Phenology and Climate Change
in the TW Daniel Experimental Forest Meadow

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Introduction

One concern from climate change is that the phenology (the timing of the seasonal life cycle) of plants may occur earlier in the year. Earlier flowering may lead to speciation and a greater risk of frost kill, possibly making species more susceptible to extinction.

This research looked at flowering time of meadow forb species in the TW Daniel Experimental Forest (TWDEF) over the last 52 years. Historical phenological data was obtained from Dr. Theodore Daniel, a former USU forestry professor who visited this meadow weekly and recorded phenological stages of the plants in 10 meadow plots.

Research Question:

- Have meadow forb species in the TWDEF experienced earlier flowering dates as a result of climate differences over a span of 52 years?

Methods

Summer of 2020 I visited the meadow weekly and recorded phenological stages and flowering dates for each species in each plot.

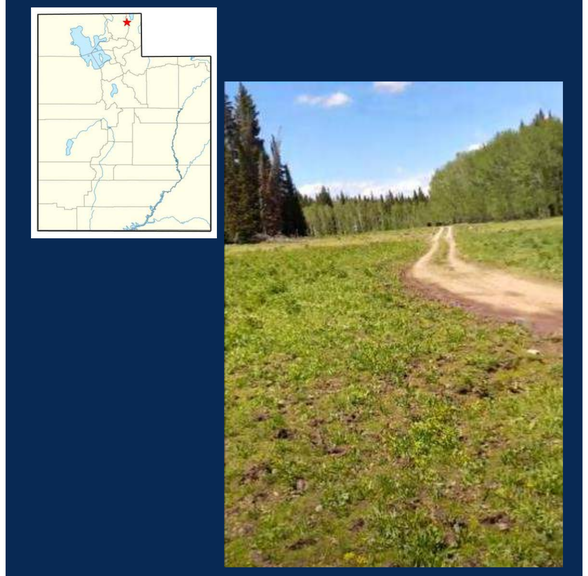
- Historical data from 1968-1974 and 1990-1995 was transcribed.
- Climate data in the form of spring degree days >5°C (DDs) was obtained from ClimateNA, representing temperatures suitable for growth.
- Flowering dates were converted to Julian days (1-365).

To answer my research question, I ran regression analyses with Julian day against number of DDs for each of 36 frequently recorded species.

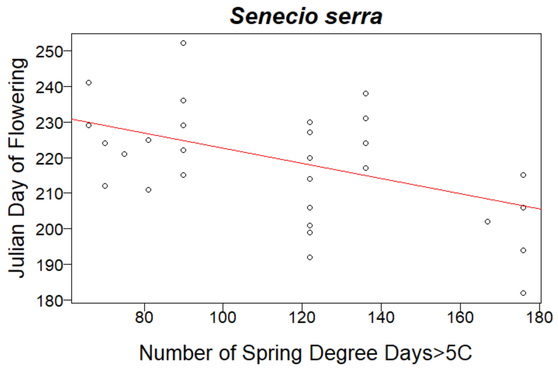
Results

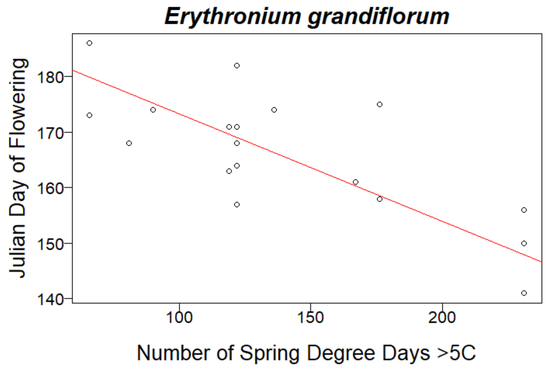
From the regression analyses all but three of the 36 species resulted in significant (<0.05) p-values. However, only three species had models with R^2 values >80% while four more species had R^2 values >60%.

Of these seven species with high R^2 values, the greatest change to the timing of flowering occurred in *Erythronium grandiflorum* with a slope of -0.36, meaning that as the number of spring degree days >5°C increases by one, Julian date of flowering decreases (occurs earlier in the year) by -0.36 days.



Location and image of the TW Daniel Experimental Forest Meadow in Northern Utah.





Graphs depicting the regression models with number of spring degree days >5°C and Julian day of flowering for Senecio serra *(R^2=0.85) and* Erythronium grandiflorum *(R^2=0.66).*

Conclusions

While the regression analyses indicate significant effects of number of DDs on the Julian date of flowering, the low number of models with high R^2 values imply that DDs may not be the strongest climate variable contributing to flowering time for most species. For *E. grandiflorum* and the six other species with the highest R^2 values, climate effects to timing of flowering might appear slow, but in unusually warm years these species may flower much sooner, leading to greater risk of frost damage and unsuccessful reproduction in those years.

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