Biodiversity Loss and Phenology in California Grasslands

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INTRODUCTION

A major consequence of climate change on plant communities is its effect on **phenology - the seasonal timing of life events such as germination, flowering, and fruiting**. Other downstream effects of climate change have also caused biodiversity loss in many ecosystems(1). Both rising temperatures and biodiversity loss have been shown to **advance flowering in California grasslands**(2). The combined effects will have severe consequences on comunity interactions, thus necessitating further study on the relationship between biodiversity and phenology.

Within multiple plant genera, population level trait variations result in **correlations between latitude and phenology**. In lower latitudes, limited water availability prompts plants to flower earlier, a response called drought escape(3). In addition, lower latitude populations display greater flowering time plasticity, the variance in the timing of flowering expressed in response to differential conditions(4).

OBJECTIVE

Understand the relationship between the latitudinal gradient of populations and the phenological response to biodiversity loss by growing populations of needle goldfields (*Lasthenia gracilis*) from three latitudes of California grasslands in environments with decreasing levels of biodiversity.

HYPOTHESIS

1. Declining biodiversity would result in greater phenological shifts (advance in flowering) for flower latitude populations
2. Flowering seasons would increase in length as a result of declining biodiversity

METHODS

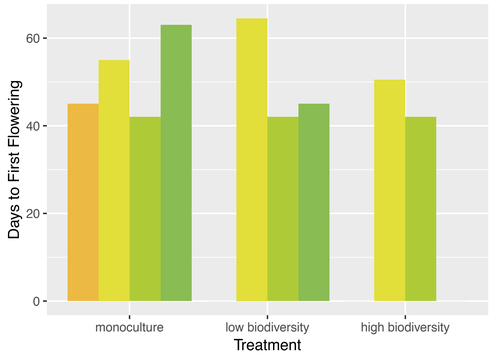
SET-UP

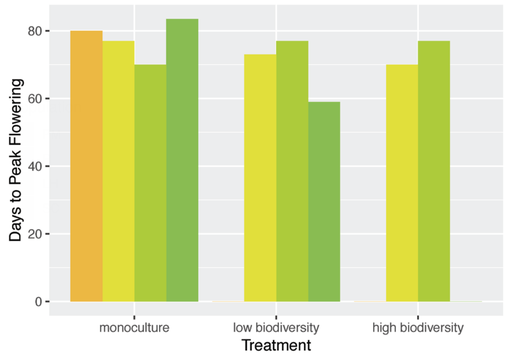
Needle goldfield seeds originated from Santa Clara, Lost Hills, and Riverside counties to represent populations of **high, medium, and low latitudes**. Seeds from each population were grown in pots with **three biodiversity treatments: monoculture, low biodiversity, and high biodiversity**. Two grass species and two other annual herb species were used to represent a California grassland community. An additional treatment of monocultures mixed all three populations. Each treatment was replicated five times.

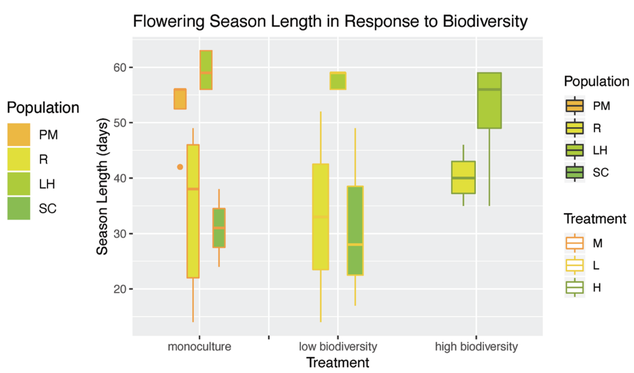
ANALYSIS

Buds and open inflorescences per pot were counted twice a week. Phenology measurements included **peak emergence date, first flowering date, peak flowering date, and flowering season length**. I determined if changes in each measurement for each population were positive or negative in relation to biodiversity loss.

RESULTS







Populations Mixed: delay in peak flowering in relation to R and LH
Riverside (low latitude): delay in peak flowering and shortened flowering season in relation to biodiversity loss
Lost Hills (medium latitude): advance in peak flowering and extended flowering season in relation to biodiversity loss
Santa Clara (high latitude): *low emergence success* delay in first and peak flowering in relation to biodiversity loss

CONCLUSION

For all three measures, there were both positive and negative relationships between biodiversity and phenological shift in needle goldfields, with no consistent latitudinal trend. This suggests that **the relationship between biodiversity and phenology may be more variable and complex than previously thought**.

FURTHER STUDY - effects of competition

Inflorescences in high biodiversity pots were much smaller than those grown in monoculture pots, correlating with higher competition from the grasses. Potential trade-offs between inflorescence size and number due to competition should be studied.

LIMITATIONS - sample size and replications

Many pots containing few or no needle goldfield plants. Small sample sizes combined with limited replications resulted in limited data availability for running robust statistical tests. Replication studies should include more populations or run germination trials prior to experimental setup.

ACKNOWLEDGEMENTS

This project was generously funded by the California Native Grasslands Association's Grassland Research Award for Student Scholarship. I would like to thank Rachael Olliff Yang and the Ackerly Lab at UC Berkeley for mentorship and guidance, as well as Pooja Butani and Emily Cox for support in running the experiment.

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