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## Carbon Exchange: Do Mangrove Forests Facilitate Carbon Outwelling to Seagrass Beds and Coral Reefs?

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### Abstract

Recent research highlighted the importance of connective nutrient fluxes between systems within the tropical coastal seascape i.e. mangrove forests, seagrass beds and coral reefs. Connective nutrient fluxes have been shown to facilitate the establishment and health of these ecosystems. However, the complex interactions of carbon exchange between connected mangrove forests, seagrass meadows and coral reef ecosystems are poorly understood. The amount of dissolved carbon exported by the mangrove forest and made available for passive tidal exchange between downstream seagrass meadows and coral reefs may be important in understanding changes in coastal productivity. Currently, there is limited quantitative data on the effect of DIC availability from mangroves on recipient ecosystems. In addition scientists and managers lack information of the actual hydrodynamic movement of dissolved and particulate nutrients between these systems. Here, we quantify the amount of DIC outwelled from mangrove leaf litter and the mangrove forest and made potentially available for phytoplankton, seagrass beds and coral reefs. This data is then used to develop a model, validated with data from our site (Chwka Bay, Zanzibar), which captures the most relevant processes of carbon exchange in the present time. An essential additional aspect in the model is that the areal extent of mangrove forests and seagrass beds can be changed to allow us to see how changes in size of the ecosystems will alter nutrient fluxes across the seascape. We can also monitor movement of nutrients fluxes within the coastal zone from an external nutrient source such as a fish farm. Both of these aspects would allow us to relate how future scenarios of the bay could affect the extent of mangrove forests and seagrass beds and thus derive from this affects on the ecosystem services.

**Keywords:** Coastal productivity, connective nutrient fluxes, coral reefs, dissolved carbon, mangrove forests, model, seagrass beds, Zanzibar