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Short Communication

Ecosystem Sustainability for Coastal Wetlands

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Abstract

Mangroves form one of the most productive terrestrial ecosystems which occupy a large fraction of the tropical and subtropical coastlines and are considered to be potential sources of organic matter due to the high rate of nutrient turnover. But presently mangroves are exposed to adverse effects of climate change. Coastal tidal inundation and nutrients influx primarily affects soil organic carbon dynamics. Moreover, soil labile carbon pools, available nitrogen and phosphorous and their relative ratios influence soil biological and microbial activities and govern the greenhouse gas production. Further, the rates of carbon storage/loss in coastal wetland are stimulated by tidal fluxes of sediments and nutrients. Even the increased greenhouse gas fluxes are able to offset the potential of carbon sequestration. It is, therefore, essential to determine whether the system acts as net carbon source/sink.

Keywords: Coastal wetlands; Mangrove ecosystem; Carbon sequestration; Climate change; Greenhouse gas

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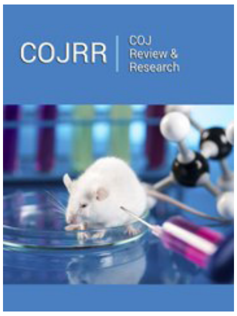

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Introduction

Impact of land cover and land use changes on nutrient stoichiometry in coastal estuarine wetland soils

The quantity and relative supply of nutrients in soils have important implications for global biogeochemical cycles [1]. Vital nutrients in soils, viz. Carbon (C), Nitrogen (N), Phosphorus (P), and Potassium (K) and their biogeochemical cycles are closely intertwined with the ecological structure, processes, and functions in soils [2]. Study finds that anthropogenic interventions can alter strongly the soil elemental pools by changing nutrient inputs-outputs [3]. Still less information is available till date for elemental stoichiometric patterns, their ratio and shifts due to the impact of land cover and land use changes on coastal wetland soils. Coastal estuarine wetlands are located in the transition zones between land and marine systems [4]. Both the terrestrial and marine ecosystems influence greatly estuarine wetlands in terms of their nutrient biogeochemical cycling, element transport, exchange, circulation, patterns, and dynamics [5].

Coastal wetlands often have high productivity, high nutrient loading rates, and dynamic oxidation-reduction shifts that facilitate nutrient processing, resulting into nutrients dynamics and associated biogeochemical functioning, leading to highly variable elemental ratios [6,7]. Anthropogenic inputs of N, P and K increased in last few decades and caused an anomaly in C, N, P, K relative stoichiometry that might increase in near future [8-10]. Therefore, in-depth study of the C, N, P and K concentrations and stoichiometry in coastal wetland soils is useful for determining the cycles and balances of the elements and the overall functioning of the soil system.

Impacts of land cover changes and land use practices on soil organic C (SOC) pools in the tropical and subtropical coastal wetland ecosystems

Coastal wetlands in the tropical and subtropical regions have been regarded as one of the most important C reservoirs among global ecosystems [11,12]. The SOC pools and its dynamics are complex and heterogeneous, consisting of active/labile, slow, and passive pools that vary in turnover time, as well as their effects on the rate of organic matter decomposition, energy transfer, and nutrient cycling [13,14]. The amount and composition of SOC can vary with land use practices and land cover changes in coastal wetland ecosystems [15,16]. Wetlands have considerable C stocks because of the low decomposition rates under the predominantly anaerobic environments [17,18]. However, the drainage of wetlands and/or conversion of land cover for human development could accelerate the decomposition of SOC significantly, resulting in the release of gaseous C into the atmosphere, significantly affecting the global C budget [11,19]. Coastal tidal inundation in conjunction with nutrient influx can affect the soil C pools [20,21]. Till date relatively little is known regarding such influence on the composition of SOC pools and overall dynamics in coastal wetland soils [22,23]. Studies examining the dominant controls of the relative magnitudes of different SOC pools would help improve future wetland management in enhancing the capability of coastal wetland soils in long-term C storage.

Conclusion

Studies investigating afore-mentioned topical aspects and outcomes thus generated will help to manage the coastal estuarine wetlands under tidal exposure through devising proper scientific intervention strategies and adoption of pertinent conservation processes and rehabilitation programme in a holistic way minimizing adverse environmental effects under changing climatic conditions.

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