



Monitoring the Status and Dynamics of Mangrove Cover in Jaffna Lagoon Using Geographic Information System and Remote Sensing

V.G.N.L. Gamage^{1*}, K. Gunaalan¹, N. Thasarathan²

¹Department of Fisheries, Faculty of Science, University of Jaffna, Jaffna, Sri Lanka.

²Department of Geography, Faculty of Arts, University of Jaffna, Jaffna, Sri Lanka.

*navodaugc@gmail.com

Mangroves are among the most productive coastal ecosystems in the world, comprising unique plant species that play important ecological roles, provide ecosystem services, and deliver socioeconomic benefits. However, they are highly vulnerable to a range of natural and anthropogenic threats, leading to significant degradation of their cover and ecological stability. Although precise data on ecosystem distribution is essential for conservation, a significant knowledge gap exists in Northern Sri Lanka, where mangrove dynamics remain insufficiently documented. This study assessed the status and temporal dynamics of mangroves along the coasts of the Jaffna Lagoon using Geographic Information System (GIS) and Remote Sensing (RS) techniques, focusing on 2002, 2013, and 2024 to represent approximately two decades of changes. The above selected low tidal cloud-free imageries (30×30 m resolution) were processed after the pre-processing analysis of the atmospheric and radiometric corrections. An unsupervised classification was performed using the ISODATA clustering method in ArcGIS Pro 3.4.0, supported by Global Positioning System (GPS)-based validation. The accuracy evaluation ranges for the overall Kappa Coefficient exceeded 87%. Results revealed a non-linear trend in mangrove cover, with a slight decline from 1,420 ha in 2002 to 1,396 ha in 2013 (~1.72%), followed by a substantial increase to 1,683 ha in 2024, representing an overall gain of approximately 18.5%. Spatial analysis identified Kavutharimunai (~555.8 ha) and Pooneryn-Nallur (~530.1 ha) as key mangrove hotspots in 2024. In addition, Mandaitivu exhibited notable expansion (~61%) between 2002 and 2024. The initial decline (2002-2013) is attributed to anthropogenic pressures, including aquaculture expansion, coastal development projects, and post-conflict resettlement, as well as natural factors. The post-2013 recovery likely reflects the combined effects of government-led restoration initiatives, policy enforcement, and natural regeneration. These findings provide a valuable baseline for sustainable mangrove management and conservation planning in Jaffna Lagoon, Northern Sri Lanka.

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