THE JONES CENTER AT ICHAUWAY

Publication Brief

2 May 2025

Soil Change After Planting Longleaf Pine on Agricultural Lands: Revisiting a Chronosequence Study After 23 Years

Longleaf pine restoration efforts have led to the establishment of millions of hectares of longleaf pine across the southern USA. Few studies have tracked changes in soil carbon and nutrient stocks over time on lands planted to longleaf pine that were formerly subjected to row cropping. To address this information gap, members of The Jones Center at Ichauway's Ecological Silviculture Lab repeated measurements of mineral soil total carbon, total nitrogen, and extractable phosphorus on a chronosequence of replicated (n = 3) planted longleaf pine stands of various age classes. The research team also collected soil in mature, never-tilled stands, and calculated carbon and nutrient stocks to serve as benchmarks for meeting soil carbon and nutrient objectives. Carbon accumulation from 1999 to 2022 averaged 2.8 Mg ha-1 in the planted stands from the surface of the mineral soil to a depth of 50 cm. Researchers also detected a pattern of carbon and nitrogen accumulation in the shallow mineral soil horizon (0–10 cm), but in deeper horizons carbon and nitrogen showed a decline. Meanwhile, mean extractable phosphorus declined since agricultural fertilizers were last applied to the soils of the planted stands about 24 to 37 years ago, but remained elevated in comparison to the never-tilled stands. The 30-year-old plantations had similar mineral soil carbon stocks to those of never-tilled stands. The soils of planted stands were generally carbon sinks despite frequent use of prescribed fire and commercial thinning. Overall, these findings suggest that planting longleaf pine on marginal agricultural lands can contribute to the objective of restoring the low native fertility of these soils and sequestering belowground carbon in stands.

Longleaf pine stand that originated from seedlings planted on marginal agricultural land in 1992. Commercial thinning occurred in 2014, and salvage logging was conducted in 2019 after a hurricane. The stands planted in 1992 had similar soil carbon stocks to those of never-tilled stands at Ichauway. Photo taken in 2024, courtesy of Joshua Puhlick.

MORE INFORMATION

Puhlick, J. J., D. Markewitz, and R.S. Taylor. 2025. Soil change after planting longleaf pine on agricultural lands: Revisiting a chronosequence study after 23 years. Soil Sci. Soc. Am. J. 89: e70062. doi.org/10.1002/saj2.70062

CONTACT

Joshua Puhlick, joshua.puhlick@jonesctr.org

KEY POINTS

There was noticeable variability in C stocks across stands which likely reflects differences in disturbance, vegetation, and the interaction of these factors.

Soils of planted stands were generally C sinks despite the frequent use of prescribed fire and commercial thinning.

Soil C accumulation was likely from root turnover by the planted pines and the understory plant community.