ECOGEOMORPHIC ADAPTATION OF A COASTAL DUNE IN SOUTHERN PORTUGAL

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ABSTRACT

Coastal dunes are complex landforms, whose morphology results from interactions between biotic and abiotic factors. This work explores the ecogeomorphic longshore variability and recent multidecadal shoreline evolution of a coastal segment (1.4 km-long), located at the downdrift end of Ancão peninsula (Ria Formosa, Portugal), aiming to understand the main drivers of the observed variability and the implications in terms of dune ecogeomorphic adaptation.

Key-words: Plant community distribution, foredune height, shoreline, dune states, Ria Formosa

1. INTRODUCTION

Coastal dunes frequently show significant morphologic variance alongshore, which results from the combined effect and potential interactions of a number of factors. Understanding and mapping dune morphologic variability is key to understand the vulnerability of these systems to storms, as well as their adaptation at longer time scales. The present work aims to identify the possible links between the variation in the long-term (*i.e.* 65 years) evolution of the shoreline along a coastal segment and the present-day dune ecogeomorphic (*i.e.* interdisciplinary approach to the study of the linkages between ecology and geomorphology) configurations. Such links can inform about the possible adaptation strategies to be adopted by dune systems.

2. METHODS AND DATA

The study area is located at the eastern end of the Ancão Peninsula, within the Ria Formosa barrier island system (S Portugal). It comprises a 1.4 km-long coastal barrier stretch, delimited to the west by the Praia de Faro settlement and to the east by a narrow migrating inlet (*i.e.*, Ancão Inlet). To identify the main factors controlling the recent ecogeomorphic evolution of the dunes in the area, long-term shoreline trends (past 65 years) were combined with high-resolution data on short-term topographical changes and data on the distribution of dune plants and morphological characterization (Figure 1). Data from different sources were integrated through multivariate statistical analyses.

3. RESULTS

The data extracted from the different temporal scales and properties to characterize the system indicate that some variables were uniform alongshore (*e.g.*, dune ridge elevation, ridge width) while others showed significant variability (*e.g.*, long-term shoreline change trends, active dune elevation, patterns of volume change). One principal component, produced by a principal components analysis, explained 82.03% of the total variance of the dune system in terms of morphology, vegetation coverage, shoreline trends and recent topographical changes, and divided the system into three sectors, defining distinct dune states (prograding, transitional and inland migrating). Detrended correspondence analysis showed cross-zone zonation in species composition and abundance in the eastern sector and squeeze of the gradient in the western part.

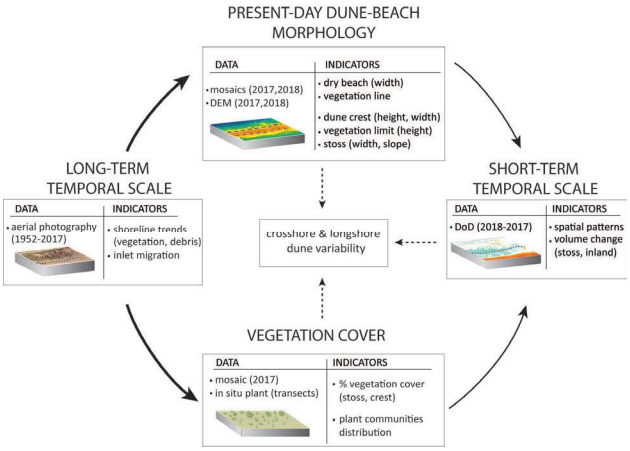

Figure 1. Approach of the present study, indicating the interactions between different factors and temporal scales.

4. DISCUSSION AND CONCLUSIONS

The obtained correlations can be interpreted as the statistical representation of morphologic and biologic feedbacks and can help to define different dune states. Overall, the main driver controlling the high variability of dune states over this narrow barrier stretch appears to be the long-term evolution of the shoreline. In addition, it is found that the role of vegetation on dune growth is rather passive and mainly controlled by regional (low precipitation and sediment transport potentials) and local conditions, namely variations in the sediment supply alongshore. Therefore, despite the undeniable role of vegetation in reinforcing dune topography, local external forces may dominate dune adaptation, inhibiting, allowing or reinforcing ecogeomorphic interactions in the long-term.

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