Carbon sink function of Sri Lankan mangrove ecosystems with special reference to Negombo estuary

By

K.A.R.S.Perera

Thesis submitted for the fulfillment of the requirements of the degree of

Doctor of Philosophy

Department of Botany

University of Kelaniya

Kelaniya

Sri Lanka

June 2014

ABSTRACT

Although mangroves are considered to be highly productive ecosystems that have potential to serve as efficient sinks of carbon, and there is a dearth of knowledge on rates of relevant processes and total capacity of ecosystem carbon sequestration and storage, especially in the Sri Lankan context. Present study therefore was carried out with the objective of quantifying carbon sink function of Sri Lankan mangrove ecosystems, including that of above and below ground components of mangrove plants as well as of mangrove soils.

Study was conducted in seven mangrove areas located in sheltered coasts of wet, dry and intermediate climatic zones of Sri Lanka. Biomass distribution between above (A) and below (B) ground components of *Bruguiera gymnorrhiza* and *Lumnitzera racemosa*(A/B), was found to be 3:1, and allometric relationship between dbh and total organic carbon (TOC) content in above/below ground components was developed.

Gross primary productivity (GPP) estimated for mangroves in Rekawa lagoon was the highest (53.26tha^{-1}y^{-1}) while that of at Malwathu Oya estuary was the lowest (27.29 t ha^{-1}y^{-1}). Net primary productivity (NPP) of Negombo mangroves was 22.82 tha^{-1}y^{-1}and theoverall rate of TOC accumulationwas11.83 t ha^{-1}y^{-1}. NPP was found to be 60% of the GPP. Largest reservoir of TOC was found in mangrove soils than in mangrove plants. Soil carbon reserves in the dry zone were much smaller (361.31 t ha^{-1}) than that of the wet zone mangroves (418.97 t ha^{-1}). TOC retained in Sri Lankan mangrove ecosystems therefore was calculated to be 8215x10^3 t and as such carbon retention/ sequestration capacity of Sri Lankan mangroves was estimated as 524.25 t ha^{-1}, which is greater than that of tropical forests. Extent of mangroves in Negombo estuary that will be inundated due to anticipated sea level rise by year 2100 was estimated to be 53.27–95.74ha, and the potentially affected amount of TOC, was estimated as 26.61x10^3–47.82x10^3 t, which accounts 37-67% of the TOC at present. Findings of the study support the hypothesis that mangrove ecosystems are efficient carbon sinks and that this capacity is reduced with permanent inundation by sea level rise.

Key wards: mangroves, carbon sequestration, allometric relationships, soil, climate change