The Effects of Time and Topography on Deep Carbon Storage in the Clarks River Valley of Western Kentucky

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Soil organic carbon (SOC) dynamics at depths greater than one meter in valley bottoms are not well understood. This study examines the stock of SOC with depth across alluvial landforms in the Clarks River National Wildlife Refuge. Nine cores along three transects from terraces to floodplains and adjacent channel bars were collected to depths of 4 meters or refusal. Bulk density, clay content, and loss-on-ignition were used to estimate stocks. Age estimates based on radiocarbon suggest the landforms range in age from 7975 to 52 yr BP. Average SOC and carbon (C) flux varied with values of 1.76 kg/m^2 ± 0.54, 2.21x10^{-4} kg/m^2/yr in the terraces, 1.05 kg/m^2 ± 0.36, 200x10^{-4} kg/m^2/yr in the floodplains and 1.47 kg/m^2 ± 0.53, 300x10^{-4} kg/m^2/yr in the bars. The percentage of total SOC by landform observed in buried soils (not modern surface soil) is 50% in bars, 71% in floodplains, and 77% in terraces. Analysis of Variance and post-hoc tests showed that the mean stock of buried soils in the floodplain are significantly lower than terrace (*p= 0.0009*), and bar sites (*p= 0.01*). These lower values may be due to labile C oxidizing in soils that have not developed enough for soil processes to stabilize SOC. The higher SOC in bars is most likely related to new C being submerged and protected from oxidation. Infrequent flooding and greater soil development in terraces allows for the accumulation of clay as well as the protection and stabilization of microaggregates containing SOC at depth.