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Effects of Soil Management Practices on Rehabilitating Compacted Urban Soils

Urban land development usually results in compacted urban soils, creating unfavorable conditions for tree establishment and growth while impairing long-term ecosystem services. Soil Profile Rebuilding (SPR) is a crucial technique to address urban soil compaction. However, its impacts on urban soil in the southeast region remain unexplored. To address this research gap, this study assessed the efficacy of the SPR method in improving degraded urban soils in the southeast of Nashville, Tennessee. Twelve experimental plots with four soil treatments (three replications each) were established using a completely randomized design in 2023. The four soil treatments include: (1) Control: no amendment; (2) SPR: Four inches of compost over the surface; (3) Biochar: One inch of biochar over the surface; (4) SPR+ Biochar: Two inches of compost and one inch of biochar over the surface. Following the application of soil amendments, the sites were prepared by subsoiling to a depth of 24 inches using a Mini Excavator and topsoil was added back. The soils were sampled in 2023 and 2024 to evaluate the changes one-year post-treatment. Results showed that soil bulk density was significantly lower in the SPR plots compared to the control plots. Soil moisture was buffered throughout the year and showed significant variations and peak in July on SPR-treated plots. However, no significant differences were observed in soil temperature across the soil treatments from January to December 2024. Similarly, the SPR technique enhanced total soil carbon and nitrogen, microbial biomass carbon, and infiltration rates relative to baseline conditions, with the most pronounced improvements in the SPR-treated plots. Overall, SPR effectively enhances soil properties in degraded urban environments. These findings provide valuable insights for urban planners, urban foresters, researchers, and stakeholders to rehabilitate degraded urban soils, increase tree canopy, and enhance ecosystem services.