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Editorial: Carbon sinks in coastal wetlands: influences from multiple factors

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Editorial on the Research Topic
Carbon sinks in coastal wetlands: influences from multiple factors

Coastal wetlands, such as salt marshes, mangrove forests, seagrass meadows, and mud flats, are highly productive and valuable for sustainable development. Commonly referred to as "blue carbon" ecosystems because of their relevance in the global carbon (C) cycle, they provide climate mitigation benefits and a wide range of ecological services, such as erosion control, biodiversity support, water quality protection, and C sequestration (Lovelock and Duarte, 2019 and Macreadie et al., 2021). Despite covering a relatively small area, coastal wetlands are estimated to sequester nearly 54 Tg C yr^{-1}, thereby serving as an efficient and natural "C sink" (Wang et al., 2021).

Coastal wetlands are also one of the most vulnerable and threatened ecosystems on Earth due to a series of anthropogenic and natural pressures (i.e., environmental pollution and biological invasions) (Yang, 2019). Such disturbances can dramatically impact their ecological integrity and C sequestration potential in the receiving systems. However, the ecological feedback and consequences remain significantly uncertain, which is a subject of growing interest and concern globally.

The editors of this special issue work on this research field in their academic careers for many years. With the support of a topic coordinator, three editors launched this Research Topic. We begin with modeling research by Li et al., which estimated the trade-offs between ecological degradation and the economic benefits of invasive plants and coastal reclamation in China. The authors concluded that coastal reclamation favors rapid economic gains over long-lasting ecological value while posing a potential long-term threat to the ecological integrity and C sinks of coastal wetlands. Another study by Carpenter et al. highlighted the importance of non-vegetated habitats in C accounting and management strategies. The study confirmed that the sequence of C-storing habitats was mangroves>saltmarshes>microbial mats>mudflats>seagrass>coastal sabkha, with the corresponding C contents of 94.3, 63.6, 51.6, 46.8, 32.5, and 31.0 t/ha, respectively, in the United Arab Emirates. In a similar study assessing C stock conducted in Southern Thailand, Phiranram et al.characterized the geophysical and chemical properties of peatlands in coastal wetlands, particularly C storage. Average values of bulk density

(0.19 g/cm^3) and total organic C (31.18 wt. %) from sediment core samples (7.5 cm diameter, 1 m length) were used to determine the C density of the peat layers, with a result of 64.09 Kg C/m^3 in the study area. Overall, these research contributions further recognized the enormous potential of coastal wetland ecosystems to store and sequester carbon.

Despite the accepted publications in this special topic highlighting the impacts of coastal reclamation, plant invasion, and environmental pollution, on carbon sink capacity in different types of coastal wetlands (peatlands, mangroves, salt marshes, mud flats, seagrass), knowledge gaps in understanding the critical roles in maintaining the blue C function still exist, such as the mechanisms of C sequestration (Liao et al., 2024a), the origin of buried C (Holmquist et al., 2024), the production and emission of greenhouse gases (Liao et al., 2024b), the linkages between C biogeochemistry and other elements, and the vulnerability to climate change and non-climatic disturbances (Wei et al., 2021; Zhang et al., 2023), and look forward to future research exploring these topics. Finally, as guest editors, we appreciate all the authors and reviewers for their great contributions. We hope that this Research Topic can incentivize researchers to persistently protect coastal blue C ecosystems, and provide scientific solutions for coastal wetland conservation and C neutrality policies.

Author contributions

JL: Writing – original draft, Writing – review & editing. SJ: Writing – review & editing. YL: Writing – review & editing. JI: Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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