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Paper: Sustainability

Net photosynthetic production and potential carbon assimilation capacity of mangroves of Kadolkele in Negombo estuary, Sri Lanka

Mangroves are considered as highly productive ecosystems that have considerable potential to serve as efficient sinks of carbon, both on short and long time scales. Magnitude of mangrove primary productivity is highly variable in space and time and it depends on factors such as tidal flushing, latitude, temperature, salinity and nutrient regimes as well as substrate characteristics. Net primary production is represented by above and below ground biomass, litter production and the rate of grazing by herbivores. Since results of very few studies on primary productivity of Sri Lankan mangroves are available, the present study was conducted with the objective of understanding the net primary productivity and magnitude of net carbon assimilation capacity of mangrove ecosystem at Kadolkele.

The study was conducted at Kadolkele ($7^0$11'42.18"- $7^0$11'50.48" N; 79^0 50'32.08"– 79^0 50'47.50" E), a relatively undisturbed natural mangrove stand extending over 13.5ha, at the northern end of Negombo estuary. Data on biomass increment and litterfall during study period were gathered from twenty 10 m x10 m permanent study plots of three belt transect of 10 m wide laid perpendicular to the shoreline. Annual increment of above and below ground biomass was calculated by girth (gbh) increment, using allometric relationships developed between gbh and biomass of mangrove trees. Biomass loss through herbivory was assumed to be negligible due to high tannin content in mangrove plant parts and thus their low palatability. Organic carbon content of each component of mangrove trees was determined by Walkey and Black wet oxidation without external heating procedure followed by colorimetric method to determine absorbance at 600 nm, using a UV- visible spectrophotometer. Annual organic carbon accumulation was calculated from NPP and organic carbon content.

Relatively high values of NPP were recorded from the water-front areas of the mangrove stand and it decreased towards inland. Annual total organic carbon increment was recorded to be 1232.17 $\pm$ 9.23 g $m^{-2}y^{-1}$ of which 682.80 $\pm$ 7.51 g $m^{-2}y^{-1}$ was found deposited in the above ground woody parts while 396.46 $\pm$ 4.65 g $m^{-2}y^{-1}$ was in the plant litter and 152.91 $\pm$ 1.94 g $m^{-2}y^{-1}$ in the roots. Potential capacity of Kadolkele mangroves in assimilating and accumulating carbon is 166.66 t y^{-1} and this amount is equivalent to the amount of carbon emitted as CO_2 by combustion of 272,694 (nearly quarter of a million) liters of diesel in motor vehicles. Assuming a motor car consumes 1200 liters of diesel per year, this mangrove stand at Kadolkele with an extent of 13.5 ha can remove atmospheric carbon produced by 227 cars during one year.