PROGRESS REPORT 2023

Background

My PhD project focusses on how climate change will impact plant species interactions and, consequently, ecosystem function. The climate change experiment simulates three consecutive hot, dry summers in a factorial drought x warming x heatwave design. The design includes two levels of drought (0% and ~70% chronic drought), two levels of warming (ambient and warmed) and two levels of heatwave (no heatwave and heatwave), giving a total of eight treatments that are replicated four times. By mapping the fine-scale species composition in each treatment plot annually, we can determine the nature and strength of plant-plant interactions within this system presently and in future climates. This information on plant interaction outcomes (e.g., competition, facilitation) can then be connected to functional trait values, thus providing the mechanistic link between compositional patterns and functional processes that determine plant community stability. Additionally, if we find that plant functional traits are responding to climate manipulations, we will gain insight on how these trait changes might drive changes in community composition.

Progress

Since receiving funding, all climatic treatments have been established - this involved building drought shelters and installing warming chambers over winter 2021 (figure 1). Later in the year, thermocouples, soil moisture sensors, and their accompanying infrastructure were installed and wired to data loggers (figure 2). In the 2021/22 summer, the footings for a 0.5 x 0.5 m survey grid were installed in each plot (figure 3). The identity of all species within each grid square (2.5 x2.5 cm) were recorded, creating a detailed compositional map of the control area (figure 4). This compositional survey is in the process of being repeated for 2022/23 and will be collected a third time in the 2023/24 summer. The heatwave event for 2021/22 was in accordance with climate projections for the area and involved heating plots for two days to ~35°C during daylight hours. Presently, preparations are underway for the 2023 heatwave event.

Figure 1. Drought shelters and warming chambers within the experiment.

Figure 2 (left). Wiring thermocouples and soil moisture sensors to datalogger.

Figure 3 (below). Grid-frame secured into footings ready for compositional survey in a drought x warming plot.

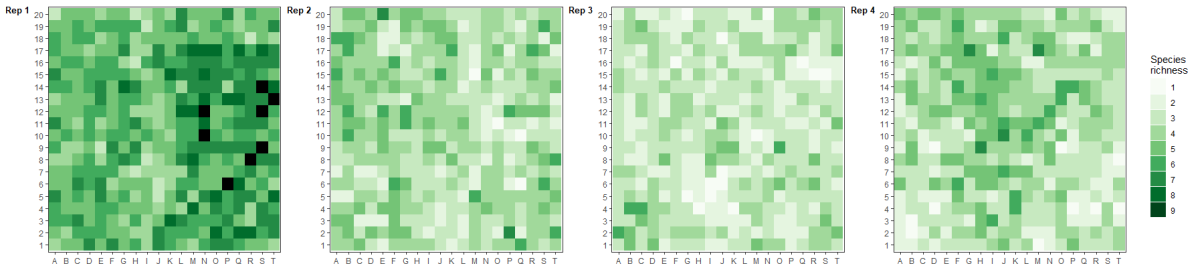

Figure 4. Digital representation of species composition survey data from one treatment (*forbs only)

Functional trait data for the seven most common forbs on site was collected during November/December 2022 and is currently being analysed. This involved collecting three individuals of each species from each treatment plot (outside of fixed survey grid) and measuring plant characteristics such as height, number of leaves, and leaf length, width and thickness. Leaf fresh and dry weight was measured in the lab and all leaves were scanned to calculate leaf area for determination of specific leaf area and leaf dry matter content. Functional trait information for the most common grasses on site will be collected in early 2023. Additionally, dried samples of both forbs and grasses will be processed in the Elemental Analyser in early 2023 to measure carbon and nitrogen concentrations in the leaves. These traits give insight into plant life history strategies and can be used to determine the mechanisms underlying plant interactions.