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ESTIMATION OF SOIL ORGANIC CARBON AND ITS INFLUENCE ON NUTRIENT DYNAMICS IN SHIFTING CULTIVATION WITHIN THE KATUPOTHA TANK CASCADE SYSTEM, SRI LANKA

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Shifting cultivation, one of Sri Lanka's oldest agricultural practices, has been important in sustaining communities since ancient times. Frequent removal of natural vegetation for cultivation often leads to the deterioration of native plant species and soil. Understanding the interactions between soil total organic carbon (TOC) and essential nutrients is vital for sustainable land management, especially in sensitive dry zone ecosystems. This study aimed to assess the relationship between TOC and some available soil macronutrients (nitrate, phosphate, and ammonium) in fallow forests after shifting cultivation at the Katupotha tank cascade system (KTCS), Mihintale, Sri Lanka. Composite soil samples were formed by pooling three samples from each of 16 random locations at two depths: surface (0 – 15 cm) and sub-surface (15 – 30 cm). Soil pH, electrical conductivity (EC), bulk density, TOC, and available macronutrients were analysed using standard protocols. In the surface soil, TOC ranged from 0.42 – 1.31% (mean 0.94%), and phosphate, nitrate, and ammonium ranged from 0.21 – 13.01, 0.29 – 26.07, and 7.52 – 57.14 µg g^{-1}, respectively (means: 4.20, 11.47, 23.97 µg g^{-1}). In the subsurface, TOC ranged from 0.24 – 1.27% (mean 0.76%), with phosphate, nitrate, and ammonium ranging from 0.01 – 3.99, 1.47 – 16.08, and 5.33 – 39.83 µg g^{-1}, respectively (means: 1.01, 6.66, 21.46 µg g^{-1}). Paired *t*-tests showed significant depth-wise differences in TOC (p = 0.019), nitrate (p = 0.037), and phosphate (p = 0.009), indicating depth-dependent variation in nutrient distribution. Pearson correlation analysis revealed a moderate positive correlation between TOC and nitrate at both depths (r = 0.50, p = 0.06 for 0 – 15 cm; r = 0.51, p = 0.05 for 15 – 30 cm), and a significant correlation was found for TOC and phosphate at the surface (r = 0.54, p = 0.04). The high levels of TOC, nitrate, and phosphate in young fallow forest soils suggest frequent cultivation and the deliberate addition of these nutrients by farmers, indicating a shift away from the sustainable nutrient management practices of traditional farming systems toward high-input, sedentary agriculture.

Keywords: Carbon sequestration, Macronutrient availability, Shifting cultivation, Soil health, Sustainable land management