Recovery of Soil Carbon Stocks on Disturbed Coastal Plain Soils Through Secondary Forest Succession

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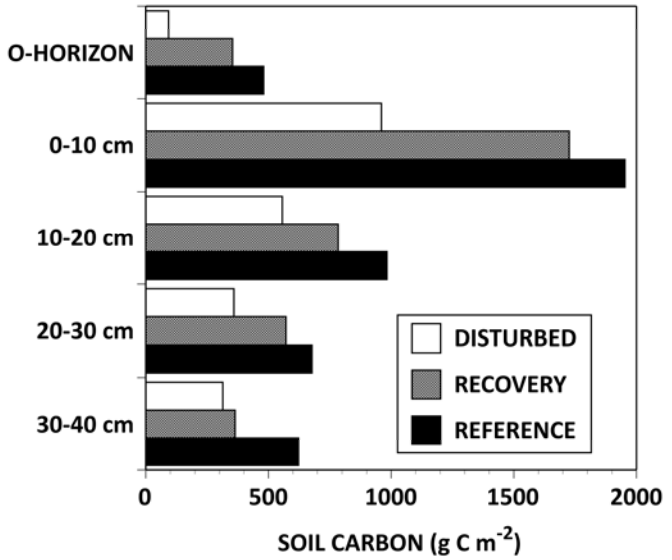
- Recovery of soil carbon stocks in historically degraded soils provides a means of carbon sequestration to mitigate increasing atmospheric carbon dioxide.
- We investigated changes in soil properties following land use change in coastal plain soils of southwestern Georgia, and compared soil carbon and nitrogen among disturbed (barren), recovered (reforested), and reference (forest) sites.
- Approximately 55 years of forest succession produced a recovery of soil carbon and nitrogen to levels not significantly different from nearby long-term reference forest soils.
- Allowing forest succession as a land management option led to restoration of soil carbon stocks (accrual rate = 28 g C m^{-2} yr^{-1}) on degraded land on the southern coastal plain.



Vertical soil carbon profiles beneath sites of long-term historical disturbance, recovered sites after 55 years of forest succession, and nearby, long-term, reference forests.

Reference: Maloney KO, Garten CT Jr, Ashwood TL (2008) Changes in soil properties following 55 years of secondary forest succession at Fort Benning, Georgia, USA. *Restoration Ecology* 16: 503-510.

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Recovery of soil organic matter on historically degraded land has been suggested as one means of carbon sequestration for the purpose of mitigating increasing concentrations of atmospheric carbon dioxide. However, the time required for recovery of soil carbon and nitrogen in degraded soils is poorly understood. We investigated changes in soil properties following land use change in highly weathered Ultisols, mainly of coastal plain origin, in southwestern Georgia. Historic soil disturbance included agriculture (pre-1944) and military training (post-1944). Soils collected in 1999 from recovery sites (bare ground or abandoned old-fields in 1944 and forest in 1999) were compared with nearby, long-term, forest soils (reference sites). Soil density exhibited an historic land use legacy effect with reference and reforested sites having lower soil densities than disturbed sites. Soil carbon and nitrogen at recovery sites approached levels measured in reference forest stands following 55 years of forest succession on abandoned, degraded, soils indicating that forest succession was a successful land management practice for relatively rapid restoration of soil carbon stocks on degraded land. Carbon accumulation rate, to a 40 cm soil depth, was approximately 28 g C m^{-2} yr^{-1} which is only slightly less than previously reported rates for soil carbon accrual under aggrading forest ecosystems. Our results also indicated a decrease in the rate of carbon accumulation with increasing soil depth resulting in longer recovery times for deeper soil carbon. Nitrogen stocks recovered at an estimated rate of 0.6 g N m^{-2} yr^{-1}. Although 55 years of forest succession produced an apparent recovery of soil carbon and nitrogen to levels not significantly different from nearby, long-term, forest soils, soil density requires a much longer recovery time which is consistent with the reported long-term effects of agriculture and military training on soil.

Maloney KO, Garten CT Jr, Ashwood TL (2008) Changes in soil properties following 55 years of secondary forest succession at Fort Benning, Georgia, USA. *Restoration Ecology* 16: 503-510.