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Editorial: Coastal Wetlands Dynamics

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Editorial on the Research Topic

Coastal Wetlands Dynamics

Coastal wetlands, provide crucial ecosystem services. These precious ecosystems are influenced by environmental change and human pressure and can be extremely dynamic from a geomorphological perspective. Among the others, the recent interest in wetlands is linked to the capability of these systems to serve as Nature-Based Solutions against flooding and to protect coastal communities from environmental change. The goal of this Research Topic is to collect recent studies exploring wetlands dynamics from a holistic viewpoint to summarize the state of knowledge on fundamental wetlands functioning as well as to provide evidence of efforts in terms of wetlands restoration and protection around the world.

Wetlands systems are interlinked with their large-scale geomorphological and hydrological settings which should be considered when evaluating their dynamics and when thinking about large-scale restoration efforts. For instance, an estuarine scale approach (Ladd et al.) has been used to show the importance of geomorphic compensation as a large-scale self-organizing pattern that facilitates the long-term persistence of salt marshes in estuaries by showing how over a time frame >50 years, salt marsh erosion was compensated by expansion of marshes somewhere else in the estuary. An investigation in Cedar Island (Hein et al.) highlights the interdependencies between back-barrier wetlands and barrier islands stability and has described a workflow for the choice of the characteristics of restored marshes for contribution to the stability of the whole barrier-island blackberries system and also accounts for design and financial constraints together with restoration benefits.

Sediments dynamics also largely influence wetlands' response to environmental change. Understanding sediments signature on wetlands is important because a positive sediment budget can help sustain healthy and resilient wetlands. An investigation in the Southern Yellow River Sub-Delta (Zeng et al.) has shown that a decline in upstream sediment supply over the past decades has resulted into sediment coarsening and this could have consequences for the geomorphological evolution of the delta. Interpreting sediments signatures within wetlands is a complex process. For the Venice Lagoon (Roner et al.), a holistic set of methodologies have been applied to explore sedimentation dynamics which suggested the existence of a time-lag between enhanced riverine inputs and their signature in the salt-marsh succession. This is because sediments get first stored on the lateral margins and are resuspended on the marsh platforms by wind waves at a later time. The case of Chesapeake Bay (Vona et al.) has been used to explore sediments exchange between salt marshes, submerged aquatic vegetation (SAV), and ripraps and showed how SAV helps stabilize bed level and shoreline.

Overall coastal restoration efforts have increased around the world. In Wang H. et al., satellite images from the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) offer a test case highlighting that protection and restoration efforts can be effective when trying to increase mangroves areas and also suggest the need for eco-friendly strategies to avoid the spreading of non-native species and decrease in habitat quality. In this sense, a study in the Yangtze Estuary

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salt marshes has shown the importance of diking design to maintain the connectedness through canals of areas within different portions of the embayment for the control and protection of biodiversity (Wang S. et al.). Alternative methods such as the use of Bamboo based fences (Mai Van et al.) have been tested in the Mekong Delta and have suggested favorable results in terms of mangroves restoration.

Wetlands have an important role in carbon dynamics and biogeochemical cycling and some of the articles within this Research Topic have explored these aspects in detail. For instance, it has been shown (He et al.) that fine roots play an important role in carbon storage, and fine root dynamics have a significant effect on carbon sequestration in mangrove ecosystems. It has been also shown (Yu et al.) that environmental filtering of pH and salinity jointly govern the assembly of prokaryotic community in offshore sediments. Finally, subsurface hydrodynamics underpin the eco-functions of salt marshes and an investigation has been presented about the impact of soil stratification (a low-permeability mud layer overlying a high-permeability sand layer) on the variable-density groundwater flow (particularly unstable flow) and solute transport in regularly tide-flooded marshes (Wu et al.).

Advancements in the understanding of wetlands dynamics have been also possible thanks to improvement in the methods available for their investigation. For instance, advancement in numerical modeling (Kalra et al.) has allowed incorporating both lateral erosion and vertical accretion including biomass production into fully coupled hydrodynamic and morphodynamical models. An investigation in Barnegat Bay through this modeling has shown that organic deposition mainly occurs in the marsh interior, whereas deposition of mineral estuarine sediments occurs predominantly along the channel edges. Recent modeling results have also shown that when thinking about coastal restoration, effective wave dissipation (>90% of wave energy reduction) is seen with a vegetation cover as low as 50% (Castagno et al.).

This Research Topic has collected a holistic set of research studies, providing points of reflection for a comprehensive evaluation of coastal wetlands including geomorphological, hydrological, and ecological viewpoints. Additional research points which are worth exploration include, but are not limited to, an understanding of the connectivity of wetlands with adjacent ecosystems, an exploration of the windows of opportunity for the establishment of coastal wetlands, investigation of the most efficient techniques for monitoring and proper diagnosis (Taylor et al., 2021). Coastal wetlands restoration is being increasingly adopted by countries around the world as a sustainable measure for coastal protection which also supports carbon capture and net-zero targets. However, wetlands are under pressure from climate change and human activities and continuous research is needed to support better understanding of wetlands dynamics.

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