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Vulnerability to sea-level rise and the potential for restoration to enhance blue carbon sequestration in salt marshes of an urban estuary.

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Abstract

Coastal wetlands can be vulnerable to sea-level rise (SLR) but are valued as nature-based solutions to climate change mitigation and adaptation. Ecosystem services and benefits derived from these habitats can be degraded by anthropogenic impacts, so restoration activities are promoted as a management approach. This study examined the potential for hydrological restoration of disused commercial salt extraction pans to enhance carbon (C) sequestration in the urban Swartkops Estuary, South Africa. We also considered the impact of SLR to 2100 on the distribution of estuarine habitats, the vulnerability of built infrastructure to tidal flooding, and how C sequestration is projected to change over time using the Sea-Level Affecting Marshes Model (SLAMM). Restoration of 320 ha to estuarine habitat was estimated to generate an increase of 67 850 Mg C. Establishing tidal connectivity was investigated as a potential restoration action, but most of the salt pan area was above the elevation of the current tidal range and would require excavation. Conversion of the salt pans to estuarine habitat was predicted to occur without intervention under SLR, but 44% of the original area would remain unchanged. Restoration of these areas would significantly increase the extent of transitional/floodplain marsh, even under SLR to 2100. C sequestration was predicted to be 15% higher (54 614.8 Mg C) by 2100 if the salt pans could be restored, compared to if no action is taken. Overall, restoration has the potential to enhance C sequestration, but SLR will still cause large losses of supratidal marsh due to 'coastal squeeze' and extensive tidal flooding of developed areas by 2100 in the lower reaches of the estuary. A full-scale restoration approach for the Swartkops Estuary could use C sequestration potential and carbon offsetting, but additional social and ecological goals need to be incorporated for a holistic and beneficial outcome.

Keywords

Sea-Level Affecting Marshes Model, tidal marsh, carbon storage, Spartina maritima