Modelling the potential for soil carbon storage using biochar- a case study

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Biochar additions to agricultural fields could greatly increase the carbon sink potential of sugarcane plantations, turning abundant crop residues into highly recalcitrant forms. Biochar not only stores carbon but the production process is energy positive. Gradual improvement to soil cation exchange capacity and bulk density may benefit nutrient and water retention, potentially mitigating some effects of climate change.

Relatively little is known about the kinetics of biochar carbon decay since accumulation over decades to centuries is not directly observed. Modelling decay based on known biotic and abiotic factors in soil and climate requires knowledge of biochar sub-pools, specifically their size and rate constants.

Here we have used accelerated chemical ageing as a proxy for oxidative ageing in soils. The resulting partitioning of biochar recalcitrance with mean residence time of up to 10,000 years allows extraction of decay parameters without resorting to extrapolation from short-term study. We compared carbon accumulation using 1, 2 and 3 biochar pools based on differently adapted versions of the RothC soil carbon model.

Results from sensitivity analyses will be presented in terms of biochar type, model structure and climate. These will be illustrated in the context of the sugarcane system of Sao Paulo, Brazil, under current and potential future climate.