

Morphological and sedimentological monitoring of a man-induced accretionary beach – dune system (Ca' Roman, Venice, Italy)

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Abstract

A detailed morphodynamic and sedimentological survey has been carried on one of the few sites along the barrier islands of the Venice lagoon where a complete coastal dune system still survives, recently included in pSIC. The high aeolian transport potential, as well as the accretionary trend caused by the shoreline advance updrift to the northern Chioggia jetty, gave rise to the formation of a large dune assemblage during the last Century. The collected data, together with the historical documentation analysis, have allowed to the reconstruction of the evolutionary history, and a better knowledge of the processes regulating the formation and the development of coastal dunes in this geographical area.

Keywords: Foredune; Accretionary beach; Dune monitoring; Management; Venice lagoon.

Introduction

For a long time the barrier islands bordering the Venice Lagoon have been subjected to man-made huge modifications. Despite the systematic coastal dune destruction occurred along the most part of the northern Adriatic sea after World War II, some complete foredune systems still survive, as rare witness of an ancient and significant morphogenetic activity. These small areas are biotopes identified as pSIC (IT3250023) "Venice barriers: littoral biotopes (Lidi di Venezia: biotopi litoranei)". One of these areas has been selected, due to its particular interest, for a detailed morphological and sedimentological study. The aim was either to improve our knowledge on the processes controlling the formation and the development of coastal dunes in this geographical area, and to consider possible management strategies in the framework of recent beach and dune nourishment interventions, carried out without any local specific study.

Study area

The Ca'Roman beach is located at the southern tip of Pellestrina island, Venice, and is characterized by a parallel series of dune ridges, with a vegetation succession of a certain

importance for the geographical context (Gehu *et al.*, 1984). The present morphological structure is the result of a continuous beach accretion, documented since the end of the first phase of the construction of the jetties of the Chioggia inlet, in 1911 (Zunica, 1971).

The wind regime appears particularly favourable as the exposure is practically onshore with respect to the dominant ENE wind, locally known as “Bora”. The direct human impact is considerably reduced, above all because of the natural isolation of the area.

The beach area and the dunes have been subject to a monitoring field survey during one year, including a detailed topographical and morphological survey along four transects, the sediment samples collection, the anemological data analysis, the comparison of historical maps and aerial photographs.

Results

The data collection and analysis have allowed to outline the conditions for the present development of the beach-dune system, and to reconstruct the evolutionary history related to the foredune morphology and beach-dune sedimentary budget (Psuty, 1988).

The present beach state is still accretionary, and the incipient foredune consists of coalescent shadow bodies, arisen due to the Bora wind action, at about 60m from the shoreline. The average elevation is up to 2m. Landwards, the incipient forms are followed by five dune ridges, grown during relative stable beach phases and featuring progressive increasing dimensions, up to 4.5m high. A positive sedimentary budget has been computed for the present foredune area, 50-60m wide, nourished by deflation over the dry beach. The sediment feeds above all the incipient foredune, and only subordinately the present foredune, which is thus destined to become a secondary dune within a short time. From the sedimentological point of view, the beach is made of fine sand, which, for the grain-size characteristics does not represent a limitation to the aeolian transport. Anyway, the effectiveness of the selective process by the wind is such to nourish dune with sand considerably finer and better sorted than the beach one. On the whole, the Ca’Roman beach highlights a high potential for foredune development and conservation, due to the favourable natural morphodynamic condition. The knowledge of the aeolian and beach dynamic constraints may address the local managers to more correct actions toward beach-dune reconstruction proposal, which recently involved the neighbouring beaches and partially also the Ca’Roman site itself.

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