SUSTAINABLE PATHWAYS FOR SHORTLEAF PINE RESTORATION IN UNCERTAIN CLIMATES

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EXTENDED ABSTRACT

Strip mining has degraded soil throughout the Southeastern United States. To enhance the probability of success in forest restoration, combinations of organic and microbial soil amendments can be utilized to improve soil health and water availability (Blanco-Canqui 2017). However, climate change may challenge the effectiveness of restoration. In this study, shortleaf pine (*Pinus echinata*) was used because its current range is shrinking due to disease, climate change, and the preferential planting of other pine species (Sutter 2019). Additionally, shortleaf pine prefers acidic soil and has been observed on postmined sites in the past (Lawson 1990).

We conducted a comprehensive greenhouse experiment using shortleaf pine seedlings treated with three different moisture regimes to understand potential impacts of precipitation uncertainty due to climate change. In a greenhouse, shortleaf pine seedlings were planted in replicates across moisture treatments receiving the following amendments: organic, microbial, organic and microbial mixture, unamended control, or control with no trees. Soil was sourced and homogenized from a postmined site in Alabama. Tree growth parameters (survival, groundline diameter, height, root-to-shoot ratio), soil-water fluxes (dissolved organic carbon, absorbance at 254 µm, specific ultraviolet absorbance at 254 nm), and soil health indicators (pH, carbon, and nitrogen content) were measured throughout the study.

After 4 months, survival was 62 percent across treatments. Across water regimes, the unamended control, organic and microbial mixture, and organic soil amendments saw the largest increases in average height across water regimes. Across soil treatments, mean height increased from 20.01 ±

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1.57 (mean ± standard error) cm to 27.33 ± 1.52 cm in the dry water regime, from 22.37 ± 0.67 cm to 28.37 ± 3.61 cm in the average water regime, and from 22.14 ± 0.43 cm to 30.17 ± 1.37 cm for the wet water regime.

The highest specific ultraviolet absorbance at 254 nm occurred in the organic treatment in the wet regime at 9.239 ± 0.533 L $mg^{-1}m^{-1}$ and the lowest occurred in the microbial amendment treatment in the wet regime at 2.424 ± 0.125 L $mg^{-1}m^{-1}$ (fig. 1). Further tree growth, soil-water flux, and soil indicator results are pending. Results from this greenhouse experiment will inform current restoration techniques using organic and microbial soil amendments.

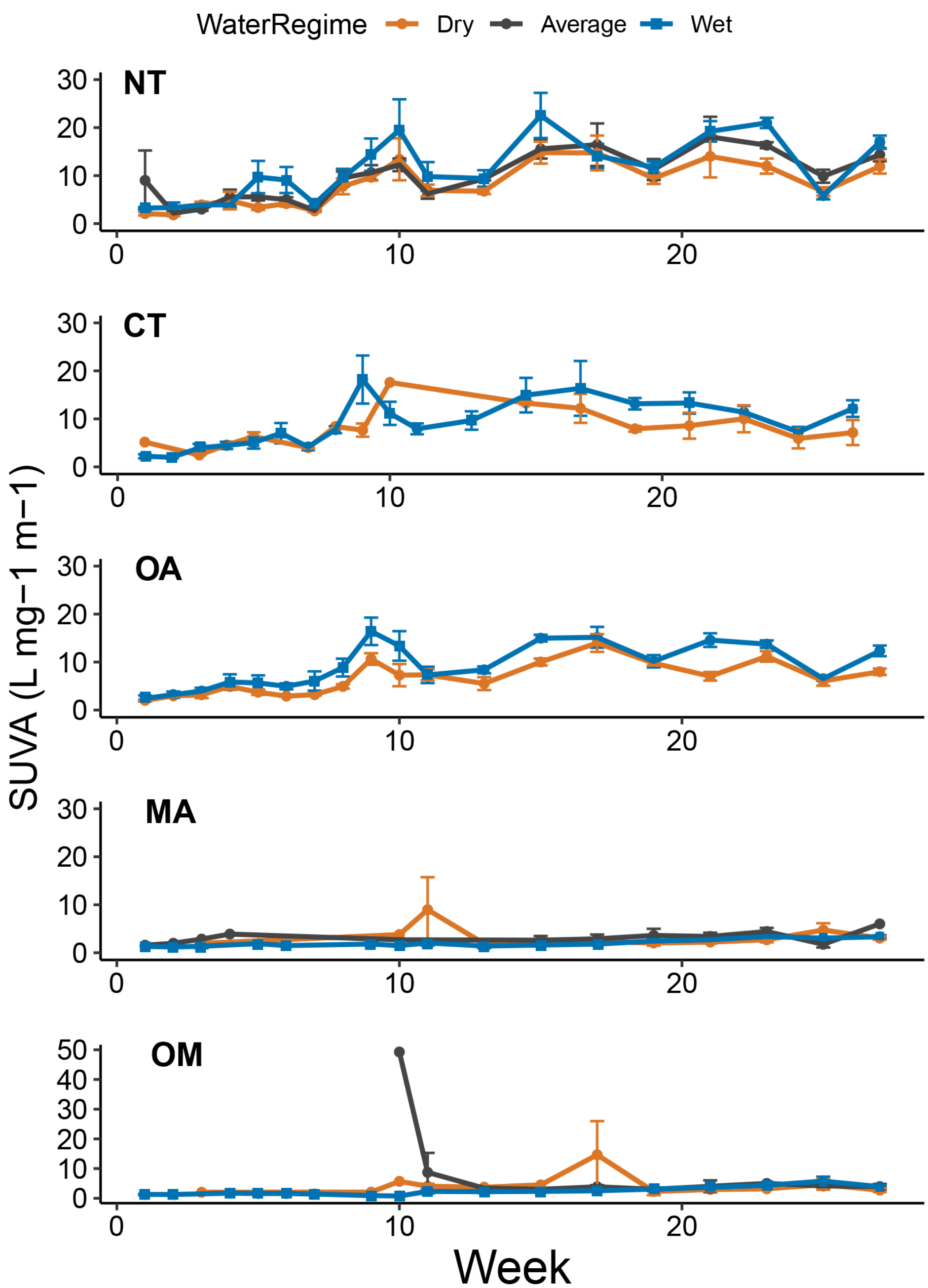

Figure 1—Specific UV absorption at 254 nm (SUVA) across the soil amendments by week. NT = control with no trees; CT = unamended control; OA = organic amendment; MA = microbial amendment; OM = organic and microbial amendment. Note that OM has a larger y-axis range compared to other soil treatments.

LITERATURE CITED

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