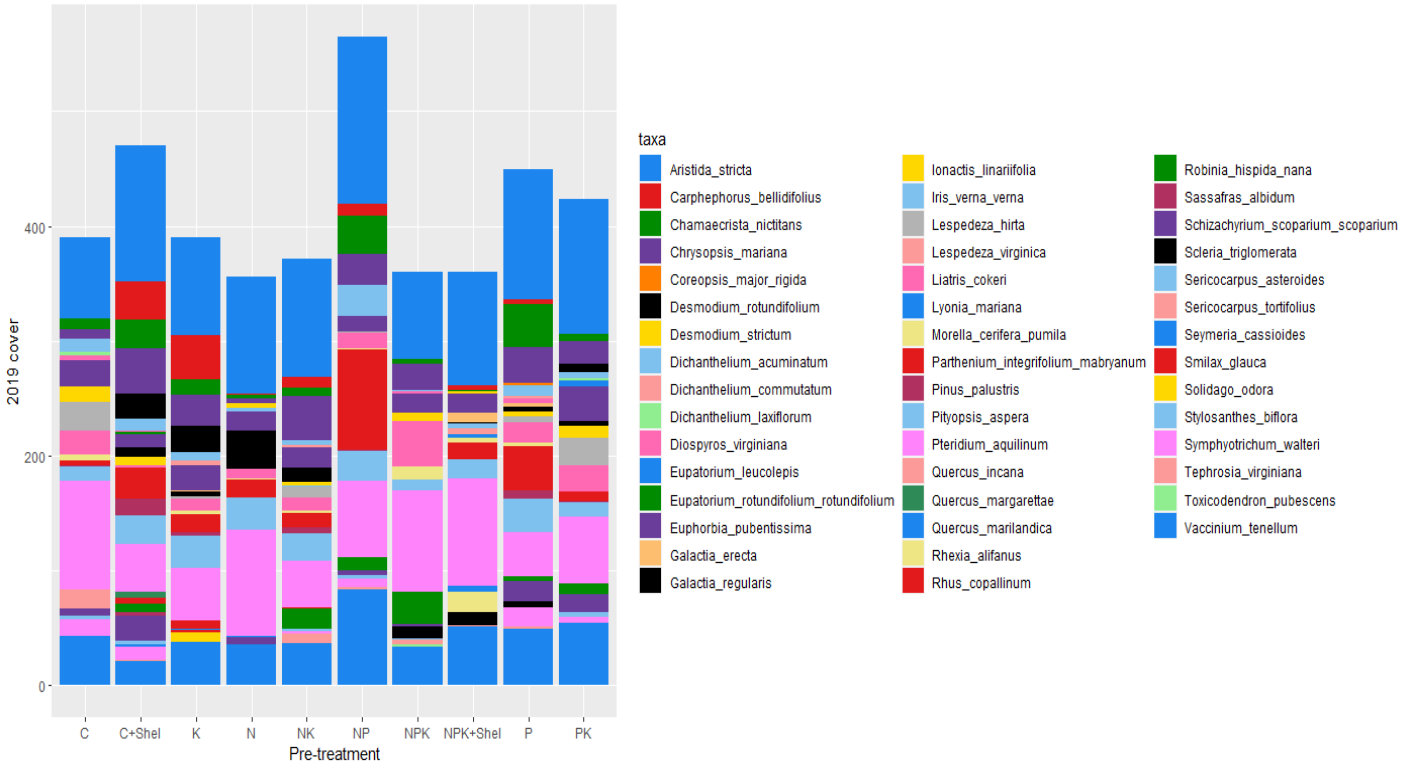
Results:

This experiment observed the biological response of arthropods and plants under drought conditions. The Control (C), Control+Shelter(C+S), NPK, and NPK+Shelter(NPK+S) treatments were used to assess community change with plant species composition (2019-2021), arthropod sampling and herbivory measurements(2020-2022).

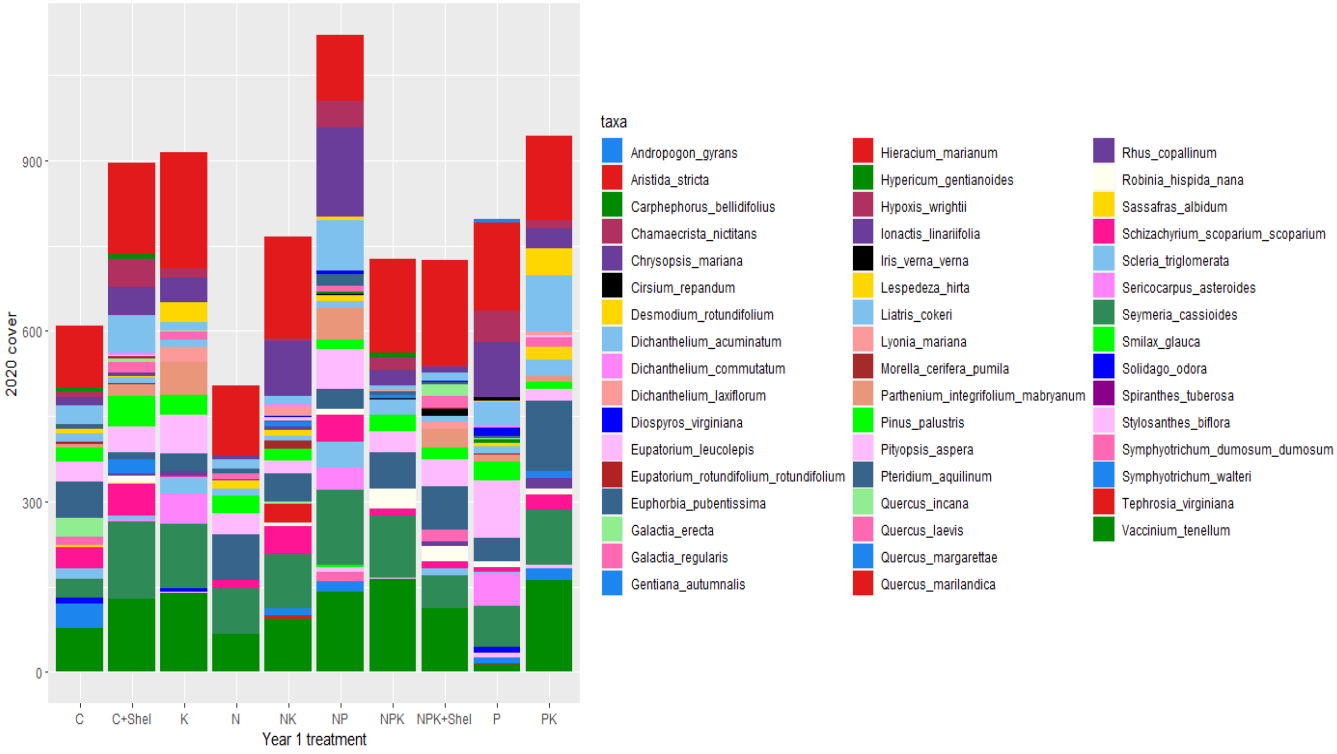
When comparing the effects of non-drought to drought treatments on plant communities in the Control group and NPK groups, we will be considering both absolute cover, as well as community change and similarity. Cover is measured using Plant community composition surveys that were conducted every year. Comparing absolute cover values gives us a broad picture of what is happening under these three years of drought and nutrient application. Herbivory measurements have been used to estimate the effect of arthropods on the plant community. Chewing, mining, and sucking damage have been measured as a single 'Damage' metric, and will be used as the basis of analysis.

In the first, pre-treatment year, 2019, there was already a difference in our C (390) and C+S (470) treatments. In 2019, both NPK and NPK+S treatments had a cover of approximately 350 (Figure 1).



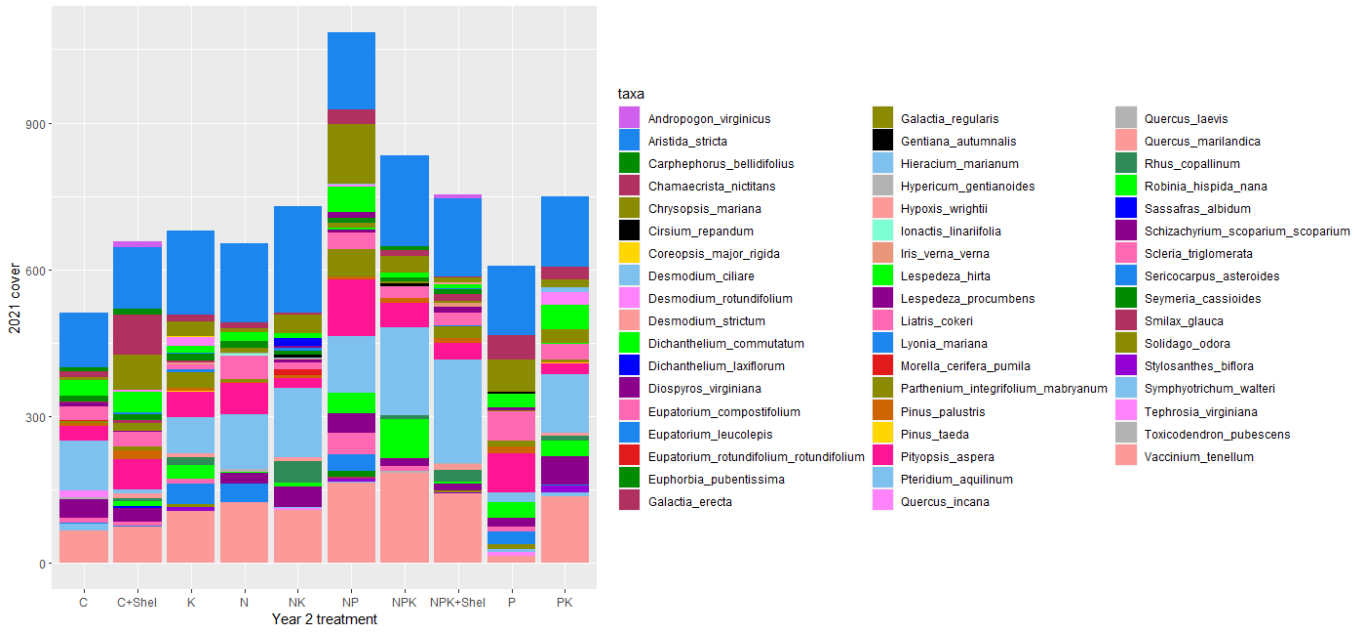
(Figure 1: Plant coverage and species composition)

2020 seemed to be a much better year for our plants overall, and then the first year we started nutrient applications and drought treatments(C-600, C+S-900). In 2020 the NPK group and NPK+shelter group had a similar cover of approximately 700 (Figure 2). While the nutrient treatments stayed even with each other, the difference in our control treatments continued to widen, with C treatments reaching a cover of 600, and the C+S treatments soaring above at 900.



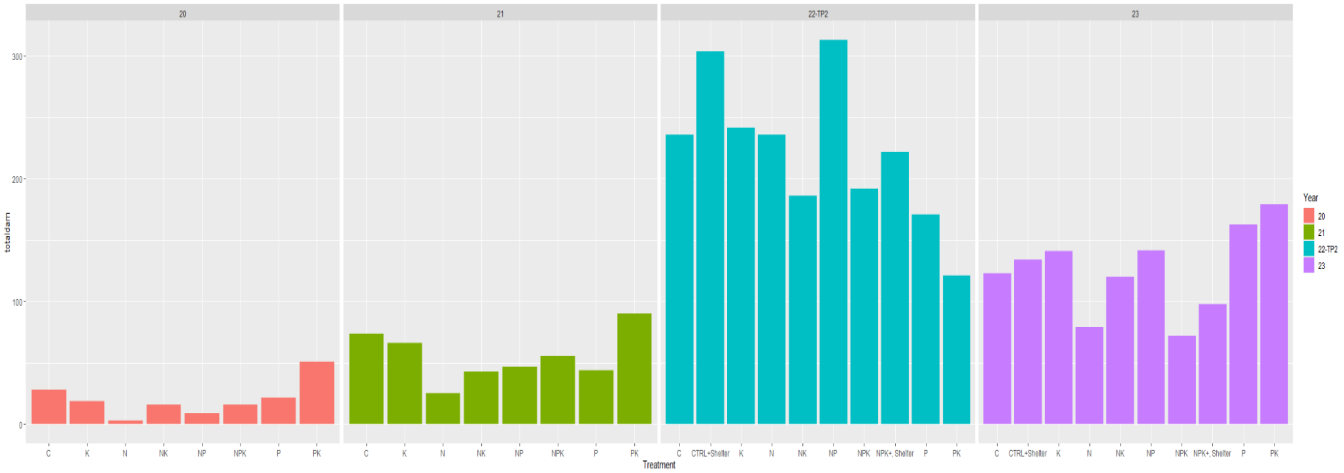
(Figure 2: Plant coverage and species composition)

2021 was our first true year of treatment, and there was a significant decrease in plant cover in both C and C+S treatments. The C treatment showed a decrease from 600 to 500 plant coverage (Figure 3). The C+S treatment similarly showed a significant decrease from 900 to approx. 690 (Fig.3) The NPK group showed an increase in coverage to around 800 and NPK+S to about 720 (Fig.3).



(Figure 3: Plant coverage and species composition)

For arthropod composition, we used herbivore data spanning from 2020 to 2022 to estimate the effect of arthropods on the plant community. From 2020 to 2021, only Control and NPK were recorded. In 2020, there was a very low amount of herbivory present in our treatments. The following year, in 2021, the Control group saw an increase to approx. 60 and the NPK group increased to approx. 40 (Fig. 4). In 2022, C+S and NPK+S data were introduced to the database. The C treatment saw an increase in herbivore damage of 150 and the Control + shelter that of approximately 220 (Fig. 4). The NPK treatment experienced damages of about 190 and the NPK+S only about 100 (Fig. 4).



(Figure 4: Herbivory total damage)

Discussion:

This paper hypothesized that sheltered areas, used to mimic drought, would have less plant coverage and herbivory damage due to limited water availability. The non-droughted areas were hypothesized to have higher levels of plant coverage and herbivore damage due to having more available resources.

Our drought treatments do not seem to be making a difference in plant community composition. With the xeric conditions in the sandhills, it would stand to reason that many plants present in the community are drought-tolerant.

The arthropods also may be attracted to plots with higher nutritional value as opposed to the shelter plots. The plants are available to thrive in areas with greater water availability and can recover faster from herbivory damage. However, when comparing the plant coverage data from 2019 to 2021 to the herbivory data from 2020 to 2023; the Control group had less plant cover and herbivore damage than that of the Control+Shelter group. Treatment differences in 2019 and 2020 were attributed purely to variance between plots (Figure 1, 2). When compared to one another, 2019 and 2020 show the amount of variability that can happen between two years. Thus, in 2021, while there is a notable difference in absolute cover, the communities do not appear to be significantly different from one another.

It is also possible that to deter plant damage from arthropod herbivory the vegetation in the Control plot chose to allocate resources to below-ground production. This allowed it to mitigate herbivore damage while also maintaining plant growth.

The NPK and NPK+Shelter were not significantly different from one another. The NPK group had greater access to essential nutrients and water availability that helped facilitate growth and plant repair. The availability of resources also attracts insects, hence the increase in herbivore damage in comparison to the NPK+Shelter and other compared groups. It is worth noting that there was a nearly threefold increase in average herbivore damage level from 2021 to 2022. We have come to the conclusion that 2020 acted as a second control year, and did not utilize the resources that were added in peak growing season. The following year, in 2021, the plant community used the resources available. Though, not until 2022 was there a meaningful difference, not in the plants but in arthropod activity. In 2023, herbivore damage is still greatly increased from 2021, but seems to find equilibrium. Nutrient deposition has a definitive effect on herbivore activity, but, over time, will likely find equilibrium in the Sandhills.

Through these shifts, there was no significant difference between droughted and non-droughted plots, leading us to conclude that the longleaf pine savanna ecosystem in the sandhills of North Carolina will not be massively affected by moderate drought conditions. Over a long period of time, both drought and nutrient deposition may have greater effects, but that remains to be seen.