CARBON DYNAMICS IN MANGROVE ECOSYSTEMS: INTERACTIONS BETWEEN INTERTIDAL AND SUBTIDAL HABITATS

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The role of mangrove primary production in the carbon cycle of mangrove ecosystems and in the coastal zone continues to be an issue of debate. Although it was long hypothesized that a direct trophic link exists between mangroves and faunal communities in adjacent aquatic habitats, all recent studies find little or no evidence for the existence of such a link, and many of the earlier work which fed the persistence of the 'outwelling hypothesis' may need to be re-interpreted. On the other hand, recent studies suggest that imported organic carbon from mangrove creeks, lagoons, or the adjacent sea does have an important trophic role.

In this talk, we summarize some of the current views on the functioning of mangrove ecosystems and their interactions with adjacent aquatic habitats. Mangroves are highly variable, however, and a whole gradient exists from 'retention systems' which show little export or import, and 'flow-through' systems where export of mangrove carbon and import of external carbon sources are prominent. Such variations are expected to have a major impact on the carbon dynamics in mangrove ecosystems. In particular, we find that the carbon substrate for microbial populations varies strongly between mangrove ecosystems with different sedimentary carbon inputs, and that for 'flow-through' systems with important external carbon inputs to the intertidal zone, surprisingly few species of macro-invertebrates make significant use of mangrove carbon as a food source but rather depend on imported and locally produced microalgae. Preliminary results suggest that as more mangrove litter is retained within the system, its trophic importance also becomes higher. Large uncertainties remain concerning the ecological fate of exported mangrove carbon. As little evidence can be found for its assimilation by subtidal faunal communities, and as the sedimentary organic carbon pool in some systems suggest that its contribution is minor, mineralization might represent a quantitatively important fate of mangrove production, although very few direct measurements exist. For an extensive mangrove ecosystem in the Gautami Godavari delta (east-India), we demonstrate that very abrupt local changes can occur in the aquatic biogeochemistry, whereby mangrove creeks act as localized sites of mineralization of organic matter, and for subsequent efflux of CO_2 towards the atmosphere.