INTERACTIONS BETWEEN GREENHOUSE GAS, NUTRIENTS MAJOR AND TRACE ELEMENTS IN MANGROVE ECOSYSTEM OF SOUTH INDIA

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ABSTRACT

Changes in atmospheric composition of trace gases such as methane, the dynamics of biogeochemical transformations and coupling of key elements such as carbon, hydrogen, nitrogen and phosphorus, induced both naturally and by human activities are aspects of immediate concern in the context of global change. Tropical coastal wetlands, represented by mangrove ecosystems, serve as a common link between the land, ocean and the atmosphere.

The first aspect of the present research work, deals with the ***'biosphere-atmosphere interaction'*** in trace gas exchanges, in relation to changing environmental forcing factors. Time-varying fluxes of methane adopting the closed chamber technique was used to estimate the methane emission from the mangrove biotopes of South India viz. Pichavaram (unpolluted), Ennore Creek (affected by oil pollution and nutrient enrichment) and Adyar estuary (polluted by organic contaminants), for a period of one year, covering monthly, seasonal and diurnal variations. The results indicate that annual average methane emission of 7.4 mg/m^2/h, 5.02 mg/m^2/h and 15.4 mg/m^2/h are emitted from the Pichavaram, Ennore and Adyar mangroves respectively. Emission characteristics obtained at Pichavaram mangroves represent natural variability with changing environmental conditions, whereas anthropogenic perturbations of the Ennore and Adyar mangroves have severely altered the normal methane emission characteristics. Several environmental factors such as low

oxygen, high organic matter, nutrient availability and soil physical and chemical properties, in addition to human-mediated interventions, have been identified to influence emission rates. First order methane emission inventory for the mangroves along the Indian sub-continent and the tropical coastlines of the world were computed, based on the range in methane emission obtained at Pichavaram mangroves. An estimate of 0.05 to 0.37 Tg CH_4/ yr and2.80 to 19.25 Tg CH_4/ yr, is projected to be emitted from the Indian and global mangroves respectively.

The second aspect of this study, is concerned with the ***'land-ocean interaction',*** giving priority to the exchange, transformation and transport of nutrients, major and trace elements in the mangrove ecosystems. Temporal variation in nutrient content and primary productivity in polluted and unpolluted mangrove ecosystems indicate that human intervention resulted in enrichment of nutrients in these ecosystems. Primary productivity was maximum at Ennore Creek (0.43 $gC/m^2/d$), followed by Pichavaram (0.31 $gC/m^2/d$) suggesting that *'added nutrient'* sources contribute to the productivity of these ecosystems. Continuous input of organic wastes into the Adyar estuary, resulted in anoxic conditions for most part of the year, thereby drastically reducing the primary productivity (0.23 $gC/m^2/d$) of the surface waters. Spatial distribution of nutrients in the Vellar-Coleroon estuarine complex, illustrates that nutrient retention is high and effective regeneration (54%) occurs within the Pichavaram mangroves. Thus, the net export of nutrients into the Bay of Bengal is negligible.

Many of the major (viz. CI and Na) and trace elements (viz. Cd, Cu, Ni and Zn) are linked to primary productivity and are essential for the growth of the mangrove vegetation. Major elements in water and sediments, displayed a conservative behaviour in the Vellar-Coleroon estuarine region, indicating the influence of sea water in this ecosystem. Trace elements in water, represented a baseline value for all elements except As, V and Zn, originating from agricultural effluent discharges. The accumulation of trace metals in the sediments was extremely high, suggesting that

mangroves act as *'sinks'* for toxic contaminants. Further, the role of mangroves as effective traps for river-borne sediments, has also been established. The results of this study, has clearly demonstrated that anthropogenic activities enhance the mobilization of biogeochemical elements, among various compartments of the biosphere, atmosphere and hydrosphere.