



Effect of Vegetation Structure on Carbon Assimilation Capacity of Mangrove Ecosystems in the East Coast of Sri Lanka

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Abstract

Mangroves are proven as highly potential of providing an efficient carbon sink, both on short and longer time scales. Capacity of carbon sequestration abilities of mangroves is not only a trait that is governed by their genetic make-up, but also by environmental conditions. Total capacity of carbon retention by mangrove ecosystems therefore is partly determined by their vegetation structure.

Vegetation sampling was carried out at six (6) randomly selected locations in mangrove areas of Batticaloa and Uppar lagoons on the east coast of Sri Lanka. Vegetation structure was determined by adopting standard methods and allometric relationships were used to determine mangrove plant biomass. Carbon content was determined by $K_2Cr_2O_7$ oxidation method.

Rhizophora apiculata and *Excoecaria agallocha* were the predominant species in Batticaloa mangroves, with representing high IVI values, 83.03 and 174.58 respectively, while *Rhizophora mucronata* and *Avicennia marina* were dominant Uppar lagoon with IVI values were 87.73 and 63.94 respectively, may reason of dissimilarities of soil salinity and nature of inundations. Chemical analysis revealed that nearly half of the biomass of wood and roots mangrove species (5) encountered in study area contained organic carbon. Accordingly higher TOC stock was retained by Batticaloa mangroves (149.71 t/ha) than Uppar lagoon mangroves (135.20 t/ha). Positive correlations ($p < 0.05$) were revealed between TOC in mangrove trees with vegetation structural complexity (CI) and leaf area index (LAI), which easily quantify in the field.

Keywords: Coastal; Mangrove ecosystems; *Rhizophora apiculata*

Introduction

Mangroves are typical wetland ecosystems found in coastal deposits of mud and silt throughout the tropics and some distances into the subtropical latitudes. Mangrove communities are normally characterized by high productivity, high litter production and biomass followed by efficient in carbon sink compared to other terrestrial plant communities [1]. As approximately half of mangrove tree biomass contains organic carbon, large amounts of carbon are potentially accumulated in mangrove forests may be the largest stores of carbon in coastal zone [2].

Although mangroves are well known for high carbon assimilation and flux rates data are surprisingly lacking on whole ecosystem carbon storage [3,4]. Limited components of carbon storage in mangroves have been reported, most notably tree biomass [5,6].

According to the recent records of Department of forests, Sri Lanka, eastern province has the second largest mangrove extent divided in three districts (Trincomalee, 2595 ha, Batticaloa, 2071 ha and Ampara, 816 ha) along the east coast of Sri Lanka. Although several of research studies on Sri Lankan mangroves, studies focused on carbon sequestration and cycling are scanty and accessibility problems especially for north and east coast mangroves were occurred in last thirty years due to civil war conditions in Sri Lanka. This study was conducted with the objectives of estimate the carbon stock retaining in

mangroves in two main mangrove ecosystems (Batticaloa lagoon and Uppar lagoon) at east coast of Sri Lanka, and propose a relationship between total organic carbon (TOC) content of mangroves and a easily quantifiable measurement in the field which enable to lessen the lengthily process of estimate TOC.

Materials and Method

Study area

Batticaloa lagoon is the largest among the lagoons in east coast and it is the third largest basin estuary in Sri Lanka, lies between $7^{\circ} 24' - 7^{\circ} 46' N$ and $81^{\circ} 35' - 81^{\circ} 49' E$ [7]. Mean depth of the lagoon recorded 1.5 m [8]. Total extent of the lagoon recorded 11500 ha, which opens into the sea through two narrow channels. Seasonal connection with the sea due to the sand bars built up by wave action during the dry period and recorded the salinity increasing up to 30 ppt at certain times (Kotagama et al., 1989). The mangrove vegetation along the lagoon covers and extent of 1550 ha [9].

Uppar/Panichchankeni lagoon is one of the larger lagoon located eastern province of Sri Lanka ($8^{\circ} 05' - 8^{\circ} 11' N$ and $81^{\circ} 23' - 81^{\circ} 25' E$) and total extent was recorded 2590 ha. Depth of lagoon recorded 1-2 m and opens to the sea through a narrow channel at its southern end. The much smaller lagoon of Uppu Alan is connected with the south end of Uppar Lagoon by a short Channel and tidal range being about 40 cm [7].