The Effects of Projected Climate Change on the Plant Species of The Pacific North West Prairie

Introduction

Changes in the seasonal timing of flowering (phenology) for plant species has been correlated to changes in climate patterns. Changing phenology can affect the reproductive and dispersal capabilities of species, which in turn can alter the community composition and ecosystem function of a given area. The effects and extent of phenological changes often vary depending on the environment, making it important to assess these changes on a local level. Through the Environmental Leadership Program at the University of Oregon, we investigated how experimental heating and precipitation reduction can influence both the phenology and productivity of native flowering forb and grass species throughout the Willamette Valley's fragile upland prairie environment.

Methods

We visited experimental plots at Willow Creek (Eugene, Oregon) eight times between April 1st and May 20th. Three treatments are applied in these plots: heating 2.5°C above ambient temperature (10 replicates) artificially induced drought by reducing precipitation 40% below ambient (5 replicates), and control (5 replicates). We observed fifteen native prairie grass and forb species planted in each treatment plot (Figure 1). We observed which species were flowering and measured the total flowers, as well as when flowers started to senesce. Additionally, we used a handheld Normalized Difference Vegetation Index (NDVI) meter to measure the quantity of reflected green light emitted from each plot. This data acts as a proxy measurement of primary productivity.

Data

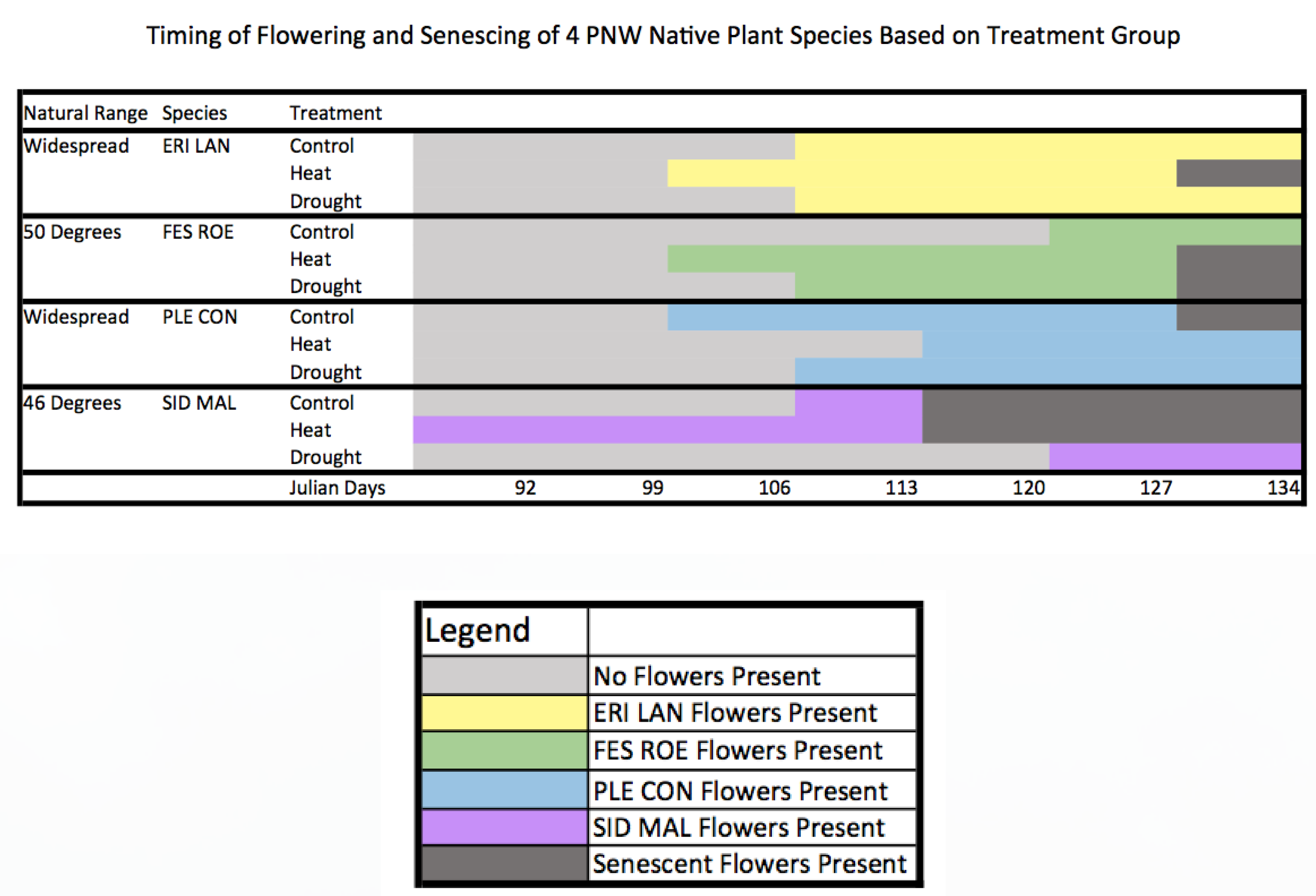

Figure 1: Date of first flowering and first senescence for four of the fifteen native plant species measured at the study site. The listed species showed a significant amount of flower production and senescence during the observation period. The remaining eleven species that were monitored did not show significant flowering during the observation period.

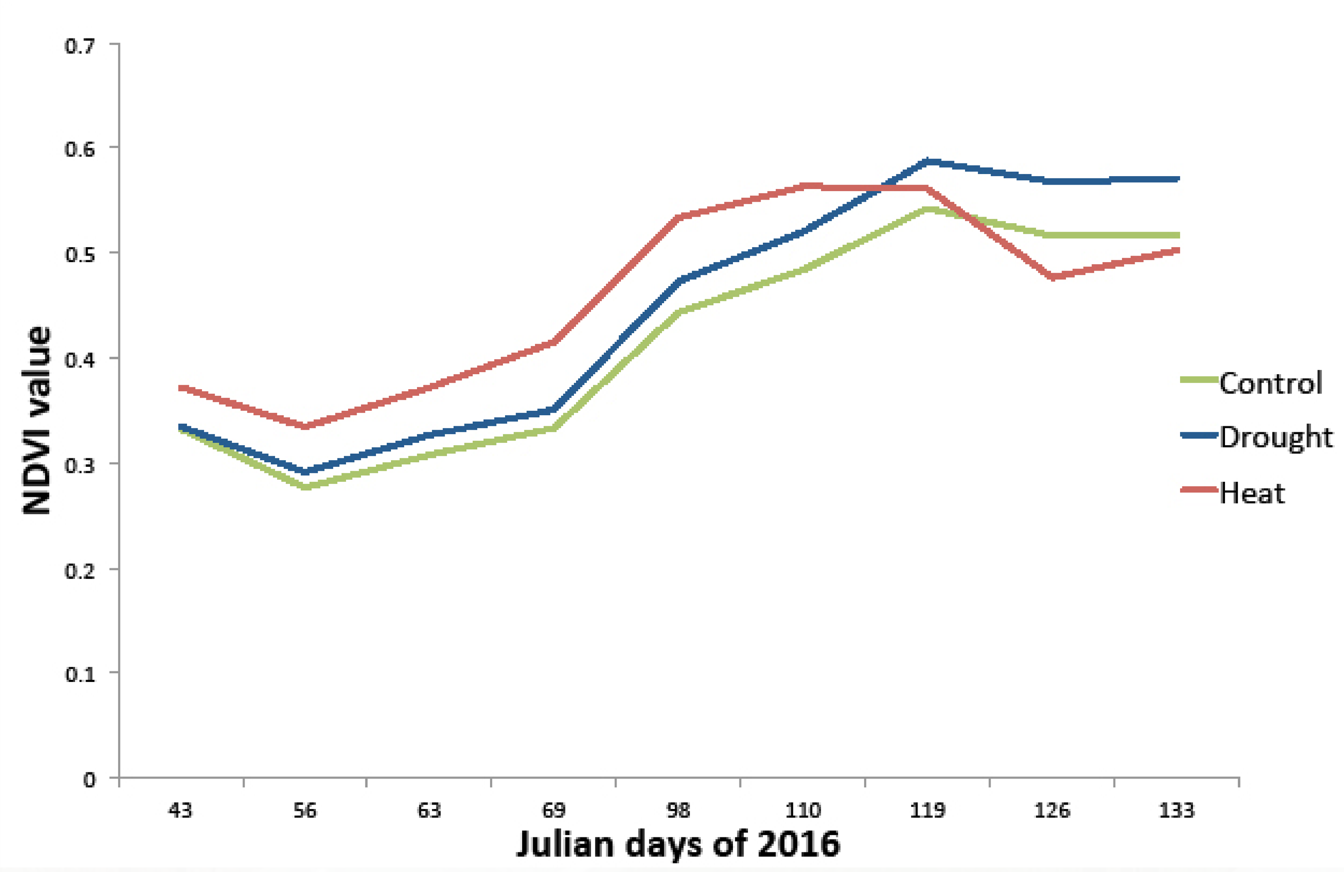

Figure 2: Normalized difference vegetation index (NDVI) data averaged from drought, heat and control plots for each measured Julian day. NDVI measures the reflected green light from a given area, and can be used as an indirect measurement of photosynthetic activity, and therefore primary productivity.

Collinsia grandiflora

Sidalcea malviflora

Results & Discussion

In general, the heated and drought treatment plots had higher levels of primary productivity than the other plots However, in late April (roughly on Julian day 120) the NDVI for heated plots drops below both the control and drought plots. This decrease suggests that plants in the heated plots in general senesced earlier than those in the drought and control plots. The date of first flowering and first senescence was advanced in heated plots for each species that flowered before date XX, with the exception of Plectritis congesta (Figure 2).

The data gathered from this project so far suggests that heat treatment does impact native prairie plant species in terms of both primary productivity (NDVI) and the timing of flower production and senescence. The increase in primary productivity is fairly consistent, but the effects of heating on phenology seem to vary depending on the species. The effects of drought treatment are more subtle, but also seem to affect the measured species in terms of the timing of flower production and senescence. This variation in phenological responses could indicate that future climate change will create conditions that more heavily favor the reproduction of certain species, while decreasing the viability of others.

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