

Valuing Carbon Stocks across a Tropical Lagoon after Accounting for Black and Inorganic Carbon: Bulk Density Proxies for Monitoring

ABSTRACT

Managing seagrass and mangrove can be enhanced through carbon valued payment incentives schemes. Success will depend on the accuracy and extent of the carbon stock mitigation and accessible methods of monitoring and marking changes. In a relatively closed socioecological Southeast Asian lagoon we estimated the value of total organic carbon stocks (TOC) of both seagrass and mangroves. Mitigation corrections were also made for black carbon (BC) and calcareous inorganic carbon equivalents (PICEquiv), and their sediment dry bulk density (DBD) tested as a cost effective means of both estimating those stock concepts and possible impacts outside their parameter confidence intervals. Overall, seagrass and mangroves TOC densities across the lower lagoon ranged from 15.3 ± 4.3 and 124.3 ± 21.1 Mg C ha⁻¹ respectively, 175.2 ± 46.9 and 103.2 ± 19.0 Mg C ha⁻¹ for seagrass and 355.0 ± 24.8 and 350.3 ± 35.2 Mg C ha⁻¹) for mangroves across the two upper lagoon branches. Only mangrove biomass made significant additional contributions ranging from 178.5 ± 62.3 to 120.7 ± 94.8 Mg C ha⁻¹ for lower and upper regions respectively. The difference between the lagoons total seagrass and mangroves TOC stocks (5.98 ± 0.69 and 390 ± 33.22 GgC respectively) was further amplified by the lagoons' larger mangrove area. When corrected for BC and PICEquiv, the carbon stock mitigation was only reduced by a moderate 14.2%. Across the lagoon the sedimentary DBD showed strong ($R^2 = 0.85$, $P R^2 = 0.67$, $P R^2 = 0.6$, $P -3 \pm 0.07$). Valuations as CO₂e was worth on average 0.44 million US\$ y⁻¹ over 20 years; less than the total income of the indigenous users as potential custodians (1.8 and 7.4 million US\$ y⁻¹). Implications of this valuation was discussed.