* fruit set differently?



Literature Cited

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11. <http://echinaceaappoject.org>

Acknowledgments

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