Effects of Floristic Composition on Mangroves Total Ecosystem Carbon Stocks: Aboveground, Belowground, and Soil Carbon Pools

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Mangroves play a critical role in climate change mitigation due to their high efficiency as carbon sinks. These ecosystems are recognized as major blue carbon pools, with a large proportion of carbon stored in soils. However, their carbon sequestration capacity varies depending on both abiotic and biotic factors, including floristic structure and composition. This study aims to assess the influence of floristic composition on carbon storage across mangrove ecosystems in southwestern Madagascar. A total of 66 circular plots were established and classified into six species assemblages. Aboveground carbon (AGC) and belowground carbon (BGC) were derived from aboveground biomass (AGB) estimated with species-specific allometric equations and belowground biomass (BGB) estimated with a generalized allometric equation, converted with a carbon fraction of 0.47 and 0.39, respectively. Soil organic carbon (SOC) was determined from soil samples collected at five depth intervals (0-15, 15-30, 30-50, 50-100 and 100-200 cm) using a CHN analyzer, and total ecosystem carbon (TEC) was estimated as the sum of all pools. Results showed that up to 100 cm depth, TEC ranged from 123.6±45 to 239.9±52.5 Mg C ha^{-1}. Mixed stands dominated by *Ceriops tagal* and *Rhizophora mucronata* exhibited the highest carbon stocks across all pools ($p < 0.05$), including AGC (37.5±19.1 Mg C ha^{-1}), BGC (21.9±8.75 Mg C ha^{-1}), and SOC_{100} (180.4±44.1 Mg C ha^{-1}). Beyond 100 cm depth, mixed-species stands maintained higher carbon storage potential (348.2±77.2 Mg C ha^{-1}) compared to monospecific stands (221.1±46.3 to 262.9±69 Mg C ha^{-1}) ($p < 0.01$). Overall, total ecosystem carbon followed the same trend as SOC, highlighting the major contribution of SOC to mangrove carbon stocks. These findings emphasize the importance of floristic diversity and composition in enhancing carbon sequestration and support the role of mixed mangrove systems in climate change mitigation strategies.

Keywords: *Mangrove ecosystems, Species composition, Total ecosystem carbon, Carbon pools, Blue carbon, Madagascar*