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TITLE: Mangrove?forest evolution in a sediment?rich estuarine system: opportunists or agents of geomorphic change?

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ABSTRACT:

Abstract The majority of the world's mangrove forests occur on mostly mineral sediments of fluvial origin. Two perspectives exist on the biogeomorphic development of these forests, i.e. that mangroves are opportunistic, with forest development primarily driven by physical processes, or alternatively that biophysical feedbacks strongly influence sedimentation and resulting geomorphology. On the Firth of Thames coast, New Zealand, we evaluate these two possible scenarios for sediment accumulation and forest development using high?resolution sedimentary records and a detailed chronology of mangrove?forest (Avicennia marina) development since the 1950s. Cores were collected along a shore?normal transect of known elevation relative to mean sea level (MSL). Activities for lead?210 (210 Pb), caesium?137 (137 Cs) and beryllium?7 (7 Be), and sediment properties were analysed, with 210 Pb sediment accumulation rates (SARs), compensated for deep subsidence (~8 mm yr ?1) used as a proxy for elevation gain. At least four phases of forest development since the 1950s are recognized. An old?growth forest developed by the late?1970s with more recent seaward forest expansion thereafter. Excess 210 Pb profiles from the old?growth forest exhibit relatively low SARs near the top (7?12 mm yr ?1) and bottom (10?22 mm yr ?1) of cores, separated by an interval of higher SARs (33?100 mm yr ?1). A general trend of increasing SAR over time characterizes the recent forest. Biogeomorphic evolution of the system is more complex than simple mudflat accretion/progradation and mangrove?forest expansion. Surface?elevation gain in the old?growth forest displays an asymptotic trajectory, with a secondary depocentre developing on the seaward mudflat from the mid?1970s. Two? to ten?fold increases in 210 Pb SARs are unambiguously large and occurred years to decades before seedling recruitment, demonstrating that mangroves do not measurably enhance sedimentation over annual to decadal timescales. This suggests that mangrove?forest development is largely dependent on physical processes, with forests occupying mudflats once they reach a suitable elevation in the intertidal. Copyright © 2015 John Wiley & Sons, Ltd.

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