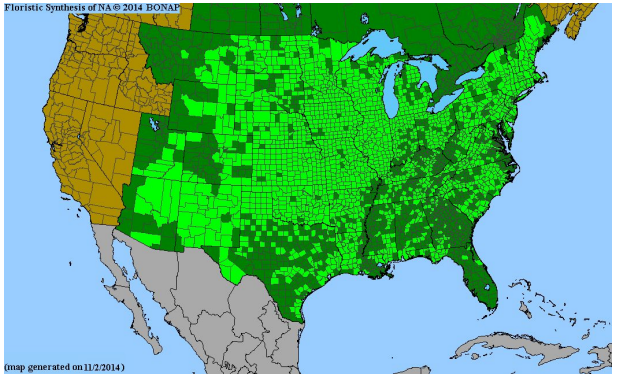
Calculating Burn-Dependant Reproductive Success in *Andropogon gerardii*

Vo Dominguez and Rebecca Lerdau, Winter 2023

Andropogon gerardii- Big Bluestem

- Quintessential Prairie Grass
  - Dominant species
  - Densely populated
  - Wide range
- Wind Pollinated



Clockwise: BONAP North American Plant Atlas, Steve Wilson, Paul Rothrock

Fire Response

It increases prairie biomass

Fire tends to increase flowering

Why do prairie plants flower more after a fire?

We Don't Know if Fire Leads to More Reproductive Success

- *A. gerardii* is **self incompatible**, so **more flowers does not mean more seeds** unless they are successfully pollinated.
- We predicted that andropogon would have a **greater seed set in burned than unburned plots**
  - Density
  - Synchrony

Therefore, we needed to calculate seed set...

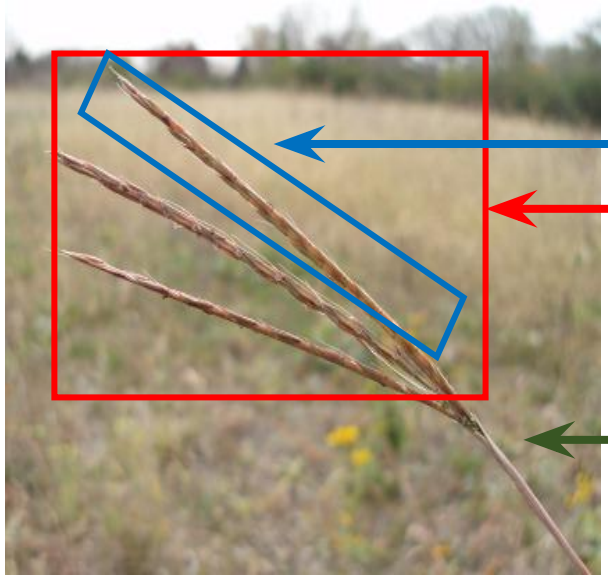
Wait… How are we supposed to do that?

We calculate seed set all the time...

Seed set = seeds produced / total fruits

- We've calculated seed set for Echinacea in this lab
- *A. gerardii* seed set is typically found by dissecting individual florets
- But this becomes challenging when looking at seed set for large amounts of *A. gerardii*

A. *gerardii* Morphology



Spike- single spire of florets

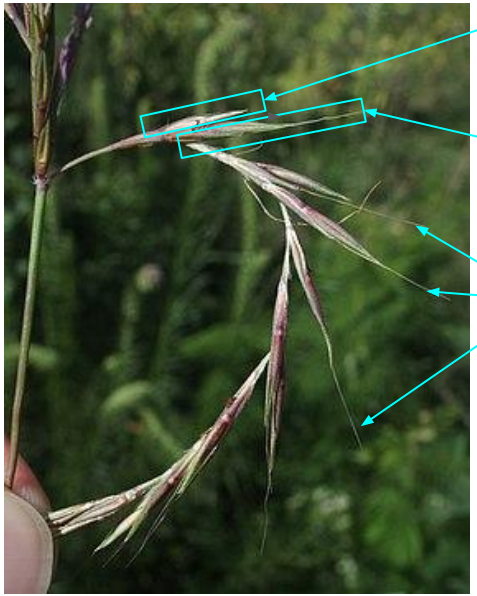
Inflorescence- flowering part of the grass, usually made up of 3 spikes

Culm = grass stem

Trouble With Seed Set

Spikes are made up of pairs of spikelets

Usually, only one of the spikelets in a pair has the ability to produce a seed



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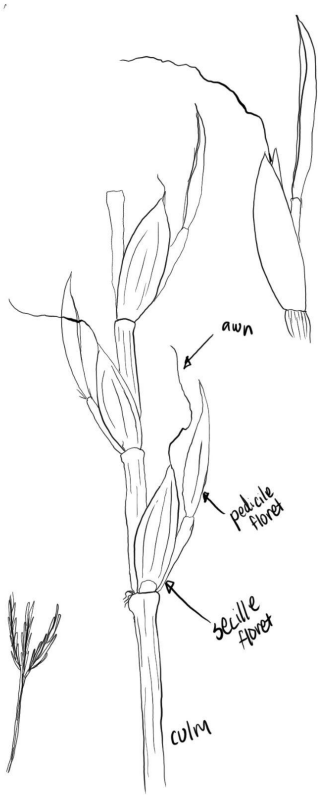
Sessile spikelet- perfect floret

Pedicellate spikelet- staminate floret

Awn



To calculate Andropogon seed set, you need to know how many sessile florets it has

How can we find total seed production without dissecting every floret?

Is there a relationship between inflorescence mass and total awns?

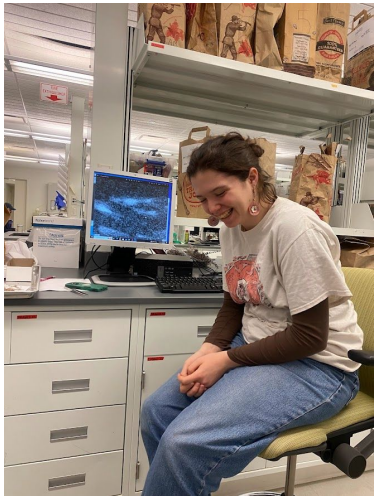
Andro-protocol-ogon

1. Cleaning

2. Weighing

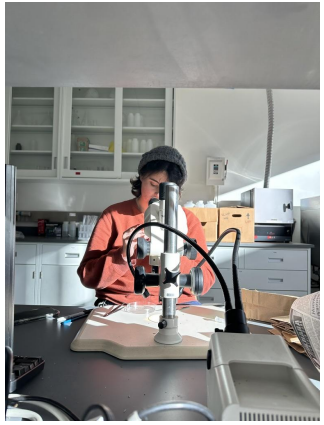
3. X-raying

4. Classifying seeds



5. Counting awns

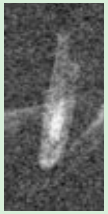
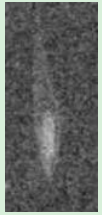
6. Weighing seeds



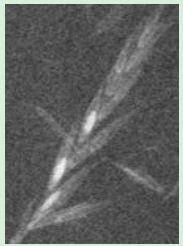
7. Data analysis

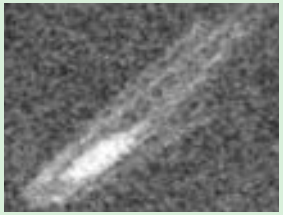
Present



one speck inside of one seed case, clearly defined

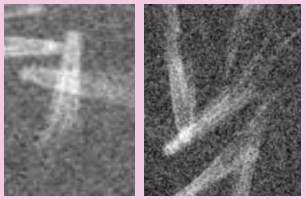




florets are **distinct** and contain clear embryos

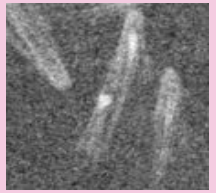
Two embryos overlap, but the bright spots **extend beyond the overlapping section**.


Absent



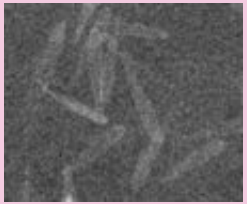
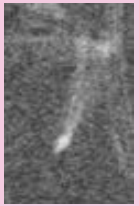
Overlapping is the only cause for the bright spot

speck is only on the **upper part of the glume**



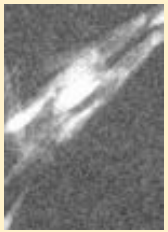
speck **without a floret case**

no embryo is present, **casing may be visible**

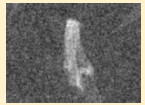



bright spot is only on the very **end of the floret** where it **attached to the culm**.

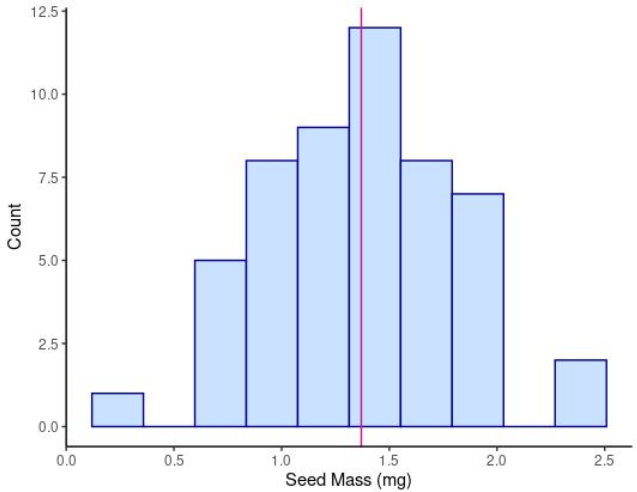
Unclear

bright spot but **unable to distinguish** if embryo is present

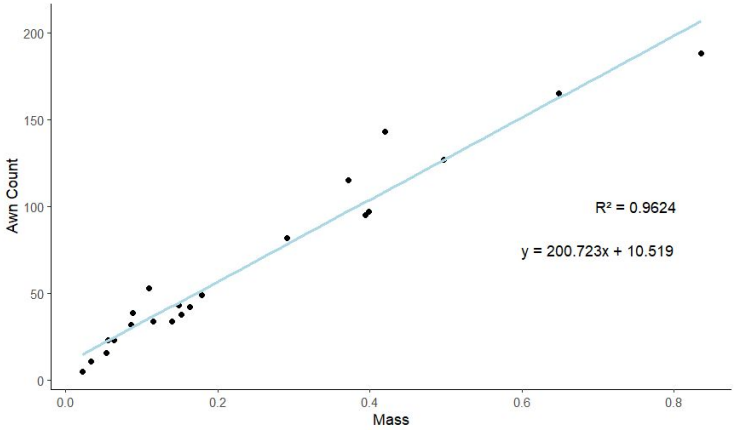


Results: New Method for Calculating Seed Set



Mean seed mass calculated to subtract

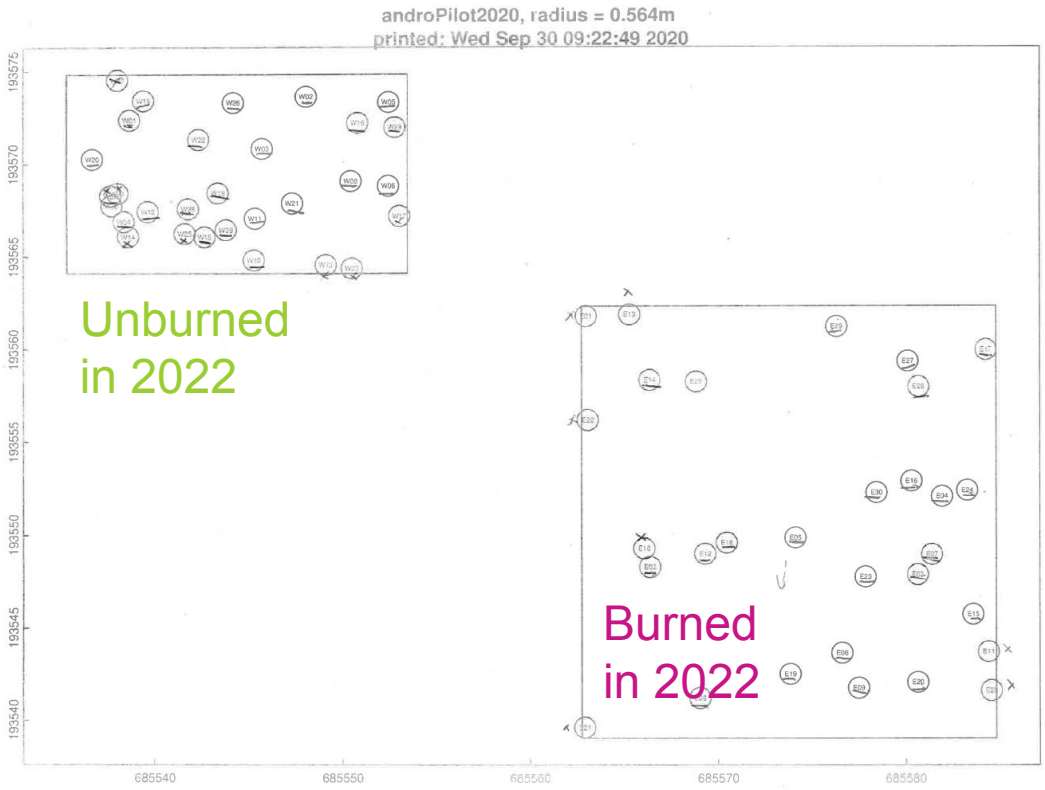
Mean = 1.369



Linear relationship between Awn Count and Inflorescence Mass

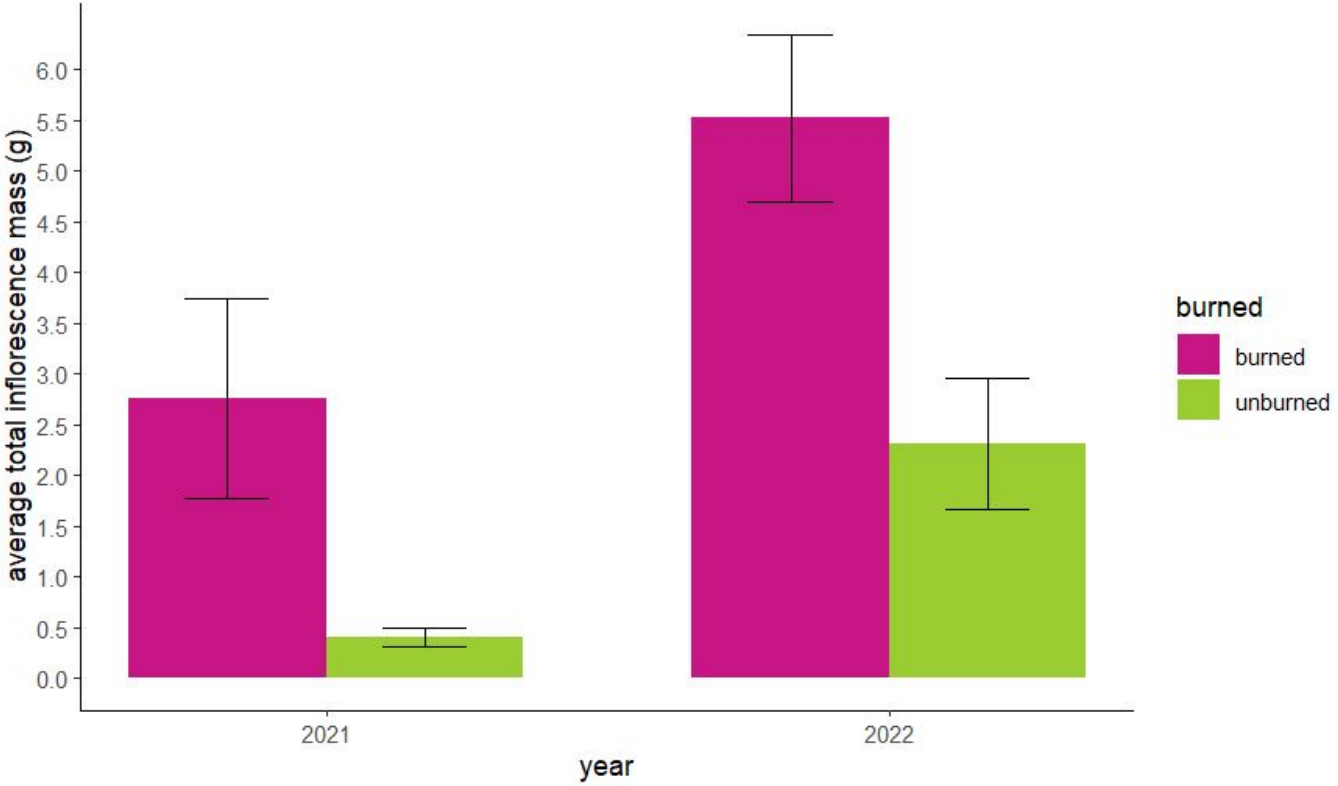
Now we can use this to see how burn affects reproductive success.

Pilot Study Design

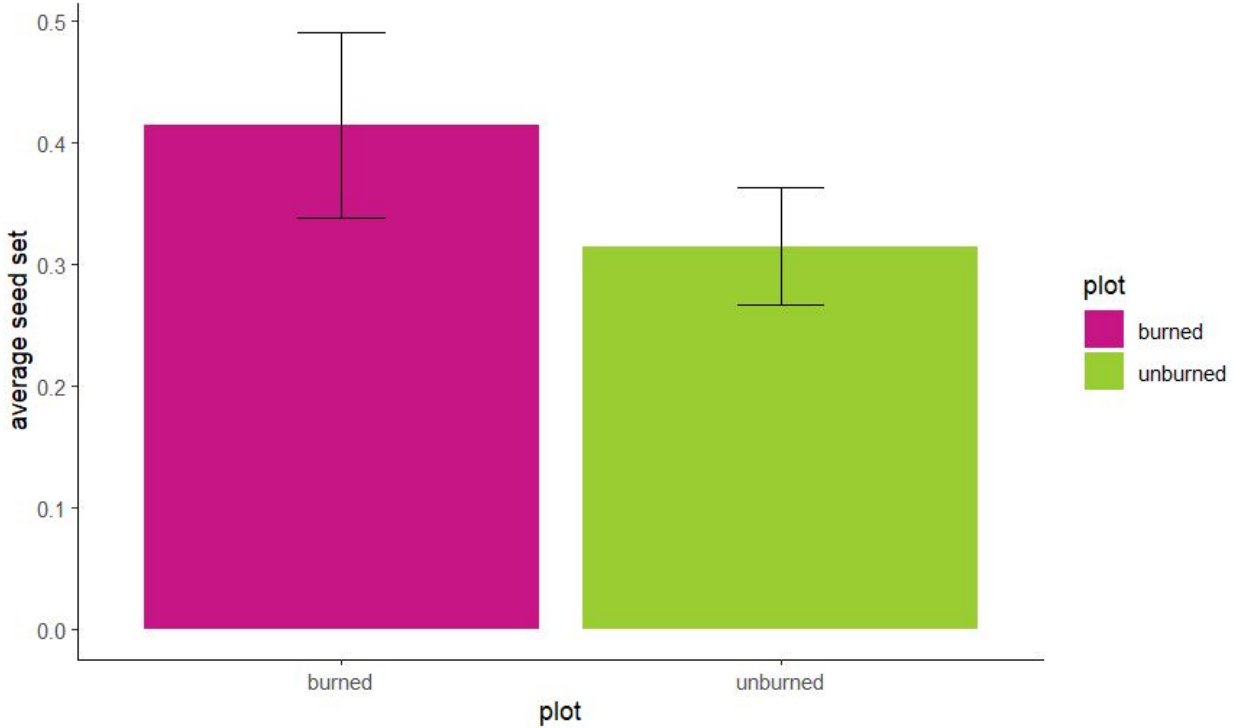


Two plots in a prairie remnant in western MN.

Fire Increases Reproductive Effort



Seed set in burned vs Unburned Plots



p = 0.1842

Conclusions

- We found a **viable method for calculating IA. gerardii seed set** without dissecting individual florets!
- We could not reject our null hypothesis comparing seed set in burned and unburned plots
- **What Could this mean?**
    - **Methods:** we did not follow our own best practices for classification
    - **Experimental Design**: The Burned and Unburned plots were really close to each other.
    - **Single Year Study:** 2022 was a high flowering year, if the reason for increased reproductive effort and success after fire is density, there might be less of a difference than in average years
        - Anova tests on reproductive effort showed that there was significant effort difference year to year
    - **Hypothesis**: wind pollination or dominance might nullify the need for post burn synchrony and density to increase reproductive success

Future Directions

- **Reclassify 2022** pilot study data
  - Median of 3 counts
- Apply our methods to samples from the same plot in **different years** *A. gerardii* samples to see if there is a significant difference in different years
- Apply our methods to samples from **multiple prairie remnants** to see if remnant size, population density, and other factors influence response to burning




↑Support and supervision provided by ↑

R Programming

↑ Stress provided by ↑

Lab provided by →

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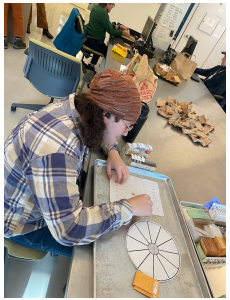
Thank you!

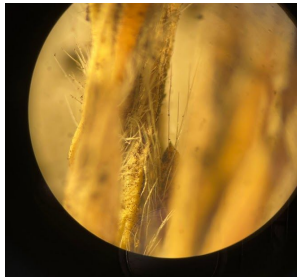
↑funding provided by↑

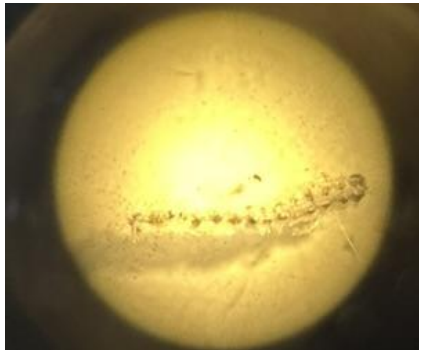
the echinacea project
investigating ecology and evolution in fragmented prairie habitat since 1995

← Students and supervisors provided by ↑




↑ Friendship provided by ↑





Questions?

Have an awn-some day!