

Sediment Organic Carbon and Nitrogen Storage Potential in Kalpitiya Lagoon Seagrass Meadows, Sri Lanka

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Abstract

Seagrass meadows are productive coastal ecosystems that provide important ecosystem services, including primary productivity, habitat provision, carbon sequestration, sediment stabilization, and nutrient cycling. Seagrasses have an ability to trap and bury organic matter within their sediments for long periods, making them effective coastal blue carbon ecosystems, with strong potential to contribute to global climate change mitigation. Although there is increasing global attention on seagrass-associated carbon dynamics, such research remains limited in Sri Lanka. Identifying this gap, this study aims to quantify the Sediment Organic Carbon (SOC) and nitrogen content in seagrass meadows of Kalpitiya Lagoon, to assess their role in the long-term storage potential of carbon and nitrogen. Sediment samples were collected by placing three 20 m transects perpendicular to the lagoon shoreline. A total of 12 sediment core samples (30 cm depth) were collected and subsampled into three depth intervals: 0-10 cm, 10-20 cm, and 20-30 cm. The SOC and nitrogen contents of samples were determined using a CHNS elemental analyzer. *Enhalus acoroides* and *Halophila ovalis* were the identified seagrass species within the study area. The results indicated a mean SOC content measured at 32.900 ± 14.535 Mg C ha⁻¹ and a mean nitrogen content measured at 21.567 ± 2.424 Mg N ha⁻¹. These values highlight the substantial accumulation of organic matter in Kalpitiya seagrass sediments, demonstrating the high potential of these ecosystems for carbon sequestration and nutrient retention. The findings provide a better understanding of the contribution of Sri Lankan seagrass meadows to global carbon dynamics. The observed SOC values are comparable to those of other seagrass ecosystems in Sri Lanka, and this is the highest seagrass-associated SOC value recorded in Sri Lanka, according to current literature. Seagrass ecosystems in sheltered lagoon environments often store large amounts of carbon due to restricted water movement, which facilitates sedimentation and the burial of organic matter over time. Additionally, the presence of considerable nitrogen content in sediment emphasizes potential environmental stress, likely due to excess nutrient input from pollution, which can lead to eutrophication and harmful algal blooms. Thus, regional conservation and restoration efforts are essential to protect these ecosystems in Sri Lanka.

Keywords: *Carbon sequestration, Conservation, Restoration, Sediment organic carbon, Seagrass meadows*