Climate-treated microbes impact plant performance

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Background

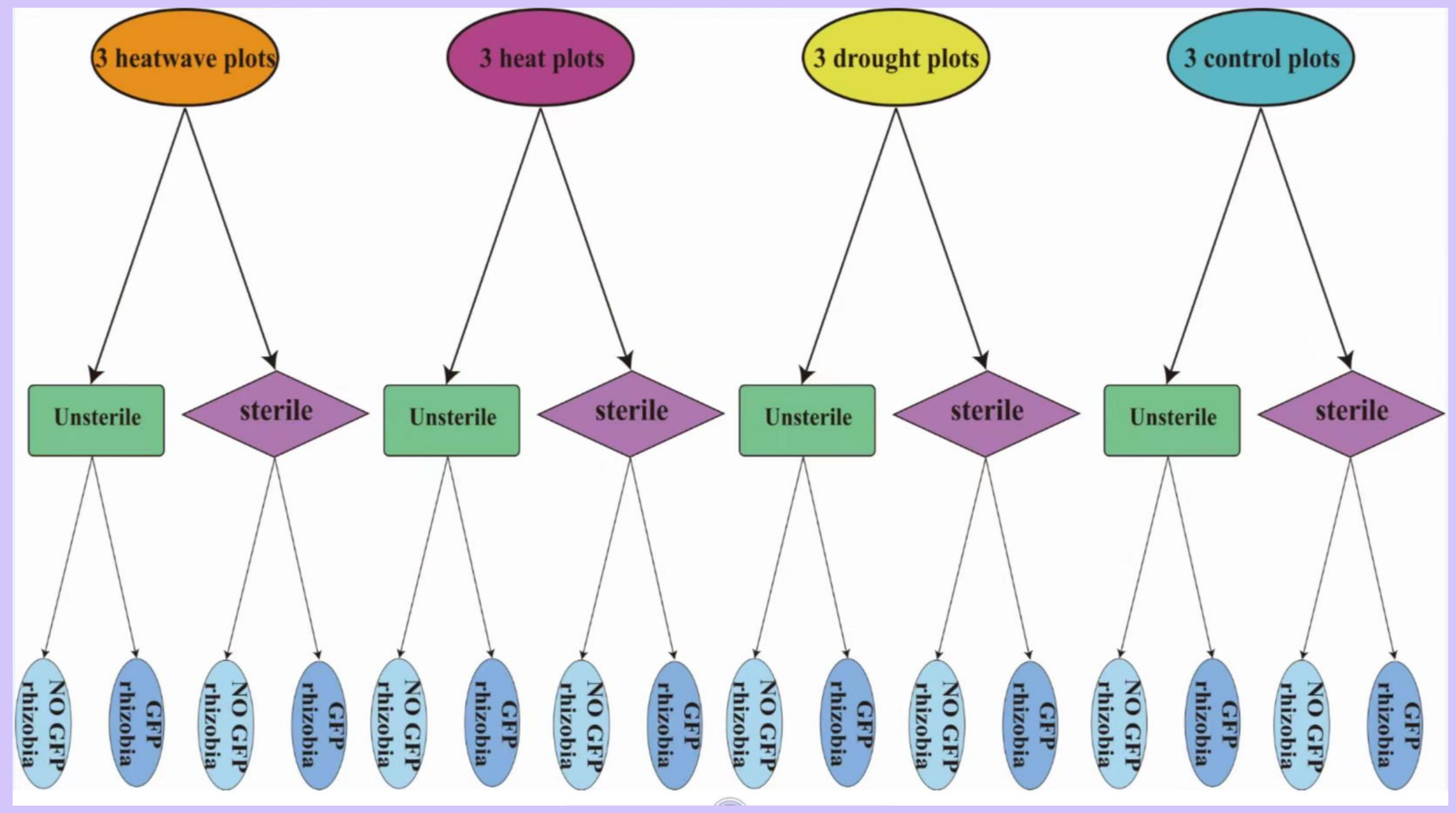
1. All plants have a root microbiome, legumes in particular have symbiotic microbes within nodules, a structure formed by plants to house N-fixing rhizobia[1].
2. Microbiomes and symbiotic microbes are important for plant survival and fitness, especially legumes[1].
3. There is research on how climate change affects microbial communities[2], but little research on how those altered communities affect plant performance, especially with legumes. We might predict legumes have a strong response to climate treated microbes because they have symbiotic microbes inside their roots.
4. Koffler Scientific Reserve at Joker's Hill (KSR, King City, Ontario) has an experimental warming array, and replicate plots have experienced warming, drought, both, or neither over the last several years.

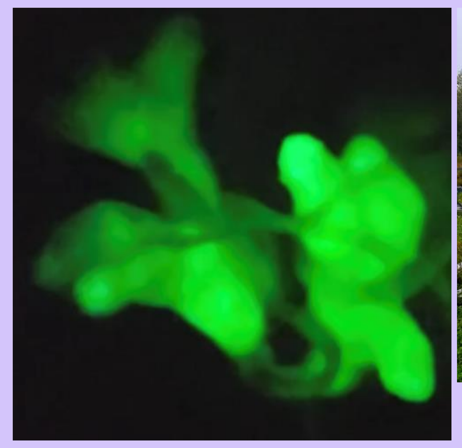
Objective

To explore how microbes in different climate-treated soils affect plant performance and symbiosis

Methods

- Collected soil (and soil microbes) from plots that have experienced different climate treatments at the KSR and sequenced soil microbiome
- Used a fully factorial design for each climate treatment with the soil being sterilized or not and adding rhizobia or not
- Applied the treatment to 720 (*Medicago lupulina*) in the growth chamber
- Added GFP rhizobia (*Ensifer meliloti* Rm1021/pDG71) to test the competitive environment of the soil with the focal microbe
- Measured: Leaf number over time. We will then measure above & below ground biomass, count number of nodules and identify fluorescent ones, for a subset we will sequence nodules & rhizospheres.





Results

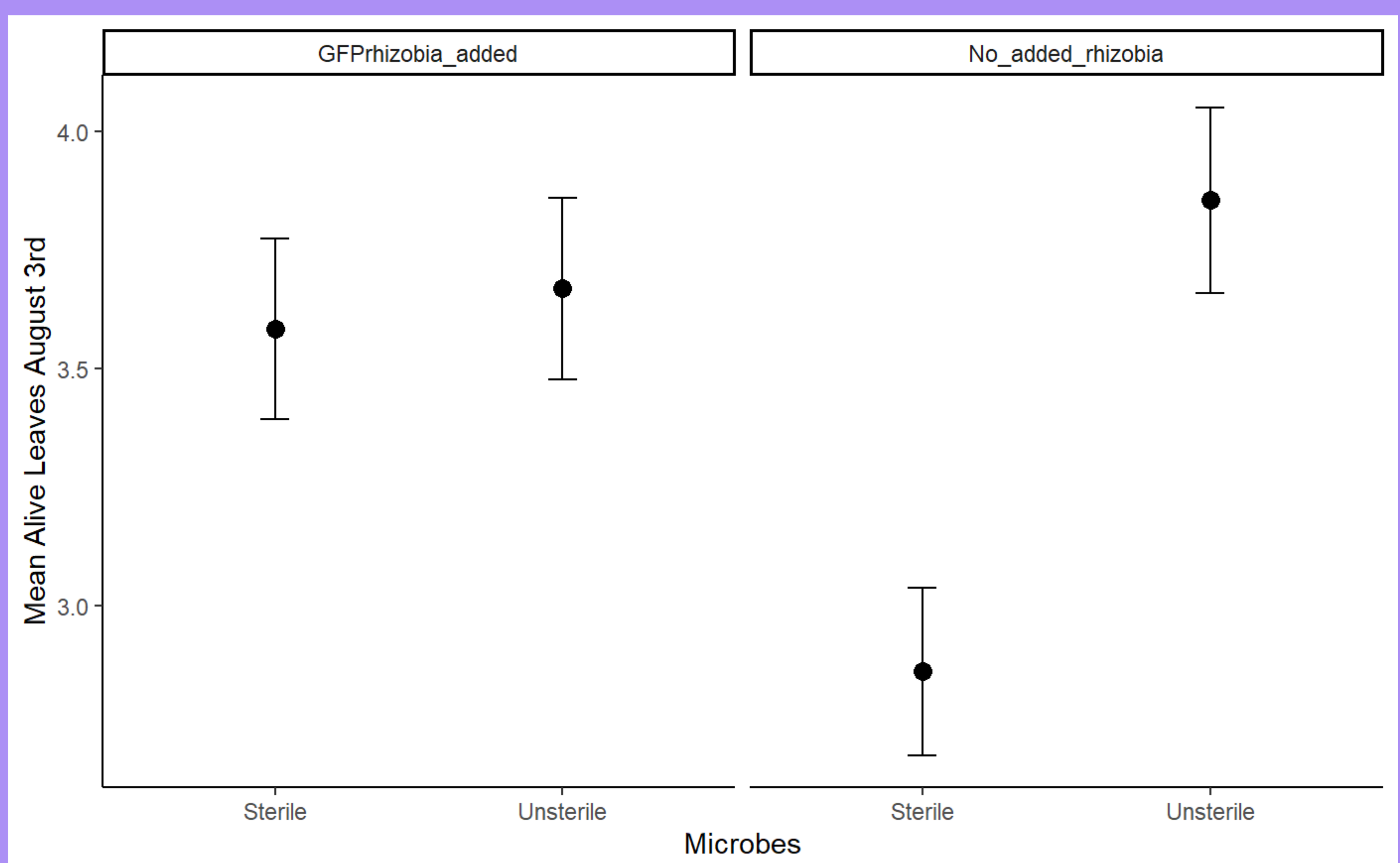


Figure 1: Microbes improve plant performance, especially field communities. Addition of GFP rhizobia seems to decrease plant performance compared to wild rhizobia.

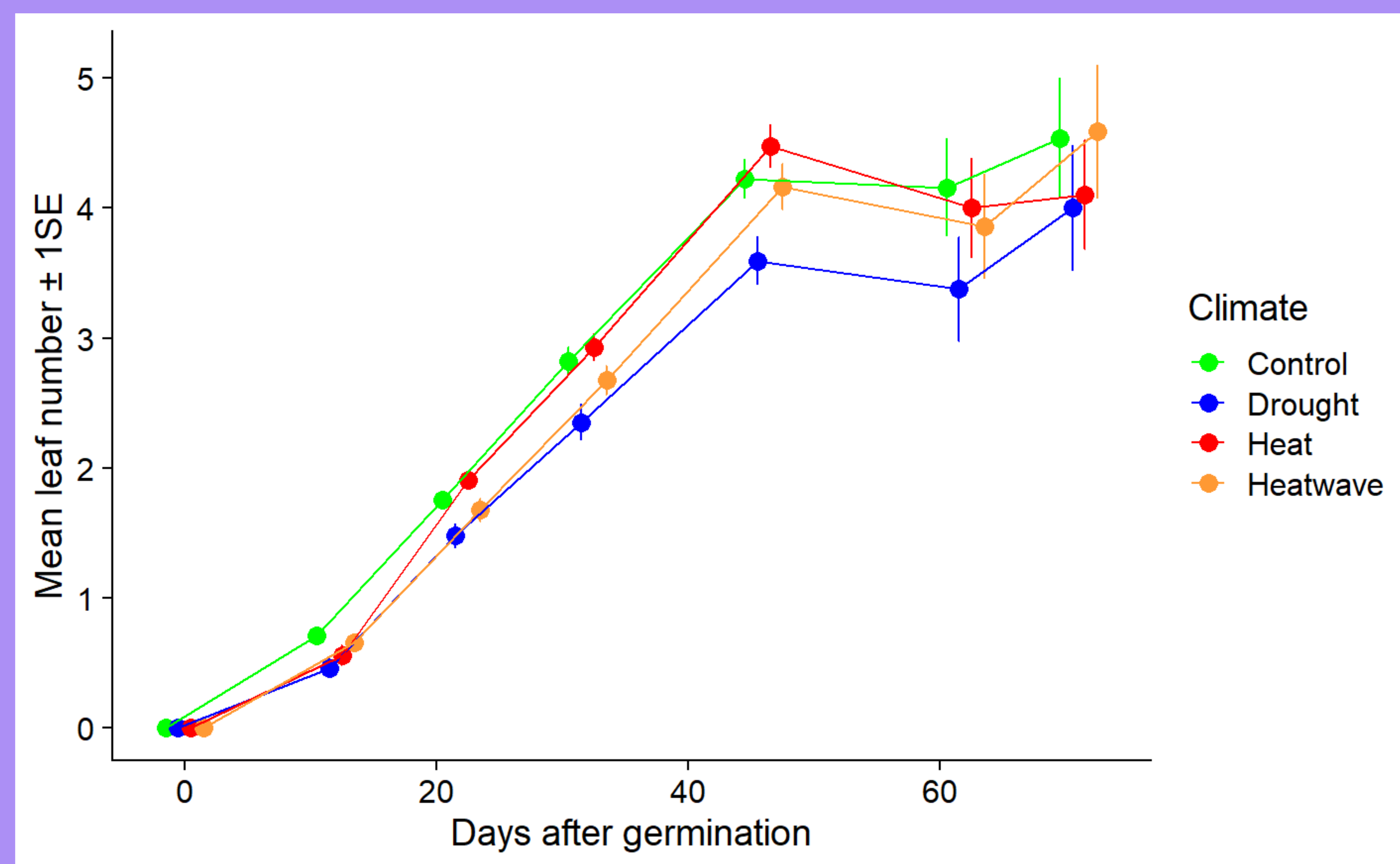


Figure 2. The climate treated microbes on leaf number over time. This graph includes only natural, alive, field microbiomes without the addition of any rhizobia. Drought microbiomes affect plant performance negatively. There are age specific effects. Mean ± SE

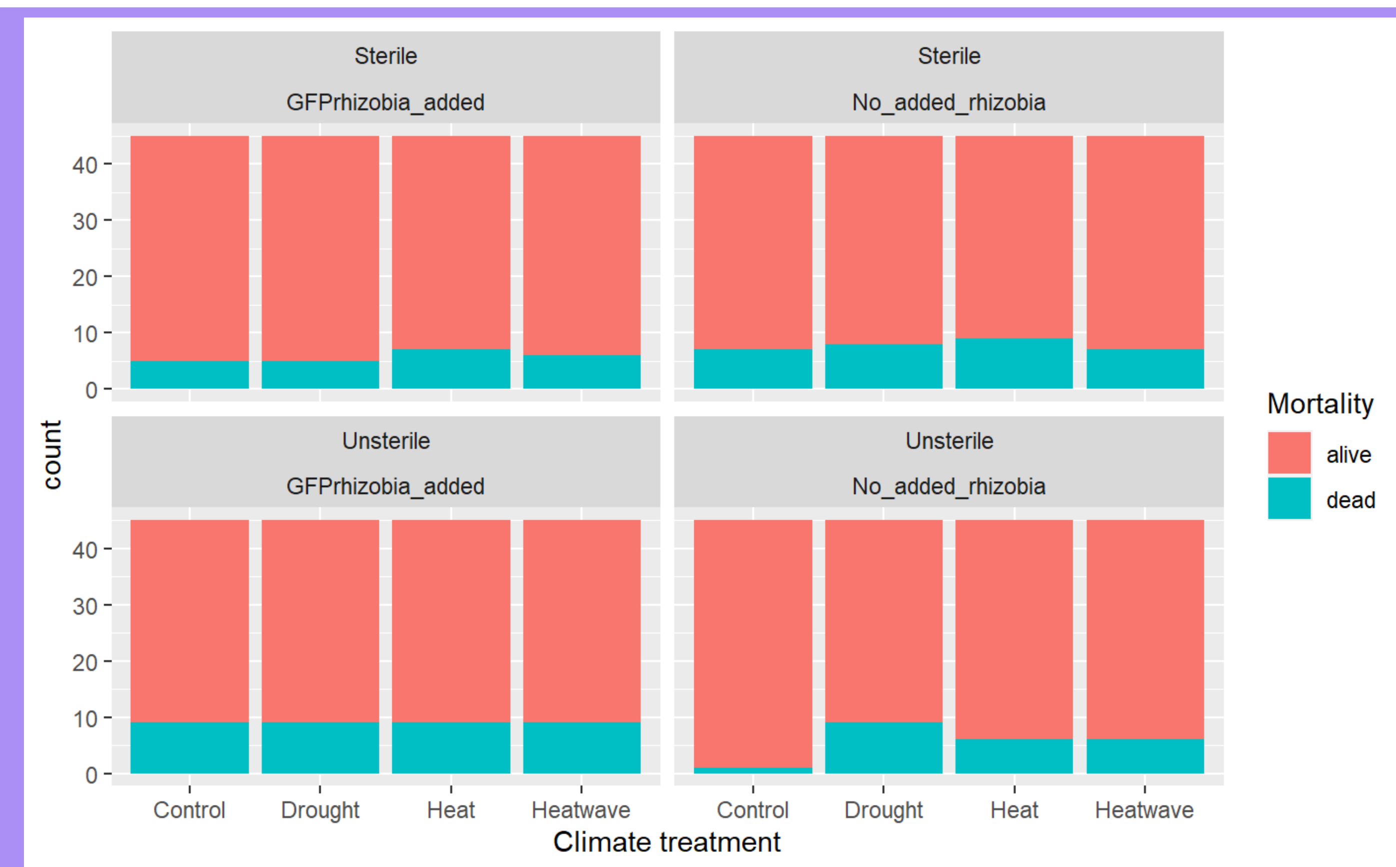


Figure 3: Plant mortality for each treatment. Overall, treatment doesn't seem to affect mortality. But for unsterile, no GFP rhizobia added plants, climate treatments might increase death. Data is preliminary and other measures of plant performance may show different or stronger trends.

Conclusions

1. Microbes are important for plant performance.

2. Climate treated microbiomes have age-specific effects on plant performance**.**

3. Plant response to climate change needs to consider their microbiomes.

References: **1.** Drevon, J.J., et al. 2015. Grain Legumes. 10: 267–290 (Springer New York).;
2. Sheik, C.S., et al. 2011. The ISME Journal. 5(10): 1692–1700.

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