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Mangrove Ecosystems at Risk: Evaluating Threats, Restoration Challenges and Strategic Pathways for Coastal Resilience

Aiman Hisyam Azmi[1]*

Centre for Coastal and Marine Environment (CMER)
Maritime Institute of Malaysia
Malaysia
aiman@mima.gov.my

Thaarshini Paramasivan[2]

Centre for Coastal and Marine Environment (CMER)
Maritime Institute of Malaysia
Malaysia
thaarshini@mima.gov.my

Syuhaida Ismail[3]

Director of Research Office
Maritime Institute of Malaysia (MIMA)
Malaysia
syuhaida@mima.gov.my

***Corresponding Author email: aiman@mima.gov.my**

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ABSTRACT

Mangroves are among the most productive and valuable coastal ecosystems, providing crucial ecological and socioeconomic services such as coastal protection, carbon sequestration, and support for biodiversity and fisheries. Despite their immense benefits, mangrove ecosystems are rapidly declining due to both natural and anthropogenic factors, threatening biodiversity, coastal protection, and carbon sequestration. Globally, restoration efforts, especially mangrove replantation, have been initiated to reverse this loss. Nonetheless, many of these initiatives have failed due to various ecological, technical, and socio-political challenges. Thus, this paper sets the objectives of determining the ecological and socio-economic benefits of mangroves to coastal ecosystems and communities, evaluating the major threats contributing to mangrove degradation with specific attention to pressures from port development and expansion and the resulting impacts on coastal stability and biodiversity, assessing the key failure factors in current mangrove replantation and restoration initiatives, and proposing strategic action plans aimed at improving the effectiveness of mangrove restoration methods globally through literature review. This paper contributes to improving mangrove conservation strategies into coastal infrastructure planning, especially in rapidly developing port regions, while supporting the global sustainability goals, and aligning with Malaysia's commitment to achieving net-zero carbon emissions by 2050.

Keywords: *Mangrove Replantation; Coastal Ecosystem; Coastal Resilience; Mangrove Restoration*