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Evaluation of Ecosystem Services Provided by Urban Street Trees in Kandy City, Sri Lanka

Senadeera, T.S.M.*, Bandara, R.

Department of Zoology and Environmental Management, University of Kelaniya, Kelaniya, Sri Lanka
**saurisena98@gmail.com*

Abstract

Urbanization is a global phenomenon defined by high population density and built-up infrastructures. It contributes to increased greenhouse gas emissions, loss of natural habitats, and degradation of water and air quality. Urban street trees are one of the solutions many countries have identified to ameliorate the negative impacts of urbanization and enhance ecosystem services. This study was designed to evaluate carbon sequestration potential, microclimate regulation potential and to estimate total PM accumulation by *Madhuca longifolia*, *Pongamia pinnata,* and *Azadirachta indica* species that have been selected from a least and highly urbanized sites in Kandy city. Carbon sequestration was measured by using total tree height, diameter at breast height, and wood density data, microclimate regulation was evaluated by measuring differences in temperature (ΔT), relative humidity (ΔRH), and illumination (ΔI) between under and away from tree canopies. Total PM accumulation was measured by quantifying large and coarse PM on and in wax tree leaves. Measurements were taken from ten individual trees and four individual trees from each species at highly and least urbanized sites respectively. One-way ANOVA and independent sample t-test were used to analyze differences in ecosystem services among species and between sites. *M. longifolia* performed the highest in total PM accumulation (149.74±23.53 µg/cm^2), microclimate regulation (ΔT:0.33±0.02℃, ΔRH:1.46±0.16%, ΔI:75579.10±2075.14lux), *P. pinnata* performed the highest carbon sequestration (39.51±4.22 CO_2eq Kg) at the highly urbanized site. At the least urbanized site *A. indica* showed the highest total PM accumulation (30.64±3.04 µg/cm^2), *P. pinnata* showed the highest carbon sequestration (22.52±3.11 CO_2eq Kg) and *M. longifolia* showed the highest microclimate regulation (ΔT:0.91±0.16℃, ΔRH:1.60±0.17%, ΔI:64299.35±1501.55lux). The pooled data showed significant positive correlations between leaf area and relative humidity increment, illumination reduction at highly urbanized sites as well as temperature reduction and illumination reduction at least urbanized sites at noon. It can be concluded that *M. longifolia* is identified as the best overall ecosystem services provider in relatively highly urbanized sites and *A. indica* shows the least performance. These findings can be used as a guideline for city planners to get eco-friendly urban environments.

Keywords: *Street trees, Ecosystem services, Carbon sequestration, Microclimate regulation, PM accumulation*