



## **Multiple equilibria in tidal eco-geomorphology**

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The dynamics of estuaries and lagoons are the result of complex feedbacks between coupled biotic (e.g. linked to halophytic vegetation and microphytobenthos) and abiotic processes (chiefly sediment erosion and deposition, hydrodynamics, eustatism and sea-level change). In contrast, our understanding of their dynamics has so far evolved within separate disciplines, e.g. concerned with the morphological evolution of tidal flats, marshes and channels or with specific compartments of tidal ecosystems, such as marsh vegetation or microphytobenthos. Here we introduce an eco-geomorphological model for the time evolution of the elevation of a tidal platform regularly inundated by the tide. The model, based on the sediment continuity equation, includes the effects of vegetation and microphytobenthos on sediment erosion and deposition. A variable set of stable and unstable equilibria emerges, depending upon suspended sediment availability, type of vegetation, disturbance of the benthic biofilm, and rate of sea level change. We show that switches between stable states may occur providing explanations for the observed response of real tidal systems to disturbances and changes in external forcings.