

Physical context of lagoon marshes facing varying sediment availability

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The services of coastal ecosystems are critical to the functioning of the Earth's life-support system, and their provision is intimately governed by biotic-geologic couplings, and the temporal evolution of key-factors influencing ecosystems conservation/maintenance. This work assesses the temporal evolution of salt marsh ecosystems and analysis its triggering processes, both natural processes and human activities. We applied imagery analysis to investigate the capacity of tidal flats and salt marsh to develop and evolve under different hydrodynamics and sediment availability conditions. The studied marsh lays in the backbarrier of a multi-inlet barrier island system, in the shallow mesotidal lagoon, Ria Formosa lagoon (Portugal). It is composed of sand-silt sediments and colonised by halophyte species, whereas the tidal flat is characterized by silty-sand and muddy-sand inter-tidal bottoms, supporting one of the most important meadow habitats in the lagoon system. A 60-year time-series of aerial photographs were used to measure changing states of marsh development and 2D maps were produced based on topography, sediment organic matter distribution and vegetation.

Data analysis showed that the main sediment source for tidal flat and salt marsh development was driven by over-washes and delivered from the Armona Inlet flood delta. Diverse rates of marsh growth were associated with different stages of inlet narrowing. Average marsh displacement towards the lagoon was below 0.3 m/year, doubling the surface area during the first 40 years of observations. Marsh response to sediment availability over the past 60 years was relate to the steps of vegetation colonization and their topographic position. The obtained findings help to predict the fate of important ecosystem services and thus can assist the design of adaptation strategies facing sea-level rise.