

Mangrove soils are superior carbon sinks: Evidence from Sri Lankan mangrove ecosystems

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Mangroves are among the most carbon rich ecosystems in the tropics. Inundation with tides and land-based surface runoff leads to anaerobic soil conditions that are conducive for accumulation of partially decomposed organic carbon. Present study was conducted to assess quantitatively the capacity of mangrove soils in retaining organic carbon. Distribution of total organic carbon (TOC) in soils of mangrove ecosystems in Negombo, Chilaw, Kala Oya, Malwathu Oya, Uppar, Batticaloa and Rekawa lagoons/estuaries, that represent western eastern and southern coasts as well as wet and dry climatic zones of Sri Lanka, was determined by using soil samples taken along the water-land gradient at 0-15 cm, 15-30 cm and 30-45 cm depths. Dichromate oxidation followed by colorimetric measurements were used to determine the percentage TOC and TOC densities were calculated using bulk density and % TOC values. Except for Batticaloa and Uppar lagoons in the dry zone, relatively a high soil TOC contents were observed in the surface soil layers (0-15 cm depth). By and large, the area between 10-30 m from the shoreline retained the highest average TOC in all mangrove areas. The highest percentage TOC in Sri Lankan mangrove soils is found not at the surface layer (4.92 - 15.1 % at the surface - 15 cm depth), but the layer below it down to a depth of 30 m (5.31 - 9.87 % at 16 - 30 cm depth). Soil beneath 30 cm contained the lowest amount (3.05 - 8.34 % at 31 -45 cm depth). Average TOC density of surface soil was 0.066 - 0.145 g cm⁻³ and in it was higher in mangroves of wet and intermediate climatic zones than those in the dry zone. The carbon retention capacity of Sri Lankan mangrove soils therefore was calculated to range between 313 - 492 t ha⁻¹ and the highest was found to occur in the wet zone while it was 414 t ha⁻¹ in the intermediate zone. Soils of mangroves in the dry zone retained approximately 361 t ha⁻¹ of organic carbon up to a depth of 45 cm. The TOC retained by the soils of mangrove areas in Sri Lanka can be estimated as 5816 x 10³ t. Inundation frequencies and durations as well as other bio-physical factors may affect the magnitude of TOC in mangrove soils.

Keywords: Mangroves, soil, total organic carbon, carbon sequestration