Mycorrhizal-Mediated Silviculture

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Scan the QR code to take a short survey!
The purpose of this survey is to gauge interest in mycorrhizal fungi-related forest research.

Introduction

- Arbuscular (AM) and Ectomycorrhizal (EcM) fungi have an extraordinary capacity to enhance the success of reforestation efforts.
- They provide soil nutrients to roots and allow resources like nitrogen to travel between seedlings and mature trees through common mycorrhizal networks.
- After timber is harvested, the legacy of mycorrhizal association (AM or EcM) and the proximity of remnant trees may affect seedlings survival and growth.

Driving Questions

1. Do AM and EcM- associating seedlings differ in survival and growth when planted in soils previously dominated by AM or EcM associated adult trees?
2. If so, does access to mycorrhizal networks explain observed differences in seedling growth and survival?

Methods

- Study conducted in experimental forest in Corinth, VT, as part of the Adaptive Silviculture for Climate Change Project, led by Tony D'Amato (Fig. 1).
- Planted 4 AM and 4 Ecm tree species in 8 quarter acre logged gaps, previously dominated by AM or EcM trees (Fig. 2).
- Measured seedling growth and survival at the end of the growing season.
- Collected leaf samples to measure δ15N (indicates mycorrhizal mediated nitrogen).
- Measured soil available nitrogen 1 month during gowing season.

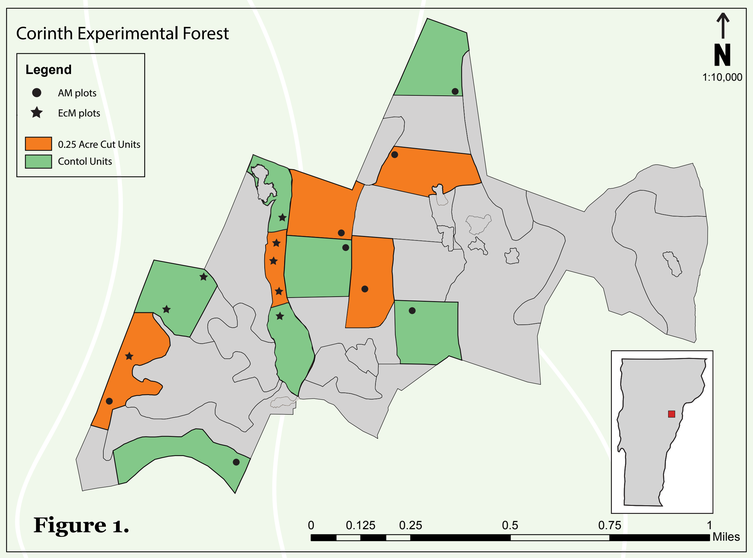


Figure 1.

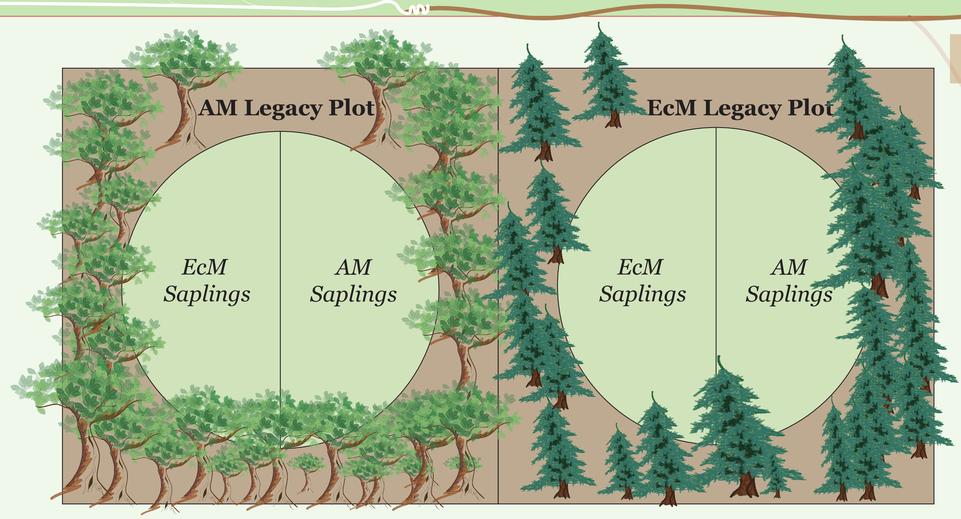


Figure 2: Eight quarter-acre gaps were established in the winter of 2021. Eight quarter-acre control plots were also established: four in EcM-dominated and four in AM-dominated areas.

Results:

Figure 3.

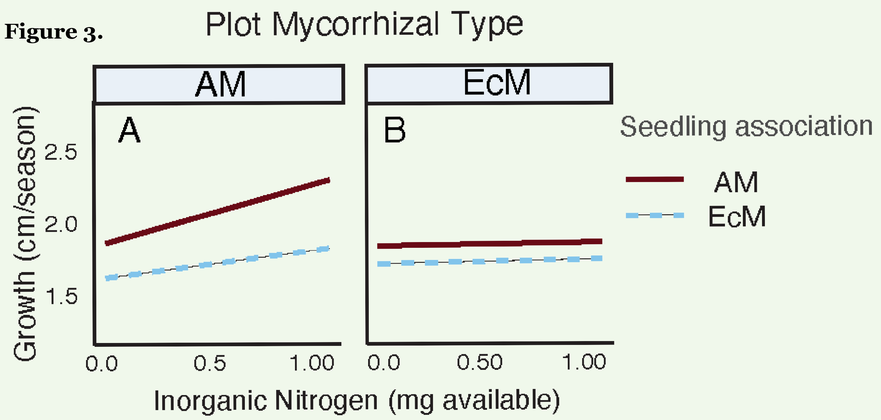
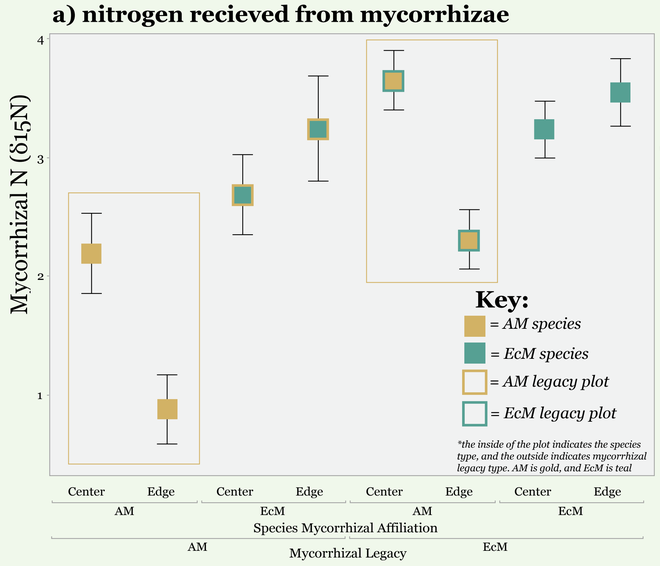
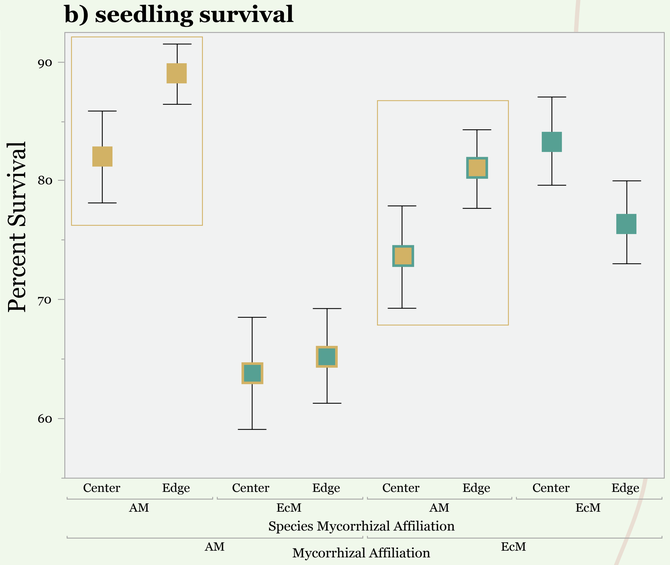


Figure 4.

a) nitrogen recieved from mycorrhizae



b) seedling survival



Discussion

- AM but not EcM seedlings had higher survival (8%) and growth (9%) in AM legacy plots, **likely driven by access to common mycorrhizal networks**.
- AM seedlings had higher survival and more mycorrhizal-mediated N ($p<0.0001$) when closer to potential donor trees (Fig 4b).
- AM seedling growth also benefited from connections to my corrhizal networks:
- AM seedling growth had a positive relationship with soil nitrogen availability (Fig 2; $p = 0.021$).
- **This nitrogen likely came from mycorrhizal networks as growth** was positively related to mycorrhizal-mediated nitrogen (Fig 4a; $p = 0.006$).

Conclusions

Nutrient acquisition via AM fungal networks is a vital factor affecting seedling regeneration and growth for trees including Acer saccharum and Fraxinus sp. EcM-associated seedlings may be more affected by the species of fungi present in the soil. We are currently analyzing soil fungal community data to better answer this question.

Next Steps

In June 2022, we established a root-exclusion study in selectively harvested and ¼ acre gap plots at Corinth to build on our current hypothesis that AM-associated seedlings require access to mycorrhizal networks and adult AM trees for survival and growth of Acer saccharum, Prunus serotina, and Nyssa sylvatica.

Acknowledgements

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We would love to hear from you with questions/comments/suggestions!

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