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Assessing Land Use Dynamics in Maduganga, Sri Lanka: A Comparative Study Using Supervised Classification

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Abstract

Maduganga estuary is ecologically significant and is known for its rich biodiversity. It is located in the Balapitiya and Karandeniya Divisional Secretariat Division (DSD) of Southern Sri Lanka's Galle District. It is 915 hectares in size, spread across 15 islands. Designated as a Ramsar site in 2003, the estuary is primarily dominated by cinnamon cultivation and is increasingly supported by a growing nature-based tourism industry. Other activities include fishing, agriculture, coir production, and traditional practices like kraal fishery, with cinnamon being a primary crop in the region. This study aims to analyze the evolution of natural habitats and human activities in Maduganga from 2017 to 2024, providing critical data to guide conservation and sustainable development initiatives. Satellite images from 2017, 2021, and 2024 were acquired through the Copernicus program, with January and February chosen to minimize cloud cover. The Balapitiya DSD was designated the primary area of interest. A true-color image was fitted to the DSD boundaries. Subsequently, Support Vector Machine (SVM) classification was employed to create raster images, categorizing land use types such as inland waters, urban areas, forests, floodplains, and croplands. Following the classification process, area-based calculations for each land use category were performed. Regression analysis provided coefficients that indicated the rate of change for each land use type through the years. Inland waters have been decreasing by 0.30 km² annually, likely due to sedimentation and encroachment, while urban areas have expanded by 0.40 km² per year, reflecting growing urbanization. Forest areas have increased by 0.31 km², possibly from reforestation or cinnamon plantation expansion. Floodplains have grown moderately, while cropland has significantly declined by 0.58 km², likely due to urban development and agricultural shifts. The consistent decline in inland waters and cropland, alongside the expansion of urban areas and floodplains, suggests significant shifts that could impact the ecological balance of the region. As urbanization and the dominance of monoculture crops like cinnamon continue, there is a risk of disrupting the natural functions of the estuary, such as water retention, biodiversity support, and flood regulation. It is crucial to closely monitor these land use patterns and prioritize sustainable development and conservation strategies to mitigate the potential negative effects on the estuary's ecosystem and ensure its long-term health.

Keywords: *Land use change, Maduganga estuary, Supervised classification, Ecosystem dynamics, Conservation*

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