

# Quantifying Effects of Historic Land Use Change on Soil Organic Carbon Using Soil Reflectance Libraries

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## Abstract

Over the last 150 years the most important land cover conversion pathways in western Kenya have been characterized by substitutions of vegetation dominated by C3 photosynthetic pathways (i.e., tree-based systems) to C4 (grass or subsistence cereal crop-based systems). Based on carbon isotope data, these past conversions are likely to have had substantial impacts on the regional distribution and abundance of soil organic carbon (SOC). Using a soil reflectance library approach, we initially show that SOC and its stable isotope composition may be reliably predicted from diffuse reflectance (DR) spectra of soils across a wide range of environmental conditions. DR predictions are subsequently applied to a case-control study of the Kakamega forest ecotone, in which we assess temporal (i.e., 0-100 year) changes in spectrally calibrated SOC stocks relative to time since conversion to subsistence maize agriculture. Results from non-linear mixed effects models indicate that asymptotic declines in SOC occur, and are principally determined by reductions in SOC inputs in converted systems.

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