



Impacts of land use and Ugandan farmer's cultural and economic status on soil organic matter and soil fertility

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Soil is the keystone in building sustainable agricultural systems, but increased demand for these soil services has led to soil degradation, particularly in sub-Saharan Africa. In Uganda, where population growth rates are 9th highest in the world, increasing pressure on soil resources and potential losses of SOM are particularly concerning because there is virtually no use of fertilizers or other inputs on farms. In addition, smallholder farmers in Uganda are placing greater emphasis on resource-intensive cash crops like maize, and thereby straining soil resources. In this study we investigate the relationships between land use decisions and soil fertility to better understand declines in soil fertility and how they might be slowed near Kibale National Park (KNP), Uganda, a global biodiversity hotspot. Within 2.5 km of the KNP border, we conducted household surveys and collected soil samples in 160 farms along a 20 km north-south transect. We also collected soils from inside KNP, adjacent to farms we visited, to serve as controls. Cultural differences in land use, such as greater residue removal and a lower likelihood of legumes in rotation with the Bakiga, likely led to the greater declines in SOM and soil fertility we observed in Bakiga compared to Batooro maize fields. We also found that households in areas of high soil fertility are more reliant on maize sales. Surprisingly, these same areas have also seen relatively smaller declines in total SOM, but do show larger relative declines in nutrients (e.g. N, P and K) when compared to the adjacent KNP soils. We found lower depletion of nutrients and overall higher soil fertility measures and more stability of SOM in banana fields compared to maize fields, which is due to transferring maize crop residues to banana plantations as well as no-till practices in banana fields. Our work reveals that complex interactions between edaphic soil properties, land use management, cultural background, perceptions of soil fertility and SOM dynamics will constrain the region's capacity to meet the demands of rapid population growth.