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## The role of mangroves in a changing coastal environment

In contrast to the global trend of mangrove decline, New Zealand mangroves are rapidly expanding, facilitated by elevated sediment inputs in coastal waters as a consequence of large-scale land use changes following European settlement. Mangroves in New Zealand thrive in the sheltered environments of infilling drowned river valleys with abundant supply of fine terrigenous sediments, showing various stages of mangrove succession. Biophysical interactions between the vegetation and the hydrodynamic forces in these mangrove systems determine the spatial distribution of the sediment deposition and shape the expansion dynamics of the mangroves.

In a series of comprehensive field experiments, we recently studied these biophysical interactions along cross-shore transects in the mangroves of Whangapoua Harbour and those in the Firth of Thames. Both mangrove systems have established relatively recently and are rapidly expanding, yet the two systems differ quite significantly in their extent, geography and dynamics. At each site, sediment transport and deposition was monitored concurrently with (profiles of) the tidal flow speeds. In addition, turbulence was measured within and above the pneumatophore understory, which consists of a (dense) cover of aboveground mangrove roots of 5-35 cm height. The latter measurements have been complemented by a controlled flume experiment, unravelling the effect of vegetation density and shape on vertical distributions of flow speed and turbulence in these pneumatophores.

Our results show that the fringe of the mangroves, where tidal currents first meet the vegetation, forms a sediment trapping environment. In this zone, flow speeds reduce significantly compared to the intertidal flats in front of the mangroves, particularly near the bed within the pneumatophore understory. This vegetation induced change of the velocity profiles is found to reduce near-bed turbulence substantially. Whereas multiple confounding factors in the field compromise a straightforward relation between vegetation density and the resulting flow and turbulence profiles, the flume results show clear correlations between those parameters. The observed quiescent conditions in denser pneumatophore canopies can enhance sediment deposition and reduce erosion rates, whereas the increased turbulence that is observed over the top of these denser canopies could also facilitate greater cross-shore sediment fluxes into the mangroves.

The capacity of mangroves to enhance sediment deposition and to mitigate coastal erosion, provides these ecosystems with an intrinsic resilience that could benefit the safety and quality of the coastal zone, now and in the future.

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