Development of Mine Soils in a Chronosequence of FRA-Reclaimed Sites in Eastern Kentucky[1]

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Abstract: Adoption of the Forestry Reclamation Approach (FRA) on surface mines in Appalachia has led to excellent survival and growth of planted native trees, and also favors natural colonization of native trees and other plant species. In addition, FRA sites exhibit rapid soil development, especially including accumulation of organic matter. The current study was conducted to characterize soil development over a series of sites representing a chronosequence of time since reclamation using the FRA (from 0 years to 20 years since reclamation). Soils were sampled at increments from 0 – 50 cm and analyzed for a number of physical and chemical parameters. Aluminum generally increased with depth and time and was positively correlated with clay. While manganese and iron did not exhibit consistent relationships with depth, they increased over time and were also positively correlated with clay. Aluminum and iron were also both negatively associated with sand. In contrast, calcium and sodium were negatively correlated with clay and exhibited complex relationships with time, increasing to maximums by 10-18 years after reclamation, and decreasing to minimums in unmined forest. While $\delta^{13}C$ exhibited complex relationships with time since reclamation ($\delta^{13}C$ was most depleted in the 10-year site and least depleted in the 18-year site), it was less depleted with depth. Organic carbon increased over time since reclamation and decreased with depth. Sand decreased over time, while silt and clay increased over time. This study provides insight into soil development patterns over time and depth in FRA-reclaimed soils in Appalachia, and provides further support for use of FRA in reclamation of surface mined land.[3]

Additional Keywords: pedogenesis, reforestation, Appalachia, radiochemistry, carbon sequestration.

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3. Location where work conducted was near 37.460490° N - 83.158137° W.