The removal of invasive woodlands leads to shifts in arbuscular mycorrhizal fungi

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Introduction

- Brazilian Pepper trees (*Schinus terebinthifolius*) are an invasive species that can deter and reduce surrounding native plant communities, especielly coyote brush (*Baccaharis pilularis*).
- Brazilian Pepper trees do this by exhibiting antibacterial chemicals through their roots and berries and are a major concern at the Upper Newport Bay Ecological Reserve (UNBER), Newport Beach, CA.
- The Big Canyon project was created to remove 10 acres of pepper tree woodland to bring back native plant diversity, which includes the native coyote brush.

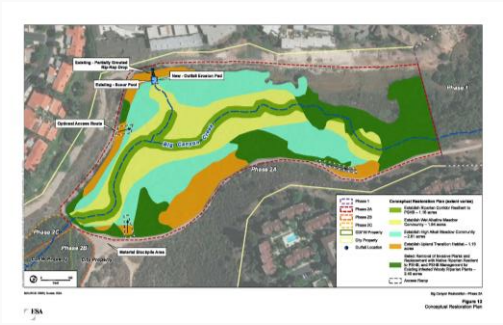

Figure 1. Map of Big Canyon and restoration site.

- Studies found that even if pepper trees are removed, they still leave detrimental impacts, also known as legacy effects.
- For the Brazilian Pepper tree chemical residuals cause the native mycorrhizal fungi to be altered in a way that the native plants cannot handle sufficiently.
- **Therefore, we predict that the soil and roots associated with the pepper tree will have a higher diversity of fungi than that of the native plant species.**
- Our results will inform future restoration efforts, especielly by determining if the legacy effect is caused by fungi.

Methods

- DNA extractions using Qiagen dnEasy Soil kit and Qiagen dnEasy Plant kit protocols.
- Used staining (trypan blue) to view the roots sytems of the pepper tree and the native coyote brush.
- We will use sequencing to determine the species found using microscopy.

Results

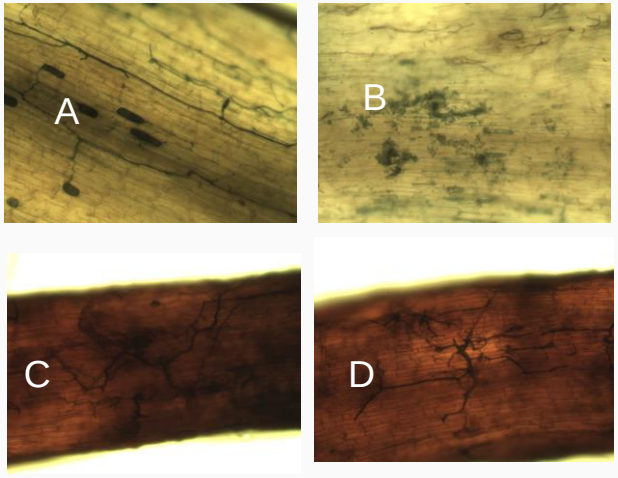

Figure 2. The native coyobrush had less mycorrhizal fungi (A) and more pathogenic fungi (B). The Brazalinan pepper tree was more abundant with both intra and extracelluclar hyphae (C, D).

- Using microscopy, Preliminary results showed that S. terebinthifolius had 32% higher colonization rate of AMF compared to *B. pilularis*.
- The native coyote brush also had higher colonization rates by non-symbiotic fungi, that could be pathogenic.

Conclusions

- Using microscopy, we have shown that the invasive pepper tree is enabled by symbiotic fungi. Evidenced by the higher colonization rates of arbuscular mycorrhizal fungi, the pepper tree could potentially use it to their advantage. Higher rates of colonization could be tied to greater resource acquisition by the pepper tree.
- High rates of colonization in native species and less in invasive plant species could be explained by pathogen release hypotheses. Meaning, the pepper tree could escape pathogens from their native range.
- Using DNA sequencing, we expect to see higher OTU abundance of AMF in the pepper tree.

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References

- Bullington, L.S., Lekberg, Y. and Larkin, B.G. 2021 Insufficient sampling constrains our characterization of plant microbiomes. *Sci Rep* 11, 3645. https://doi.org/10.1038/s41598-021-83153-9.
- Dawkins, K. and Esiobu, N. 2017. Arbuscular and ectomycorrhizal fungi associated with the invasive Brazilian pepper tree (*Schinus terebinthifolius*) and two native plants in South Florida. *Frontiers in microbiology*, 8, 665. https://doi.org/10.3389/fmicb.2017.00665.
- Gomes, S.I.F., Merckx, V.S.F.T. and Hynson, N.A. 2018. Biological invasions increase the richness of arbuscular mycorrhizal fungi from a Hawaiian subtropical ecosystem. *Biol Invasions*, 20, 2421–2437. https://doi.org/10.1007/s10530-018-1710-7.