Quantification of Belowground Biomass and Sediment Accretion in Mangroves of Different Coastal Environmental Settings of the Costa Rican Pacific Coast

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The adaptation of intertidal ecosystems such as mangroves to anticipated accelerated relative sea level rise is dependent on net increase of sediment surface elevations and forest migration inland. Ecosystem models developed to simulate trajectories of ecosystem adaptations have determined that rates of soil formation are most sensitive to surface sediment (organic and inorganic) deposition and subsurface organic production by mangrove roots. Mangrove belowground biomass contributes to soil organic matter accumulation, while mangrove litter has minor contribution due to export and annual decay. In addition to belowground biomass production, inorganic sediment loading is also a key contribution to soil formation and accretion. Incorporating necromass (dead root mass) into model simulations enhances soil formation estimates, as this component represents a substantial portion of the soil's refractory organic matter pool. However, it is frequently neglected in field studies, impeding our comprehension of its contribution to mangrove soil formation. Mangrove belowground bio- and necro-mass allocation (total belowground mass) and vertical accretion may vary both among and within coastal environmental settings in response to geomorphic forcings and gradients in resources (nutrients), regulators (salinity, sulfate) and hydroperiod (flooding frequency, depth and duration). Carbon allocation by mangrove total belowground mass and soil formation rates vary according to coastal geomorphology. I established this study in an estuarine (Nicoya Gulf) and in a deltaic (Térraba-Sierpe Delta) coastal environmental setting along the Pacific coast of Costa Rica to test differences in coastal environmental settings in a mesotidal conditions. Root mass was sampled using the trench method, and accretion was assessed via the feldspar marker horizon method and plastic mesh plates for comparison. I found no significant differences in biomass allocation and necromass contribution between estuary and delta coastal environmental settings. Similarly, accretion rates exhibited no significant differences across these coastal settings. I estimated the first field-based belowground biomass/necromass allocation and accretion estimates for Costa Rican mangroves. Improved confidence in these estimates reduces uncertainty in accretion rate simulations. Our findings contribute to Costa Rica's National Blue Carbon Inventory and enhance estimates crucial for soil cohort models predicting sediment accretion and carbon sequestration rates in Costa Rican estuaries, deltas, and similar ecosystems worldwide.