

Identifying the spatial drivers and scale-specific variations of soil carbon in a montane natural forest ecosystem in Sri Lanka

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Abstract

Soil organic carbon (SOC) is a key driver of ecosystem functioning, more importantly in the areas with very little stocks. The SOC stocks were mapped in this study using spatial linear mixed models over the Knuckles forest reserve in Sri Lanka using a variety of environmental covariates. The study area consisted of diverse ecosystems ranging from montane to submontane to grasslands and characterised by rigid terrain. Results of the spatial modelling revealed that for 0-15 cm depth interval SOC stocks were mainly driven by vegetation type and elevation while for 15-30 cm depth interval SOC stocks were driven mainly by the forest type, elevation, slope, and wetness index. Further several (4) spatial transects of 100-m interval were extracted from the digital maps representing the study area and noise-assisted ensemble empirical model decomposition analysis was carried out to examine the scale specific variability of SOC stocks. Spectral analysis was performed to identify the exact scales and the correlation analysis was performed with different environmental covariates to identify the dominant controlling factors at different depths. Majority of the large-scale variations were attributed to the elevation and climatic factors, while small-scale variations were attributed to the land management (e.g. forest type, vegetation index). The scale-specific controlling factors at different locations and their relative controlling factors may help selecting environmental factors in digital soil mapping at different scales for improving mapping accuracy.

Keywords: Forest soils, spatial modelling, Digital soil mapping, wavelets analysis