Coastal Vegetation Zonation and Dune Morphology in Some Mediterranean Ecosystems

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ABSTRACT

This paper describes the vegetation zonation and its relationship with dune local morphology through the application of a randomization test on some sandy ecosystems of the Italian Mediterranean coast. We postulate that the slope and the aspect of sand dunes are essential variables in the analysis of a correct plant community position along the sea–inland vegetation gradient. This study presents an analysis of coastal vegetation zonation in some of the best preserved sites of the Lazio coast (central Italy). Analysis of variance with randomization testing was performed in order to establish whether community differences are related to slope and aspect. Results from vegetation transects showed that complete community sequence is lacking in the study area. Although some community types are very common and widespread, others are rare and only restricted to areas with well-preserved dune ridges. Regarding slope/aspect, the randomization test shows that only community types located in both extremes of the vegetation gradient revealed significant differences while no differences were found for rare or heavily disturbed communities.

ADDITIONAL INDEX WORDS: Randomization test, sandy ecosystems, central Italy, multifactor comparisons, coastal dunes.

INTRODUCTION

Coastal dune vegetation zonation is associated with tolerance to gradients of coherence and salinity of sandy sediments, wind, salt spray, and wave inundation (Barbour and De Jong, 1977; Ranwell, 1972). In well-preserved dune ecosystems, it is assumed that typical dune vegetation zonation is closely related to the geomorphological and sedimentological features of dune systems (Aboudha, Musila, and van der Hagen, 2003; Carter and Wilson, 1990). Owing to this interdependence between community types and the environment, the analyses of vegetation zonation growing in dune ecosystems can only be properly understood if it is treated as a whole.

Vegetation is an important controlling factor for dune morphology, given that it impedes sand movement (Wolfe and Nickling, 1993). Many disturbance factors affect European coastal ecosystems (Van der Maarel, 2003). More specifically, coastal erosion, agriculture, urban development, and tourist pressure should be mentioned for the Italian coast (Acosta et al., 2003; Gehu and Biondi, 1994a; Gehu et al., 1984; Pignatti, 1993). Coastal sand dunes have been identified as being particularly susceptible to destabilization through visitor pressure, which has increased dramatically in the last 50 years (Curr et al., 2000). As far as the Italian coastal dunes are concerned, they are currently undergoing a geomorphological change that, in general, leads to the modification, and in some cases to the destruction, of geoforms that support plant communities (Valpresa and Simeoni, 2003).

A better understanding of the disturbance effects induced on dune morphology and plant communities should provide a significant contribution to the ecology and conservation of coastal ecosystems. However, very few detailed studies have investigated the possible relationships between plant coenoses and local dune morphology. Several studies on Holocene dune vegetation along the central Italian coast have described plant communities from the tide line back to fixed dunes (Acosta et al., 1998, 2000; Acosta, Blasi, and Stanisci, 2000; Filiesi and Ercole, 2000; Vagge and Biondi, 1999). However, no studies concerning the relationship between vegetation zonation and local morphology have been carried out on a quantitative level.

In this paper we first describe coastal vegetation zonation (major community types and spatial patterns) in some of the best preserved sites of the Lazio coast through vegetation transects. We then pose the question whether community types of the coastal zonation are associated with the slope and the aspect of sand dunes. We postulate that these two environmental variables are essential to analyse the correct community position along the sea–inland vegetation gradient. Finally, we analyse the relationship between phytoeco-