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The importance of geomorphology, sea-level change and human action in the recent evolution of saltmarshes along the Tróia peninsula, Sado estuary, Portugal

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Abstract

Introduction

Saltmarshes are valuable ecosystems, crucial in shoreline protection. Understanding their recent dynamics is essential to create mitigation plans, especially against SLR.

This work studies the evolution of six saltmarshes located along the Tróia sandspit (fig.1A) using historical aerial photographs with the goal of (1) determining multi-decadal trends of saltmarsh change; (2) interpret them in the context of marsh geomorphology; and (3) relate them to concurrent changes in sea-level & land-use.

Methods

A large dataset of aerial photographs and orthophoto-maps was acquired, spanning the period 1942-2018. The photographs were georeferenced through back-stepping and geomorphological sketches were created through heads-up digitizing. Overlay analysis was performed to create maps of differences between sequential years and for the entire interval. Lastly, several landscape indices were calculated to assess marsh fragmentation throughout.

Results

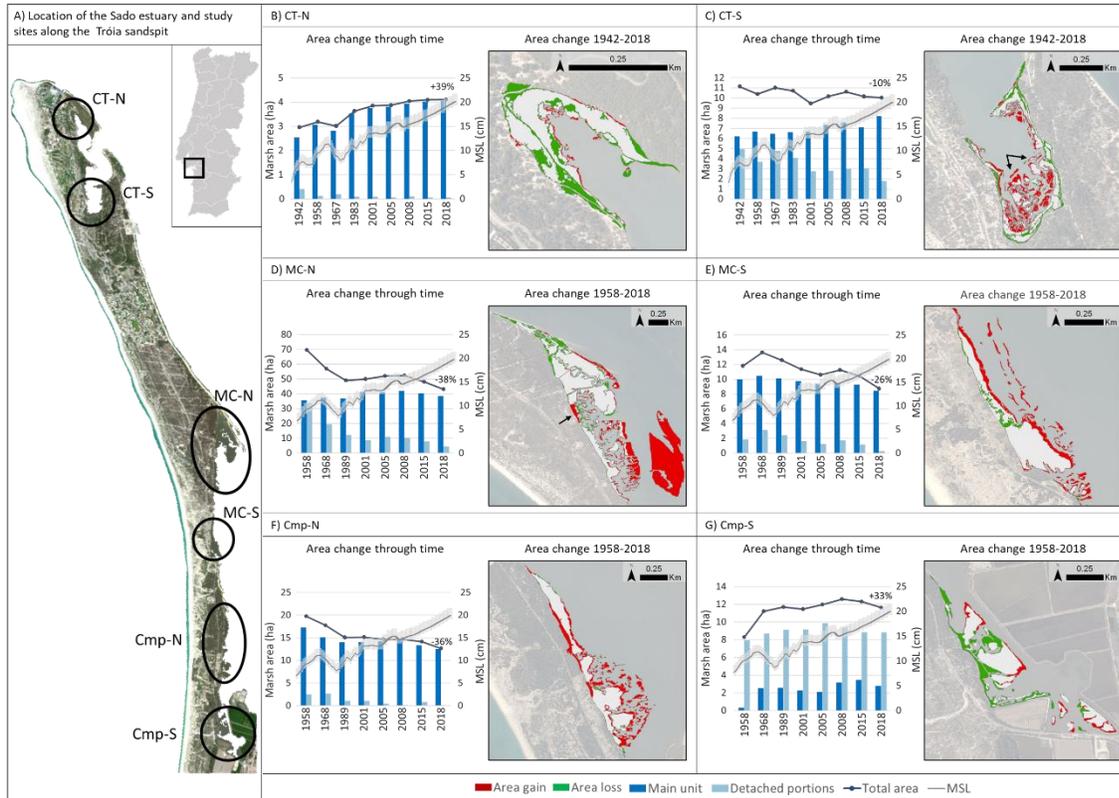
The progression of the marsh area and the overall changes during the study period are shown in figure 1.

Only CT-N (fig.1B) and Cmp-S (fig.1G) increase in size, all other marshes suffer substantial losses in total area. Where marsh islands exist, they disappear first through fragmentation and drowning. Once the main unit is exposed to wave action, marsh edge retreat begins or accelerates, primarily via erosion and slumping. Availability of accommodation space and level of protection seem to be key factors in marsh resilience.

There appears to be a link between the rise of the mean sea-level and the colonization of terrestrial areas, as well as with the drowning of the marsh islands.

Direct human action can be observed in CT-S (fig.1C) where the presence of a tide mill in the past defined the marsh's morphology; and in MC-N (fig.1D) where the marsh was destroyed to build a cement platform.

Globally, these saltmarshes shrunk over 30ha ($\approx 27\%$) in the past 70 years.



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