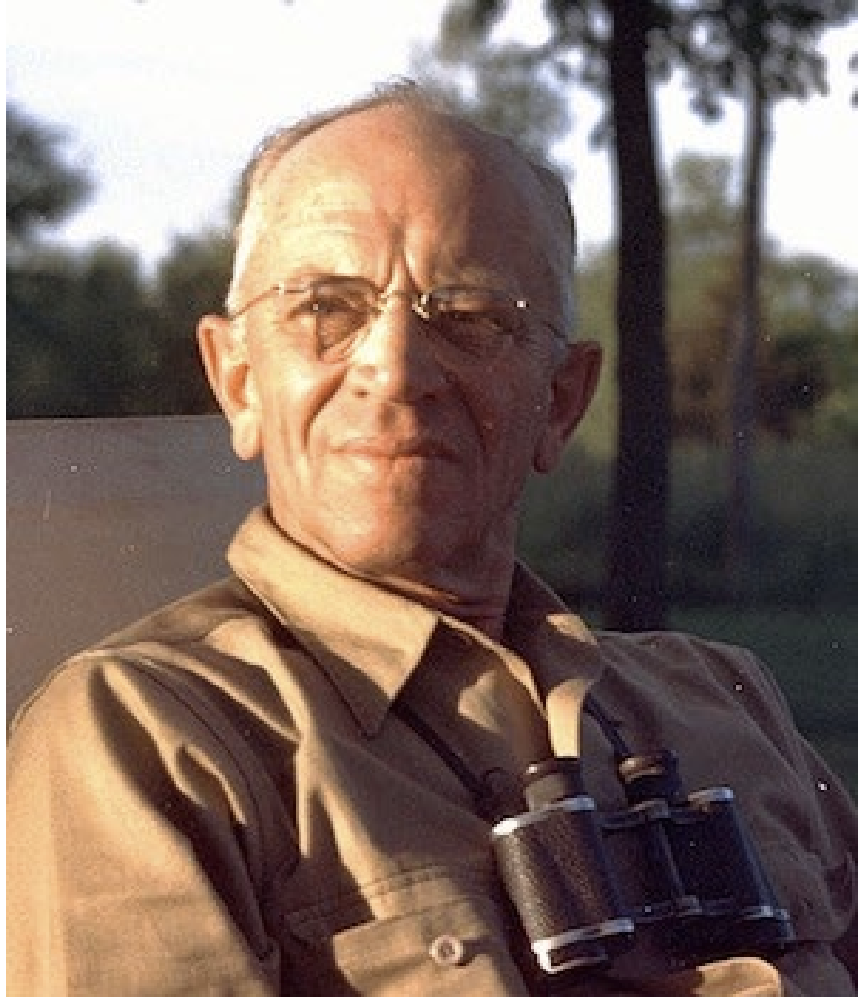
Impact of Warmer Spring Temperatures on Flowering Times of Individual Native Wisconsin Prairie Plants

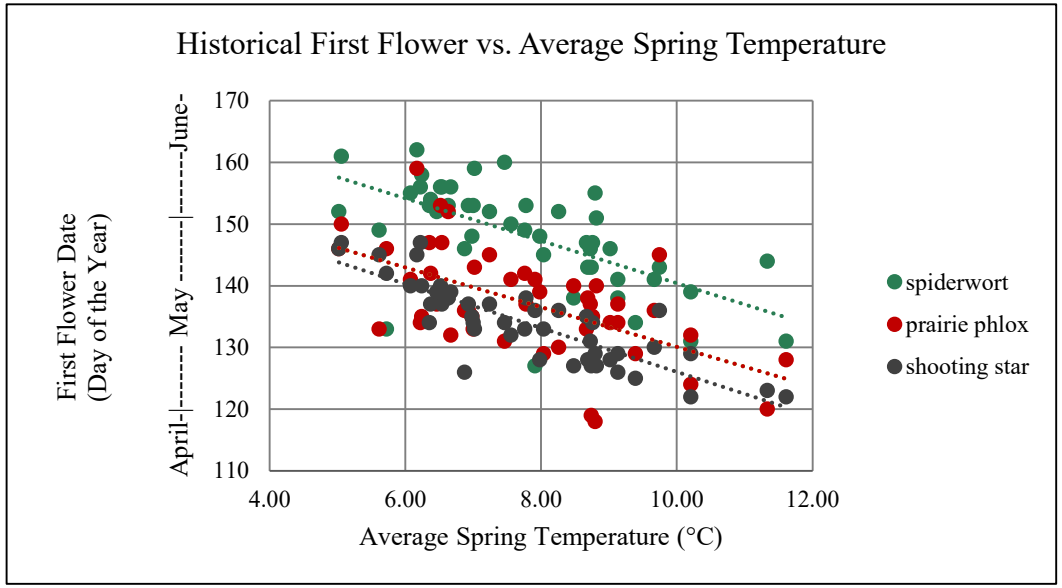
LAKESHORE NATURE PRESERVE COMMITTEE MEETING



Historical Study of Phenology: Aldo Leopold

Background & Biological Rationale

- Study of cyclical natural phenomena



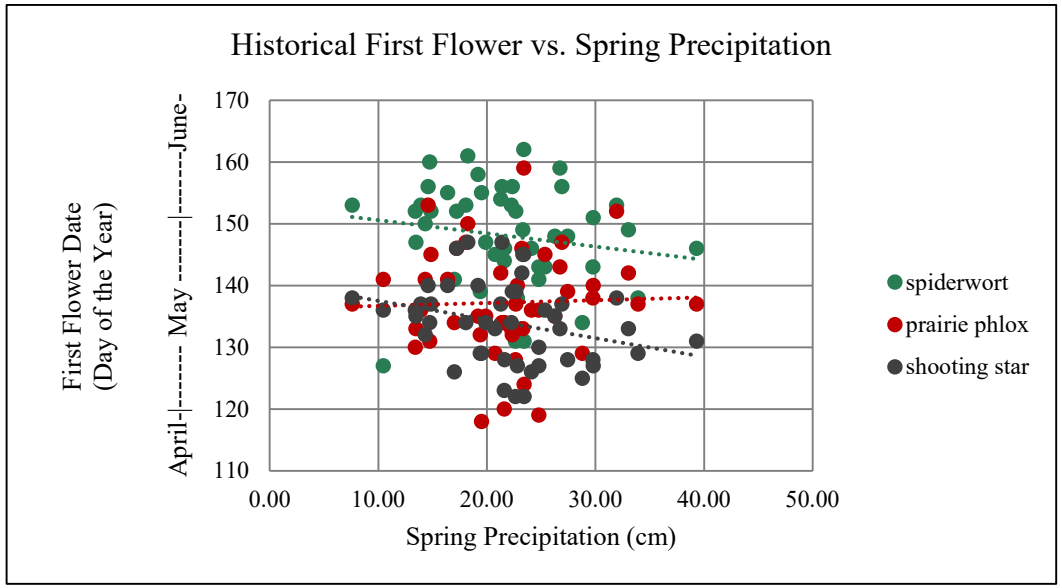


Figure 1: First flowering dates of spiderwort (T. ohiensis, max=162, min=127, mean=148.1), prairie phlox (P. pilosa, max=159, min=118, mean=137.3), and shooting star (P. fassettii, max=147, min=122, mean=134.0). Data were collected in 1935-1945 by Aldo Leopold, his students, and members of his family and in 1977-2012 by Nina Leopold Bradley, Stanley A. Temple, and members of the Aldo Leopold Foundation. A) First flowering date compared to average spring temperature (spiderwort: $R^2 = 0.4023$, $F(1, 45) = 30.29$, $p < 0.001$; prairie phlox: $R^2 = 0.343$, $F(1, 45) = 23.50$, $p < 0.001$; shooting star: $R^2 = 0.7029$, $F(1, 45) = 106.48$, $p < 0.001$). Average spring temperature was calculated using temperatures in March, April, and May. B) First flowering date compared to spring precipitation (spiderwort $R^2 = 0.0264$, $F(1, 45) = 1.22$, $p = 0.275$; prairie phlox: $R^2 = 0.0012$, $F(1, 45) = 0.054$, $p = 0.817$; shooting star: $R^2 = 0.0851$, $F(1, 45) = 4.19$, $p = 0.047$). Spring precipitation includes both rainfall and snowfall for March, April, and May (13). First flowering dates are given as days of the year, where January 1st is day 1.

Methods

1. Identify plants
2. Label with metal stakes
3. Find location coordinates
4. Observe plants
5. Record first flowering date
6. Photograph flower
7. Compare first flowering date to other years (using average spring temperature, spring precipitation, and other variables)

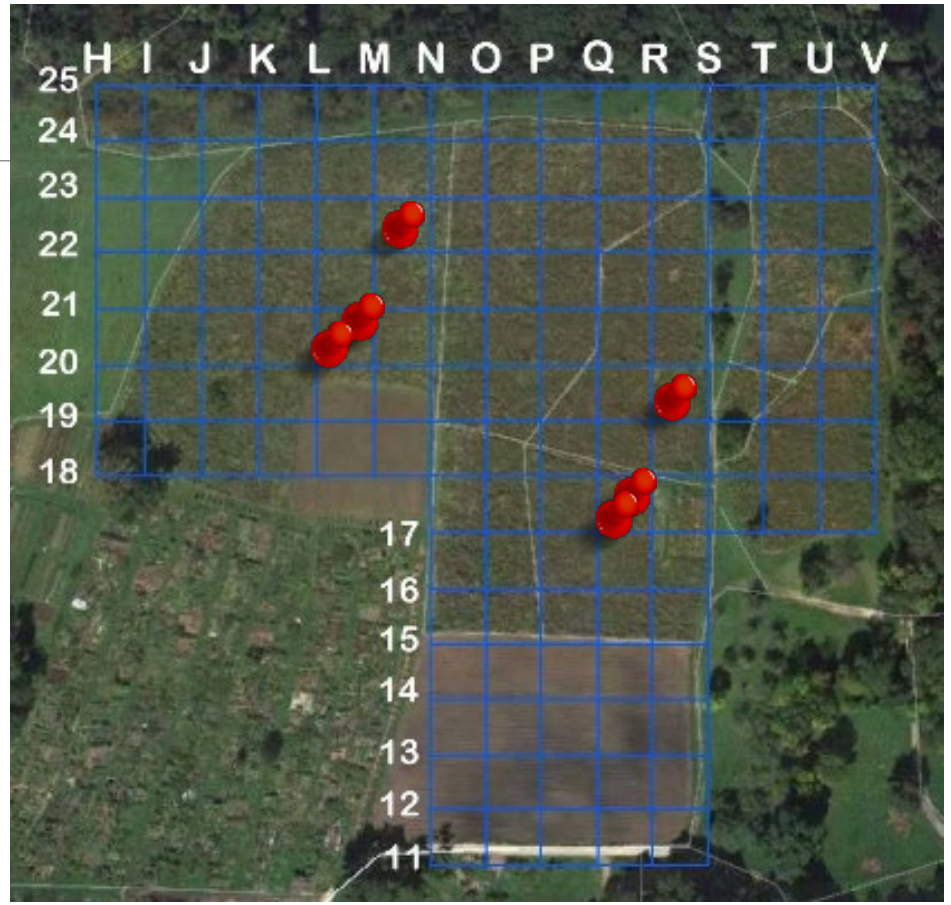


Figure 2: Map of the Biocore Prairie with grid overlay. Each of the six lupine (Lupinus perennis) are indicated by a red pin. Their coordinates correspond to their location within the grid: L20, 7.0m E, 7.1m N; L20, 13.5m E, 16.6m N; M20, 19.3m E, 4.9m N; Q17, 1.0m E, 0.0m N; Q17, 3.4m E, 0.0m N; and R18, 2.7m E, 16.9m N.

Photographs

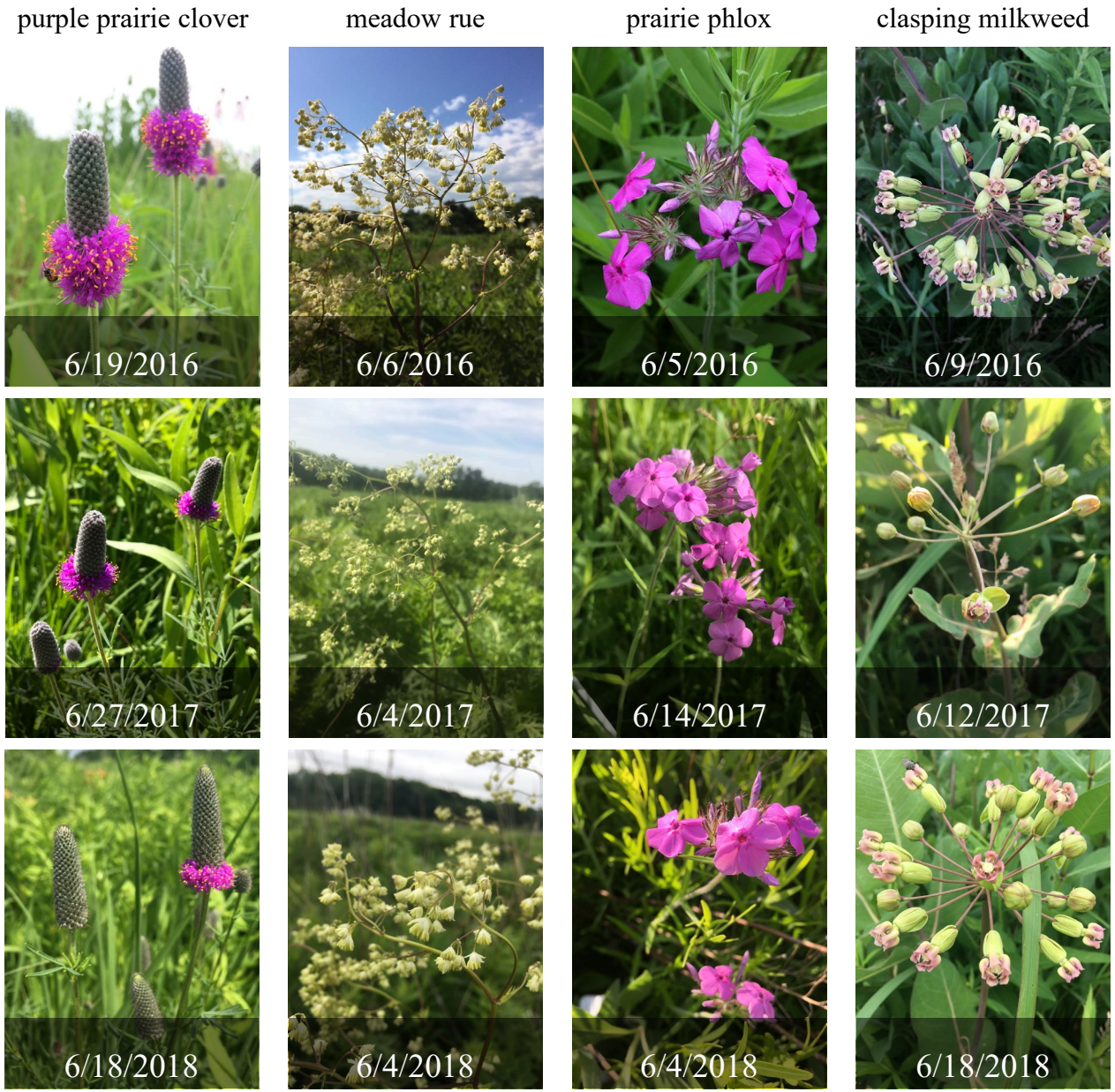


Figure 3: First flowers of plants whose flowering dates were recorded in 2016, 2017, and 2018. Each column includes the images for an individual plant in each year of the study: purple prairie clover (Dalea purpurea), meadow rue (Thalictrum dasycarpum), prairie phlox (Phlox pilosa), and clasping milkweed (Asclepias amplexicaulis).

Results & Analysis

- No significant relationship between spring temperature and flowering time for individual prairie plants

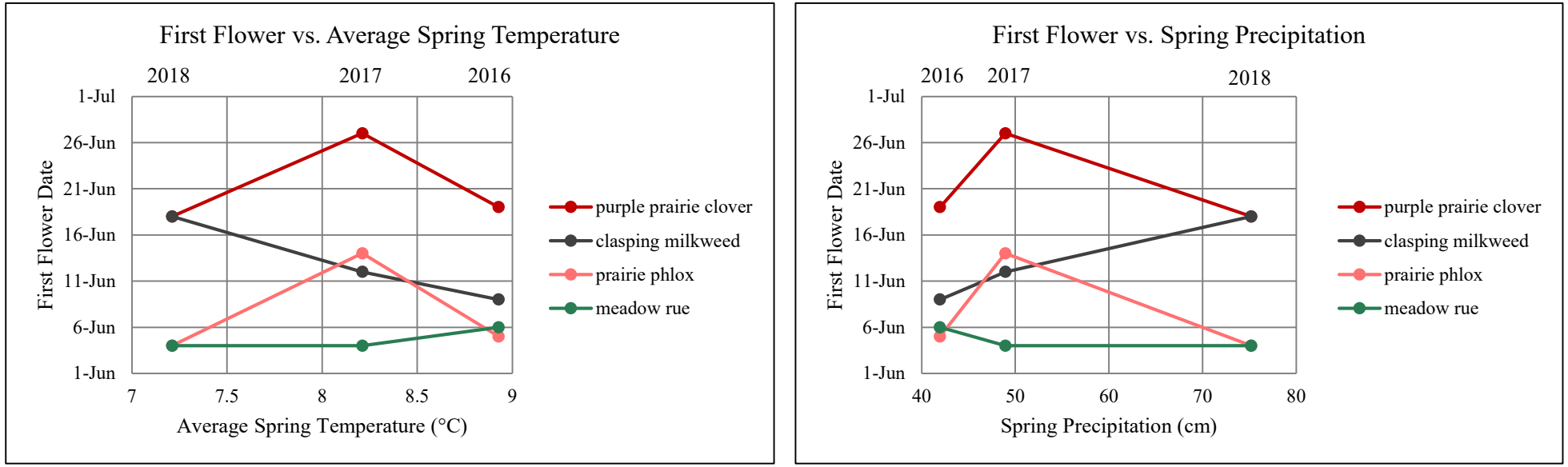
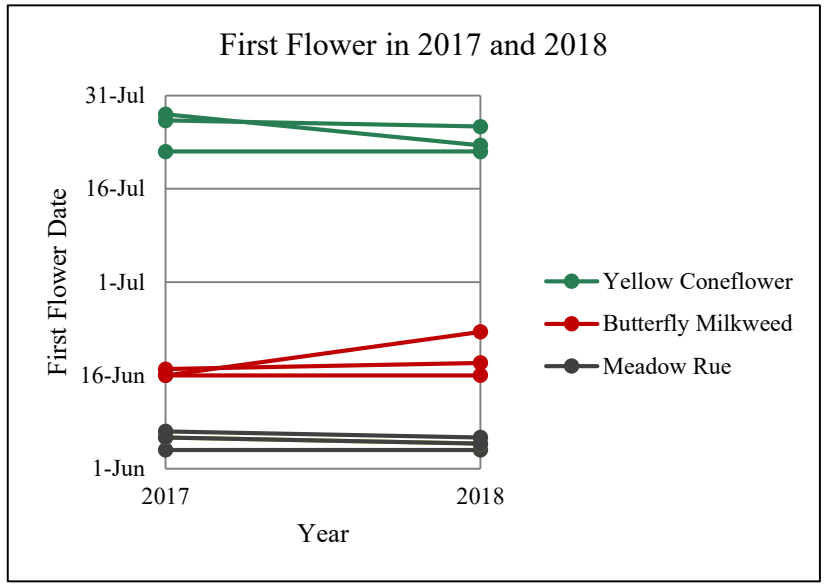


Figure 4: Graph of data from 2016, 2017, and 2018. Each line represents an individual plant's first flowering dates in 2016, 2017, and 2018. A) First flowering date compared to average spring temperature. Average spring temperature was calculated using temperatures in March, April, and May (8.93°C in 2016, 8.21°C in 2017, and 7.21°C in 2018). B) First flowering date compared to spring precipitation. Spring precipitation included both rainfall and snowfall for March, April, and May (41.96 cm in 2016, 48.95 cm in 2017, and 75.21 cm in 2018).

Results & Analysis

- Relationship between climatic variables and flowering time is species dependent



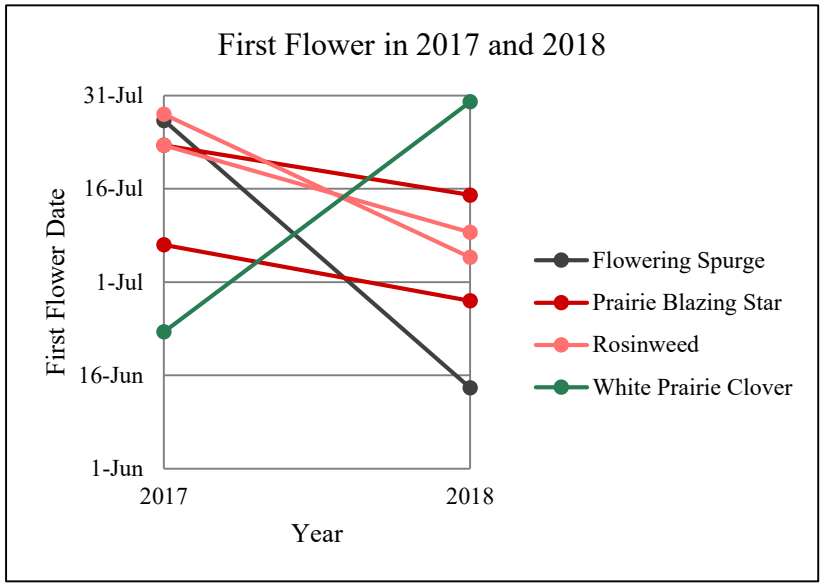


Figure 4: Graph of data from 2017 and 2018. Each line represents an individual plant's first flowering dates in 2017 and 2018. Lines of the same color are individuals of the same species. In 2017, average spring temperature was 8.21°C, spring rainfall was 27.84 cm, spring snowfall was 21.11 cm, and total spring precipitation was 48.95 cm. In 2018, average spring temperature was 7.21°C, spring rainfall was 32.16 cm, spring snowfall was 43.05 cm, and total spring precipitation was 75.21 cm. Spring temperatures and precipitation were calculated using values from March, April, and May.

Implications

Temperature & sunlight

Precipitation

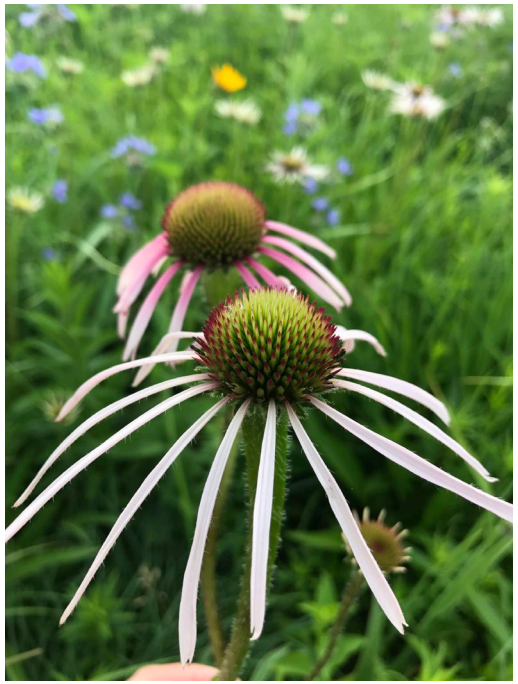
Winter temperature & snow depth

Genetic constraints

Flowering time

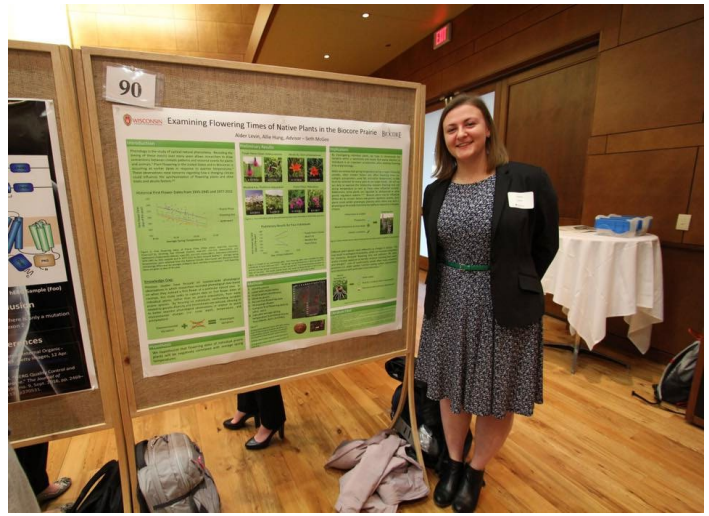
Implications

Altered flowering time



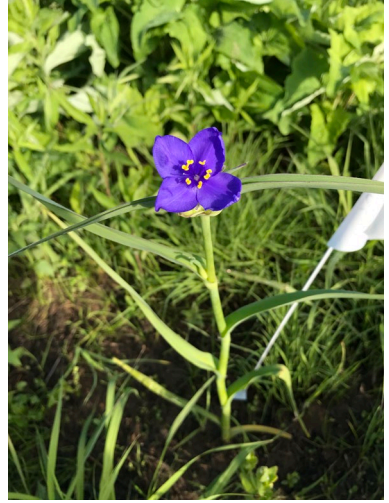
- Water uptake
- Nutrition cycling & carbon sequestration
- Interactions with pollinators & herbivores

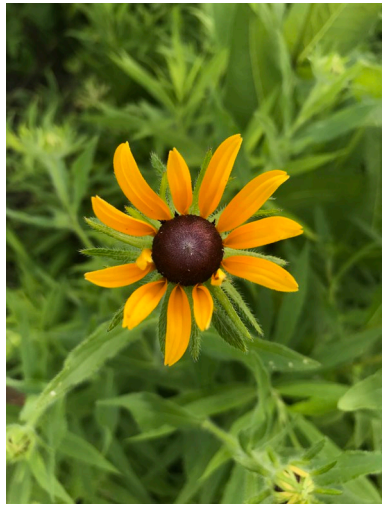
The Prairie Enthusiasts

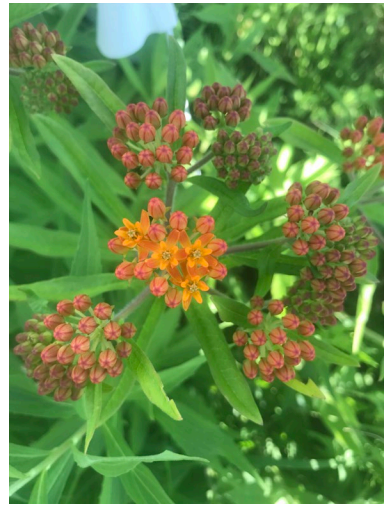


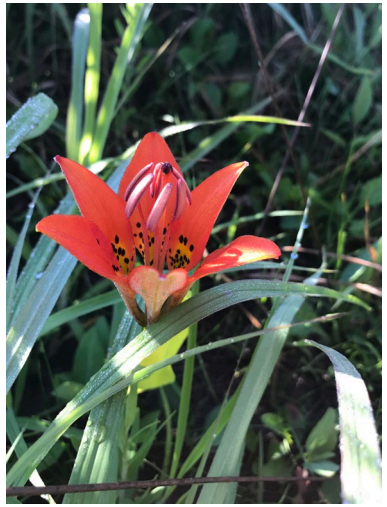
Accomplishments





Thank You!