



The dynamics of Soil Organic Carbon fractions defined by alternative fractionation schemes

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A change in (1) soil carbon input or (2) rate of stabilisation of new inputs, results in a trajectory for soil organic carbon (SOC) towards a new equilibrium level. The ultimate change in SOC may become statistically significant over decades, but is not easily detected within 1–10 years. Pool-based soil carbon models suggest that larger changes should occur in the distribution of carbon between fractions that differ in turnover rate. These effects may be measurable, indicative of change and potentially diagnostic.

Alternative schemes exist for isolating sets of contrasting SOC fractions. In the Ecosystem Land Use Modelling & Soil Carbon GHG Flux Trial (ELUM) project, two schemes have been applied to soils from 20 sites in transitions from pasture and/or arable to different types of short rotation forestry (biomass energy crops). Both schemes target carbon fractions of intermediate stability that should show proportional changes. These fractions should decline with higher decomposition and increase with greater soil inputs.

In this work we show the relationship between fractions obtained using “sand plus aggregate protected SOC” (Zimmerman et al., 2007) and “intra-aggregate SOC” (Sohi et al., 2001). The correlation is first made for soils continuing in historical land use at each site, as well as adjacent soils changed to one or more types of forestry. The variable of interest here is the quantitative comparability of the fractions, as well as the effect of site specific factors (notably soil texture and land-use). This is shown as a proportion of SOC as well as amount of SOC.

Secondly, we compare the status of the alternate fractions in transition. A different relationship relative to soils at equilibrium could suggest they are characterised by a different reactivity in the soil (turnover rate, mapping to modelled SOC pools), or that they are affected differently by soil texture, initial total SOC, etc. This reveals information on the fractions' likely use as indicators or in support of modelling land-use change.

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