

Ecosystem Carbon Sequestration of Different Land-uses of the Lowland Wet Zone: A Case Study from Waga Area, Kalutara District, Sri Lanka

K.A.J.M. Kuruppuarachchi^{1*}, B.D. Madurapperuma² and G. Seneviratne³

¹*Department of Botany, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka*

²*Department of Forestry and Wildland Resources, Humboldt State University, Arcata, California, USA*

³*National Institute of Fundamental Studies (NIFS), Hantana Road, Kandy, Sri Lanka*

This study examines plant above-ground carbon and soil carbon stocks of different land-use types with the same climate and geology in Waga area i.e., natural forests (NF), home gardens (HG), coconut plantations (CP), pine and Araucaria mixed plantation forest (PAP), rubber plantation (RP), rambutan plantation (RAP), pineapple plantation (PP) and tea plantation (TP). Five representative sampling sites viz., 20 m × 20 m were selected in each land-use for floristic survey and to make composite soil core sampling (20 samples mixed together) up to a 30 cm depth. Plant parameters, such as DBH, height and physicochemical properties of soil samples were evaluated. The normalized difference vegetation index (NDVI) was calculated using 2017 Landsat 8 image at 30 m spatial resolution, which was acquired during leaf-on season (i.e. mid January to mid March), to recognize the vegetation health. The study revealed ecosystem carbon and soil C densities in the order NF (625 and 52 t C ha⁻¹), PAP (290 and 38 t C ha⁻¹), HG (199 and 21 t C ha⁻¹), RP (188 and 17 t C ha⁻¹), CP (167 and 25 t C ha⁻¹), RAP (167 and 28 t C ha⁻¹), PP (40 and 38 t C ha⁻¹) and TP (15 and 15 t C ha⁻¹), respectively. NDVI values of the land-uses were RP (0.623), HG (0.618), NF (0.615), CP (0.611), PP (0.592), TP (0.576), RAP (0.562), and PAP (0.556). The highest soil moisture accumulation was reported in NF (17.7%) and RP (16.38%). Soil pH values were mainly acidic (< 5) for all land-uses. High total soil N concentrations were observed in both NF (0.18%) and PAP (0.14%). Higher amounts of soil nitrate were recorded in RAP (15.55 µg g⁻¹ soil), NF (11.45 µg g⁻¹ soil) and PP (9.32 µg g⁻¹ soil). Soil total P concentrations were relatively low in NF (0.041%), PAP (0.042%) and RP (0.045%), and it is an obvious fact for tropical land-uses with perennial vegetation. This study revealed that the land-use types, such as NF, PAP, HG and RP were good carbon reserves in tropical lowland wet zone of Sri Lanka. Further investigations on micro carbon cycles of each land-use are recommended for better understanding of ecosystem carbon footprint.

Keywords: Ecosystem carbon, Land-use types, Low land wet zone, Waga