Mangrove Blue Carbon in Sri Lanka: A Comprehensive Review of Carbon Stocks, Sequestration Potential, and Climate Change Mitigation

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Mangrove ecosystems are globally important blue carbon reservoirs that capture and store atmospheric carbon, while enhancing coastal resilience. This review synthesizes evidence from 23 studies published between 2016 and 2025. Relevant literature was identified through searches of ScienceDirect, Google Scholar, Sri Lanka Journals Online, and ResearchGate using the keywords “mangrove”, “blue carbon”, “carbon stocks”, “carbon sequestration”, and “Sri Lanka”. The selected studies were reviewed to evaluate the carbon stocks, sequestration potential, and climate mitigation value of Sri Lankan mangroves within a global context. The reviewed studies confirm that mangroves are among the most carbon rich ecosystems on Earth. Global mangrove ecosystem carbon stocks average 738.9 Mg C ha^{-1} and reach 987.4 Mg C ha^{-1} in Pacific Island systems in 2020. Global assessments indicate a mean mangrove organic carbon stock of 738.9 Mg C ha^{-1} and a mean global mangrove carbon stock of 6.17 Pg C in 2020. A national-scale assessment of Sri Lankan mangroves reported considerable spatial variability in ecosystem carbon stocks, ranging from 734.7 Mg C ha^{-1} in the dry-zone Batticaloa Lagoon to 1,455.4 Mg C ha^{-1} in the inter-mediate-zone Rekawa Lagoon. Soil organic carbon was the dominant carbon pool, contributing approximately 83 – 90% of total mangrove ecosystem carbon storage. Recent assessments of northern Sri Lankan mangroves recorded total organic carbon stocks of 695.03 Mg C ha^{-1} and carbon sequestration rates of 6.52 Mg C ha^{-1} yr^{-1}, highlighting their significant atmospheric car-bon removal capacity. Despite their importance for climate mitigation, Sri Lanka’s mangrove ecosystems are increasingly threatened by anthropogenic disturbances, affecting their long-term carbon sequestration potential. Restoration initiatives demonstrated high ecological effectiveness, with Rhizophora mucronata sapling survival reaching 85% at the Koggala restoration site, substantially exceeding the survival rates (<50%) reported for most restored mangrove sites in Sri Lanka. These findings highlight the importance of integrating mangrove blue carbon into carbon accounting systems, climate adaptation frameworks, and sustainable coastal management policies. Conservation and restoration of Sri Lanka's mangroves represent a high-value nature-based solution for climate change mitigation and long term ecological and socio-economic benefits.

Keywords: *Blue carbon, Mangrove ecosystems, Carbon sequestration, Carbon stocks, Climate change mitigation, Sri Lanka*