

Hidden Carbon Treasures: Quantifying Mangrove Biomass in Sri Lanka's Overlooked Dry Zone Ecosystems

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Tropical mangrove ecosystems serve as critical blue carbon repositories. However, comprehensive biomass carbon assessments are limited in the dry zones of Sri Lanka. This study was conducted to estimate biomass carbon stock in the Valachchenai estuary, Batticaloa (dry zone), using non-destructive methodology. Diameter at breast height (DBH) and height of individual mangrove species were measured in 34 plots of 100 m², and species were identified using taxonomic keys. Biomass was calculated using the equation, and species-specific allometric equations were used to estimate carbon stock. Analysis was conducted using R Studio and Microsoft Excel. Ten mangrove species were recorded, representing 47% of national mangrove species, with common species including *Avicennia marina*, *Excoecaria agallocha*, and *Rhizophora* species. There was no significant variation among species for species diversity based on the Shannon-Wiener index. Total biomass for the Valachchenai mangrove forest area was 0.4220 Mg C ha⁻¹, and mangroves exhibited a ratio of 4:1 AGB: BGB (78.21%: 21.79%). *E. agallocha* and *Lumnitzera racemosa* were major biomass carbon contributors, with Importance Value Index scores of 42.38 and 26.09, storing 0.24812 and 0.16145 Mg C ha⁻¹. Structural analysis revealed that over 80% of trees belonged to the 5.9–9.99 cm DBH class, suggesting a regenerating forest with growth potential. The encounter rate of 0.21 ha per species indicates moderate accumulation patterns typical of tropical estuarine environments. These findings establish baseline carbon storage estimates essential for climate mitigation strategies and ecosystem valuation. The study highlights the role of Sri Lankan dry zone mangroves in global carbon cycling and the need for adaptive management frameworks incorporating blue carbon. These findings are important for Sri Lanka's national climate change commitments and for incorporation under national communications. Additionally, this study can support future ecosystem-based climate financing instrument development.

Keywords: *Allometry, Blue carbon, Dry zone, Ecosystem, Mangroves, Biomass*