

Bison grazing increases plant productivity in Minnesota oak savanna

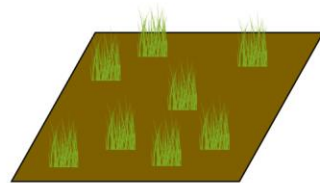
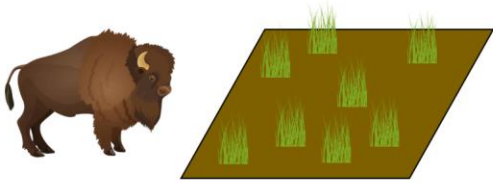


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Thank you

Talk about a project that started last summer reintroducing bison to Cedar Creek
The affect of bison grazing on productivity during the first year

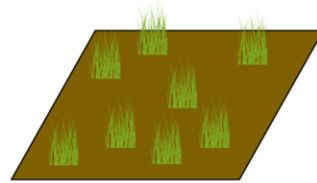
How does grazing affect productivity?



There has been a great deal of debate over whether grazing should increase or decrease productivity

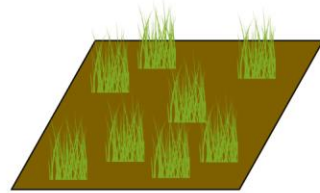
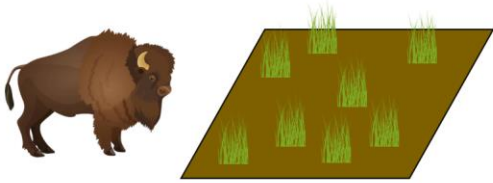
Dependent on precipitation, resource availability, intensity and frequency of grazing, system has an evolutionary history of grazing

How does grazing affect productivity?



Grazing reduces photosynthetic tissue, removes resources (bad for productivity)
Reduces light competition (good)
Reduces the dominant grasses (good)

How does grazing affect productivity?



regrowth



Relatively little work in Midwestern savannas
What role might bison play in oak savannas?



Cedar Creek has nearly 1000 acres of relatively intact oak savanna.

Historically bison were present in these communities.

Prescribed burning to maintain and restore oak savanna at Cedar Creek has been ongoing since the 1960s

Important for the maintenance of savanna but alone it is insufficient?

Burning has some similar impacts as grazing (remove biomass) but its not selective...

There may be an interaction between fire frequency and grazing on productivity.

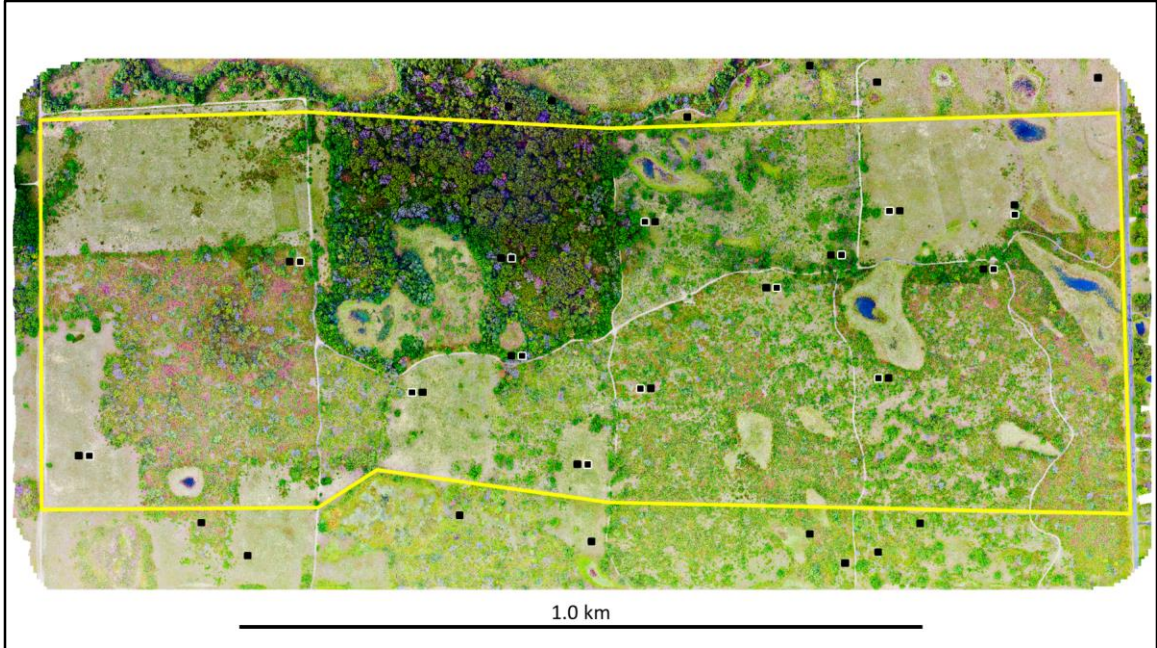
Research questions

1. How does bison grazing affect productivity in oak savannas?
2. How is the grazing-productivity relationship affected by fire frequency?





2018 released a herd of 32 bison into the savanna at cedar creek

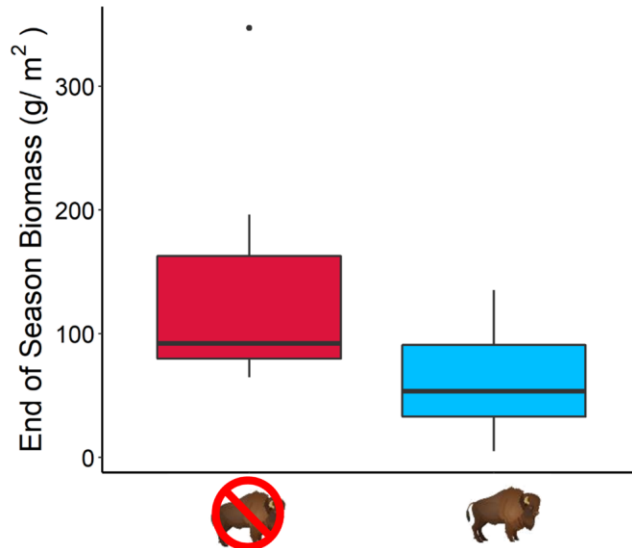


Bison are able to roam freely within the fenced area (yellow line)
~220 acres
Paired plots inside and outside the fence (42 total)



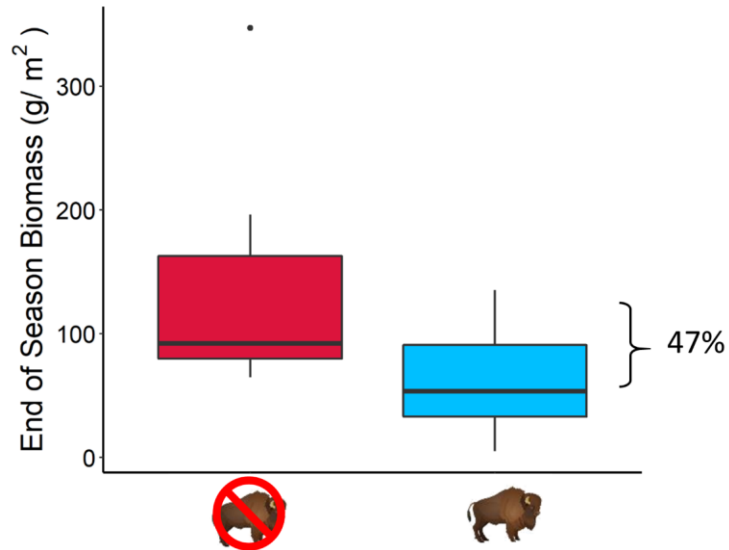
7mx7m plot. Fenced. Not fenced (allows grazing by bison). We have 14 of these pairs of plots across the savanna.

On average there is 80 g/m² less biomass where bison graze



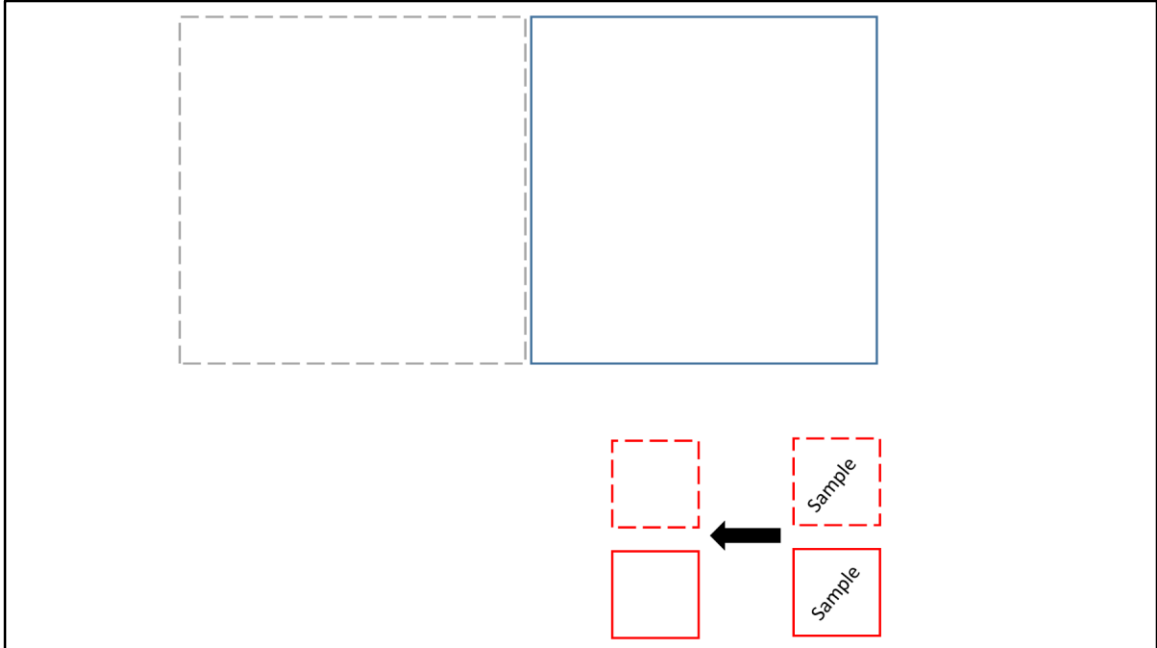
More biomass in the ungrazed plots but this doesn't count how much productivity/biomass was consumed by bison throughout the year as grass is grazed and regrows.

On average there is 80 g/m² less biomass where bison graze



Does grazing by bison increase productivity?





At each plot we used movable exclosures to measure how much biomass regrows after bison graze.

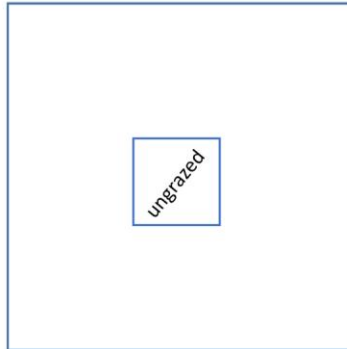
We moved exclosures every two weeks for the entire summer.

Solid line=no bison grazing

Dotted line=bison grazing.

Productivity

$$Productivity = (fence_t - grazed_t) + (fence_{t+1} - grazed_{t+1}) + \dots + (fence_{t+n} - grazed_{t+n})$$



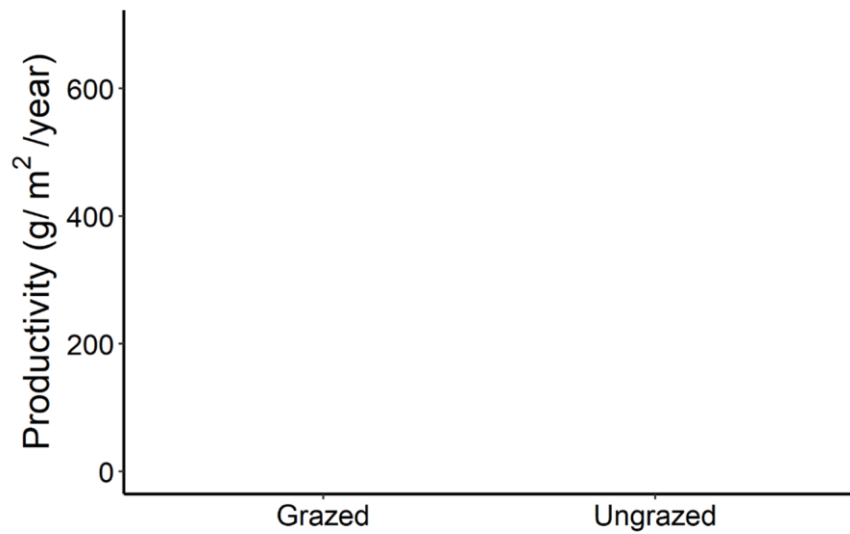
Calculate productivity by subtracting what was left in grazed plots from what regrew in fenced plots and sum across all sampling time points for each plot.

We can compare productivity from our movable exclosures to that in plots that were ungrazed by bison.

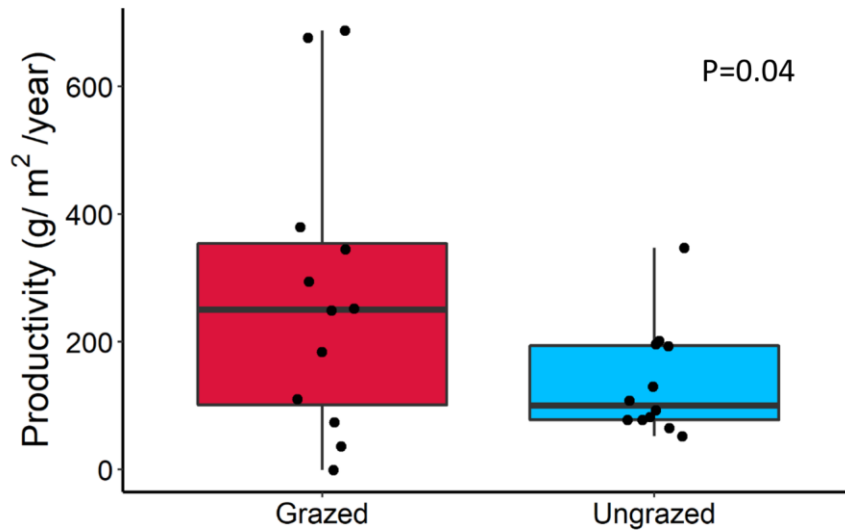


Comparison of a grazed vs. fenced plot

Does grazing by bison increase productivity?

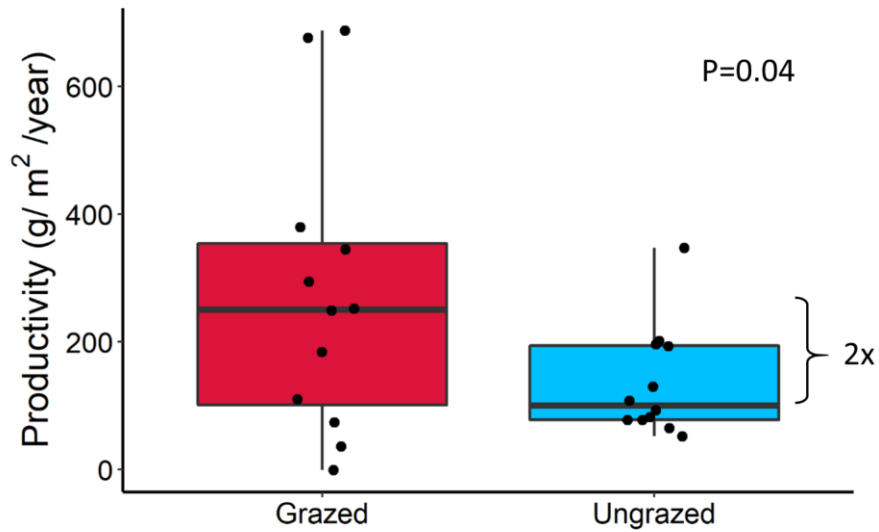


Does grazing by bison increase productivity?



Significant effect of grazing on productivity

Does grazing by bison increase productivity?



Productivity was twice as high in grazed plots compared to ungrazed plots

Research questions

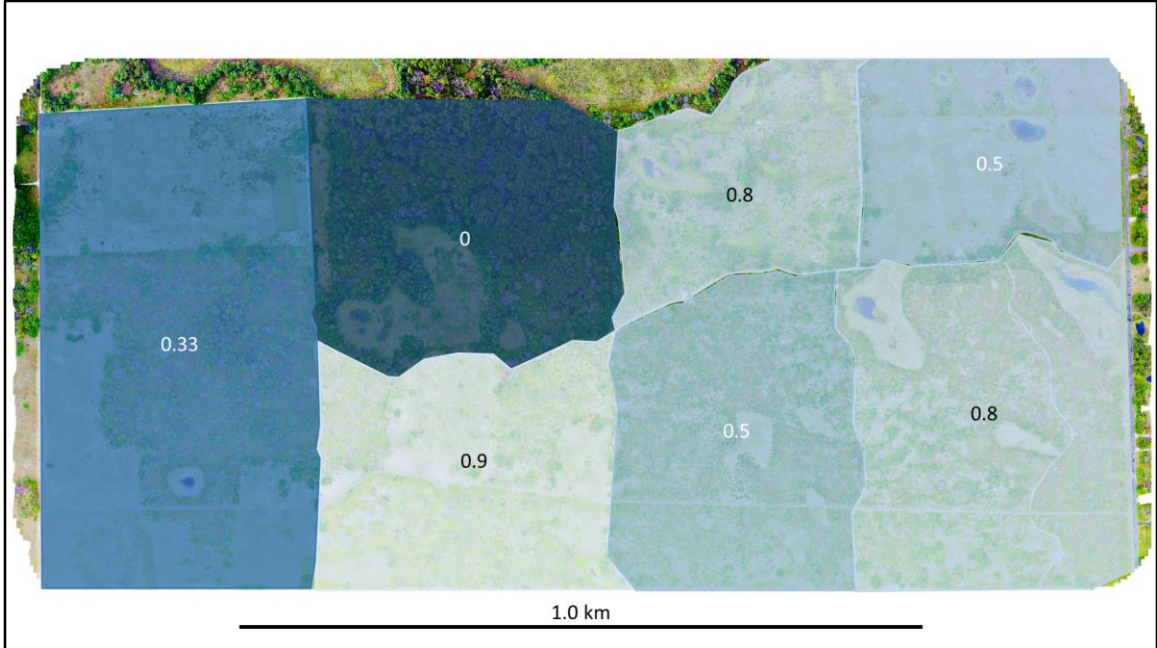
1. How does bison grazing affect productivity in oak savannas?

Yes, at least aboveground.

2. How is the grazing-productivity relationship affected by fire frequency?

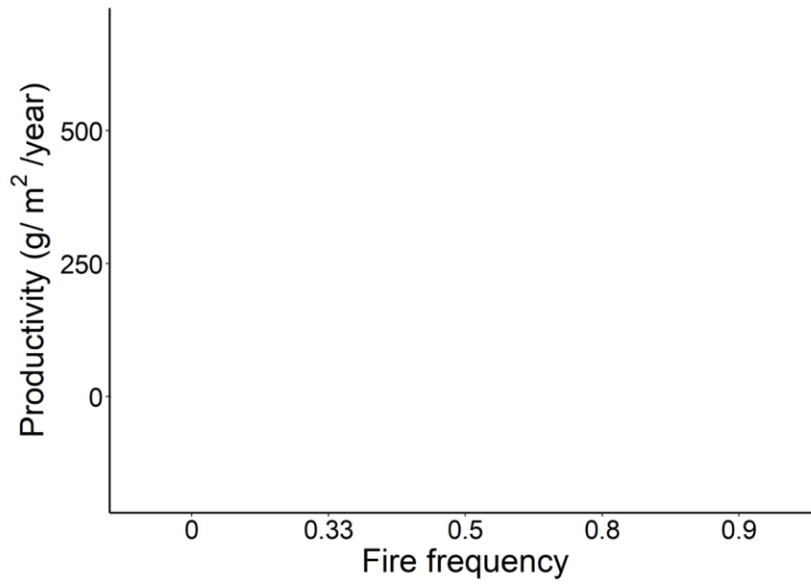


Fire removes litter and productivity is often increased after a recent fire
Could cause an interaction between grazing and fire

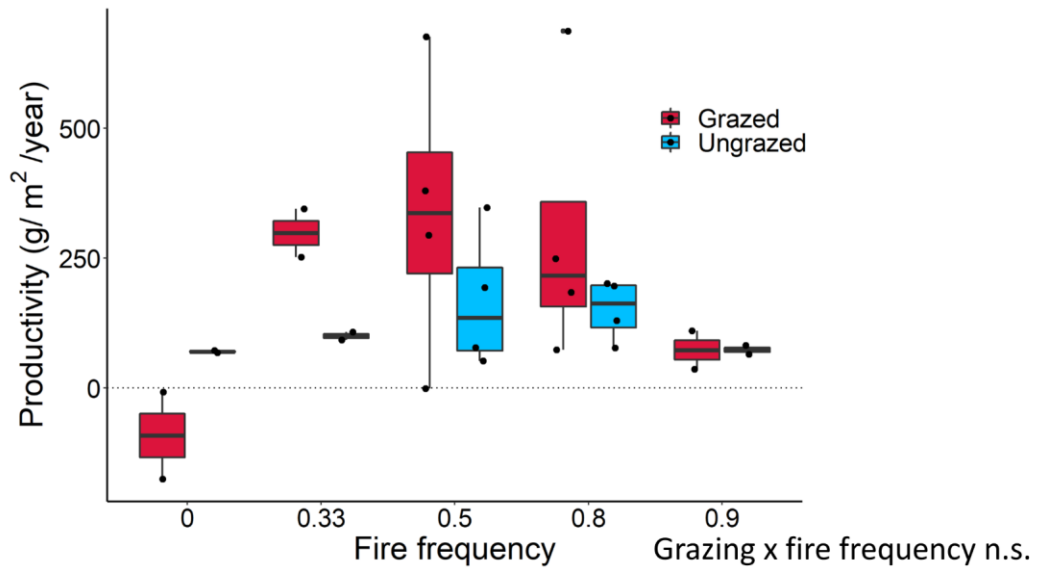


Prescribed burning at Cedar Creek since 1964.
Units are burned at different frequencies e.g. 1 out of every 3 years.

How does fire affect the grazing-productivity relationship?

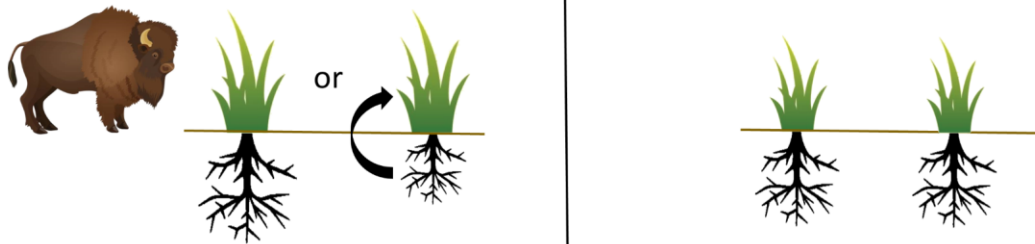


How does fire affect the grazing-productivity relationship?



Trend: increasing fire frequency diminishes the affect of grazing on productivity but nont significant.

Is grazing increasing productivity or causing plants to reallocate resources?



This summer we installed root in-growth cores to measure belowground productivity?

Is productivity actually increasing or are plants just reallocating resources from below to aboveground.



We also have camera traps at each plot pair to study how frequently bison graze each plot.

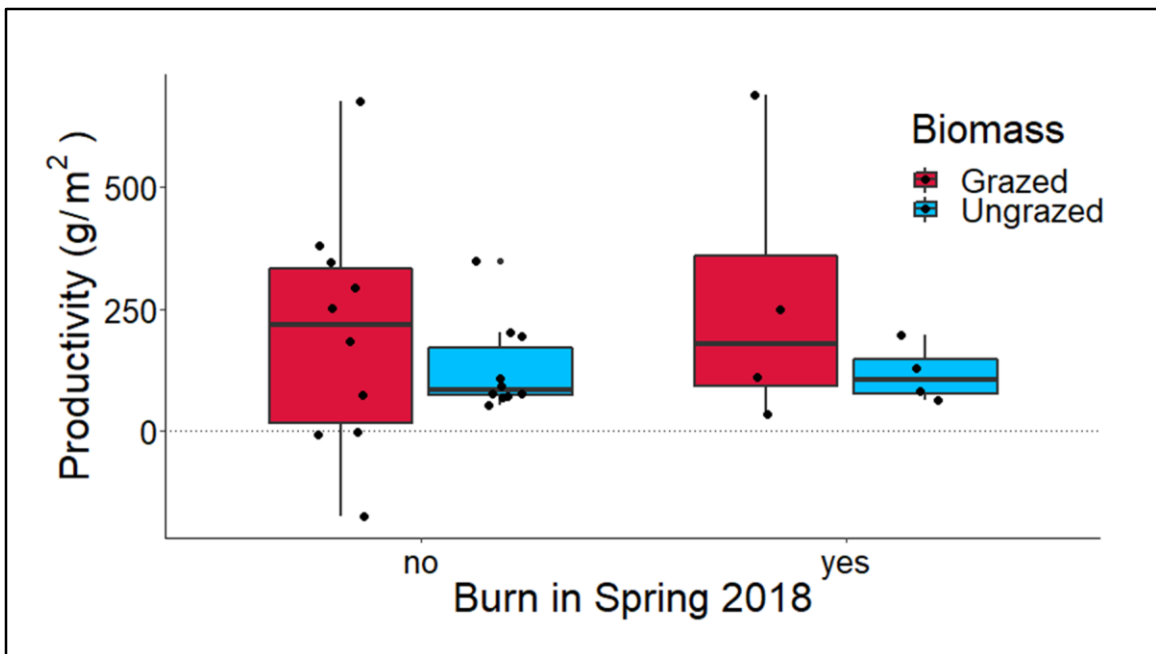
Do patterns in grazing change throughout the season?

Thank you!

- Minnesota Environmental and Natural Resources Trust Fund
- Cedar Creek staff and volunteers
- Many interns
- Dave Tilman & Forest Isbell







There was no significant interaction between spring burning and grazing on productivity.