

IMPACT OF TEMPORAL CLIMATE VARIABILITY AND LAND USE DYNAMICS ON THE INTEGRITY OF SEAGRASS BEDS IN THE NEGOMBO ESTUARY, SRI LANKA

R.A.T. Wickma¹, S.H.U. Chathurani³, J.M.N.M. Jayasundara³, D.D.G.L. Dahanayaka² and W.C.P. Egodawatta¹

¹*Department of Plant Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka.*

²*Department of Zoology, Faculty of Natural Sciences, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka.*

³*National Aquatic Resources Research and Development Agency, Crow Island, Colombo 15, Sri Lanka.*

Seagrasses are marine angiosperms, thriving in brackish and shallow marine waters. This study aimed to assess the impacts of rainfall changes due to climate anomalies and anthropogenic land use changes on the distribution, species richness and diversity of the seagrass beds in selected locations in the *Negombo* Estuary. Locations with abundant seagrass beds were randomly selected and surveyed from August to October 2024. Three transects perpendicular to the shoreline were established across four distinct ecozones. Water quality and seagrass beds were assessed to determine their current status compared to past changes in rainfall and land use within the estuarine ecosystem. The blue carbon stocks of seagrass ecosystems were also quantified by estimating the total above and below-ground organic carbon fractions of seagrass beds. The present status of the estuarine seagrass spatial distribution, species richness, and diversity were compared with the published literature. Over the past three decades, notable changes in monthly average rainfall were observed during the south-west and second inter-monsoon periods. Land use changes during the past two decades exhibited an increase in vegetation (4.70%), built-up areas (4.24%), and roads (1.16%), while water areas decreased by 0.76%. Estuary sections near *Basiyawaththa* exhibited the highest diversity, while *Kadolkele* and *Munnakkaraya* recorded no diversity, being composed only of *Halodule pinifolia*. Quantified seagrass coverage of three sections *Munnakkaraya*, *Kadolkele* and *Basiyawaththa* were 77%, 74% and 65%, respectively. Seagrass coverage and density were significantly correlated to Secchi-depth, indicating an indirect link between turbidity, rainfall, and water influx. Sea surface temperature exhibited a negative correlation linking the adverse effect of elevated temperatures, likely caused by thermal stress. The blue carbon stock of the ecosystem was significantly higher at *Munnakkaraya* (24.15 Mg C ha⁻¹) compared to *Kadolkele* (14.35 Mg C ha⁻¹) and *Basiyawaththa* (13.45 Mg C ha⁻¹). This study underscores the sensitivity of the *Negombo* Estuary's seagrass ecosystem to rainfall fluctuations, land-use changes, water quality variations, and blue carbon content.

Keywords: Blue Carbon, Rainfall, Seagrass ecosystem, Sea surface temperature, Water quality