

Variability of soil organic carbon and the changes in labile and non-labile fractions in different land uses of *Mahakanumulla* village tank cascade system

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Abstract

Depletion of soil organic matter (SOM) in Village tank cascade system (VTCS) in Sri Lanka has been identified as a major constraint. This study determines the changes in labile and non-labile fractions in different land uses in *Mahakanumulla* VTCS and assess the sustainability of their soil organic carbon management. Soil samples ($n=166$) were taken from 0-30 cm depth along a longitudinal linear transect and three cross-sectional linear transects at 50 m intervals, representing the distribution of ten tanks and five predominant land uses (paddy, forest, scrub/shrub, upland crops and home gardens). Permanganate oxidizable carbon (POXC) and total organic carbon (TOC) contents of the soil were determined and the lability, carbon pool index (CPI), lability index (LI) and carbon management index (CMI) were calculated. Considerable variability of TOC and POXC was observed between the land uses ($CV>25\%$). Even though the POXC fraction in the soils of the scrub/shrub was 9% lower than that of the forest soils, there was no significant differences. Forests recorded the highest TOC ($1.33 \pm 0.38\%$) compared to all the other land uses. The CPI has decreased by 18-33% in lands converted from forests to agricultural lands and home gardens and the highest reduction was observed in paddy lands. However, the highest lability was recorded in paddy soils (0.056) in which the LI also significantly higher than that of home gardens, forest and scrub/shrub. Harvesting practices using combine harvesters, ensure the return of paddy straw back to the same field, rather than burning and submerged conditions might have resulted the higher lability in OC in paddy soils. The CMI of scrub/shrub lands (82.9), previously cultivated with upland crops or as *chena* but now abandoned for about 10-20 years, was significantly lower ($p<0.05$) than that of all the other land use types (98.0 to 103.7) that were not significantly different among themselves. While CMI values indicates that SOM management practices in paddy lands, upland soils and home gardens of the VTCS are sustainable, the need for introducing management strategies such as agroforestry systems combined with the addition of organic matter/amendments for scrub/shrub lands in the VTCS is highlighted.

Keywords: Labile carbon, Soil organic matter, Sustainability, Village tank cascade

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