



Socio-Ecological Risks to Mangrove Restoration Efforts in the Batticaloa Lagoon

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Mangrove ecosystems provide critical ecological and socio-economic services, including biodiversity conservation, carbon sequestration, and support for fisheries and aquaculture. However, these ecosystems are increasingly threatened by climate change and human activities. The present study was conducted in the Batticaloa Lagoon, Sri Lanka, to evaluate the survival performance of selected mangrove species and to identify factors influencing the success of restoration efforts. Two sites, Thannamunai and Thirupperunthurai, were selected on the basis that previous restoration initiatives in these areas had failed. In the first quarter of 2024, seventy *Rhizophora mucronata* seedlings, approximately 3 ft in height and bearing six leaves each, were planted in Thannamunai at a water depth of approximately 30cm with 1m spacing. During the same period, twenty *Avicennia marina* seedlings of similar height and leaf number were planted on elevated land approximately 150cm from the waterline. In 2025, 350 *R. mucronata* seedlings, approximately 3 ft in height and each bearing six leaves, were planted in Thirupperunthurai under similar conditions. Plant survival was monitored every two months, and the collected data were analyzed using ANOVA followed by Duncan's Multiple Range Test at $\alpha=0.05$. The results revealed a continuous decline in plant survival at both sites. In Thannamunai, *R. mucronata* exhibited survival reductions of 28.6%, 27.1%, 11.4%, and 32.9% across successive monitoring periods. Similarly, in Thirupperunthurai, reductions of 44.7%, 11.4%, 2.9%, and 48.0% were observed. *A. marina* in Thannamunai also exhibited declining survival, though it demonstrated relatively better adaptation than *R. mucronata*. Unexpected flooding during the North-East monsoon was identified as the primary cause of mortality, followed by increased wave action caused by strong winds during June–August. Additional factors, including fishing activities, particularly net dragging across planted areas, together with transplantation stress and grazing pressure, also contributed to the reduced survival of young mangrove plants. The findings highlight the importance of appropriate site selection, nursery conditioning under lagoon like conditions, effective hydrological planning, and community awareness in enhancing the success of mangrove restoration programmes in the Batticaloa Lagoon region.

Keywords: Mangrove restoration, Seedling survival, *Rhizophora mucronata*, *Avicennia marina*, Batticaloa Lagoon, Coastal ecosystem management