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Venice lagoon salt marsh vulnerability and halophytic vegetation vertical migration in response to sea level rise

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Salt marshes are biogeomorphic systems that provide important ecosystem services such as carbon sequestration and prevention of coastal erosion. These ecosystems are, however, threatened by increasing sea levels and human pressure. Improving current knowledge of salt-marsh response to changes in the environmental forcing is a key step to understand and predict salt-marsh evolution, especially under accelerated sea level rise scenarios and increasing human pressure. Towards this goal, we have analyzed field observations of marsh topographic changes and halophytic vegetation distribution with elevation collected over 20 years (between 2000 and 2019) in a representative marsh in the Venice lagoon (Italy).

Our results suggest that: 1) on average, marsh elevation with respect to local mean sea level decreased , (i.e. the surface accretion rate was lower than the rate of sea level rise); 2) elevational frequency distributions are characteristic for different halophytic vegetation species, highlighting different ecological realized niches that change in time; 3) although the preferential elevations at which different species have changed in time, the sequence of vegetation species with increasing soil elevation was preserved and simply shifted upward; 4) we observed different vegetation migration rates for the different species, suggesting that the migration process is species-specific. In particular, vegetation species colonizing marsh edges (Juncus and Inula) migrated faster facing to changes in sea levels than Limonium and Spartina , while Sarcocornia was characterized by delayed migration in response to sea level changes. These results bear significant implications for long-term biogeomorphic evolution of tidal environments.

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