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Assessment of Anthropogenic Influence on Blue Carbon Stocks of Tidal Salt Marshes in Northwest Coast, Sri Lanka

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Abstract

Blue carbon ecosystems are now in the global spotlight, due to their significant ability to sequester carbon, positioning them as key players in climate change mitigation. Among these ecosystems, salt marshes have received the least attention compared to other blue carbon ecosystems such as mangroves and seagrasses. Despite their immense value, these ecosystems face significant threats due to anthropogenic activities around the world. Salt marshes along the Northwest coast of Sri Lanka, particularly near the Puttalam lagoon, have suffered rapid degradation due to anthropogenic activities such as shrimp farming, salterns, and encroachments. Therefore, this study aims to assess the influence of human disturbances on blue carbon stocks by comparing an undisturbed natural salt marsh site and a disturbed site subjected to anthropogenic impacts. Vegetation carbon stock was assessed by developing species-specific allometric equations, providing an accurate estimate of the carbon stored in above-ground biomass. Soil carbon stocks were assessed through the loss on ignition method, using soil samples collected from a 1-meter depth. The estimated total carbon stock in the natural site was significantly higher (162.87±38.58 Mg C ha^{-1}) than that of the disturbed site (118.01±23.47 Mg C ha^{-1}), indicating that human activities have a detrimental effect on the carbon sequestration potential of these ecosystems. Moreover, soil chemical properties (pH, electrical conductivity, total dissolved solids, salinity) were analyzed along the depth profile in both sites. It revealed further differences between the two sites. The natural salt marsh exhibited an alkaline pH throughout the soil profile, supporting optimal conditions for long-term carbon storage. In contrast, the disturbed site showed acidified conditions in the upper 30 cm of soil, accompanied by a significant reduction in electrical conductivity, total dissolved solids, and salinity parameters that are essential for maintaining the unique characteristics of salt marsh environments. There was no significant difference in chemical parameters in the deeper layers (below 30 cm) in both sites. The degradation in the surface layers suggests that human activities have accelerated the disruption of ecosystem functions critical to carbon storage. These findings highlight the urgent need to address the impacts of anthropogenic pressures on salt marshes, particularly in the context of climate change. Our research emphasizes the necessity for further investigation into salt marsh blue carbon dynamics, as well as the implementation of conservation and management strategies to ensure the long-term sustainability of these crucial ecosystems.

Keywords: *Blue carbon, Carbon sinks, Salt marsh, Soil organic carbon, Anthropogenic influence*