Variation in Above-ground Carbon Stock of Selected Tropical Rainforests of Sri Lanka Along an Altitudinal Gradient

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Tropical rain forests (TRFs) function as a major terrestrial carbon sink by absorbing ca. 40% of global CO_2 emissions. Strength of this carbon sink varies both spatially and temporally as a result of varying climatic and soil factors. Furthermore, biomass carbon storage of TRFs could diminish with global warming and climate change. In this study, we aimed to determine how the standing carbon stock of selected TRFs in Sri Lanka varies along an altitudinal gradient. Five one-hectare permanent sampling plots were established in Kanneliya (KDN 1 and KDN 2, altitudes 134 and 152 m asl), Pitadeniya-Sinharaja (PTD 1 and PTD 2, 606 and 509 m asl) and Rilagala (RLG, 1667 m asl) Forest Reserves. All trees with DBH ≥ 10 cm were measured and identified. Aboveground biomass (AGB) was calculated by using a published allometric equation for tropical rainforests. Carbon fraction of biomass was considered as 0.5. A total of 3781 trees was recorded, with a total basal area of 203.68 m^2. Maximum DBH ranged from 71 cm (KDN 1) to 137 cm (PTD 2). In the lower altitude plots over 60% of plants were in the 0-20 cm DBH range, while in the higher altitude plot, 95% of plants had DBH within 0-20 cm. Highest plant density was recorded in KDN 1 (974 plants ha^{-1}) and lowest was in PTD 1 (545 plants ha^{-1}). Even though, KDN 1 had a high plant density, PTD 2 (604 plants ha^{-1}) had the highest total aboveground carbon (ABGC) stock (380.75 Mg C ha^{-1}) while RLG had the lowest (34.8 Mg C ha^{-1}). Total DBH per ha showed a significant (p=0.0019; Adjusted-R^2=0.964) linear decline with increasing altitude (6.99 cm ha^{-1} DBH m^{-1} altitude). In contrast, both total tree basal area (>10 cm DBH) and ABGC stock per ha increased with altitude up to 636 and 741m asl respectively and declined subsequently, thus showing second-order polynomial relationships (p=0.053, Adjusted R^2=0.893; p=0.095, Adjusted R^2=0.810). These findings provide important indicators of the response of TRFs to varying altitude and to the associated environmental variations. Further investigations are needed to elucidate the underlying basis for the above response patterns.

Keywords: Tropical rainforests, altitude, above-ground carbon, basal area