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Changes of Bulgarian Coastal Dune Landscape under Anthropogenic Impact

A. Palazov (1), R. Young (2), M. Stancheva (1), and H. Stanchev (1)

(1) Institute of Oceanology, Bulgarian National Oceanographic Data Centre, Varna, Bulgaria (palazov@io-bas.bg), (2) Program for the Study of Developed Shorelines, Western Carolina University, Belk 294 Cullowhee, NC 28723, USA

At one time large sand dune formations were widely distributed along the Bulgarian coast. However, due to increased urbanization in the coastal zone, the areas of total dune landscape has been constantly reduced. Dunes presently comprise only 10% of the entire 412 km long coastline of Bulgaria: they embrace a total length of 38.57 km and a total area of 8.78 km2

Important tasks in dune protection are identification of landscape changes for a certain period of time and accurate delineation of sand dune areas. The present research traces sand dune changes along the Bulgarian Black Sea coast over a 27 year period (1983-2010). This period includes also the time of expanded tourist boom and overbuilding of the coastal zone, and respectively presents the largest dune changes and reductions. Based on the landscape change analyst in GIS environment the study also aims to explore the importance of different natural and human factors in driving the observed dune alterations and destruction.

To detect and assess dune changes during the last 3 decades, we used data for sand dunes derived from several sources at different time periods in order to compare changes in shoreline positions, dune contours and areas: i) Topographic maps in 1:5,000 scale from 1983; ii) Modern Very High Resolution orthophotographs from 2006 and 2010; iii) QuickBird Very High Resolution satellite images from 2009; iv) Statistical information for population and tourist infrastructure is also used to consider the influence of human pressure and hotel developments on the dune dynamics. In addition, for more detailed description and visualization of main dune types, digital photos have been taken at many parts of the Bulgarian coast. The study was performed in GIS environment.

Based on the results obtained the dunes along the Bulgarian coast were divided into three main groups with relation to the general factors responsible for their alterations:

i) Dunes that have decreased in result of shoreline retreat and erosion of the beach itself. Typically dunes are located behind sand beaches and they are part of the beach-dune systems. Such type of dune reduction could be driven by combination of many factors, both natural ones (such as severe storms, erosion, heavy rains or flooding) and human impacts (large number of installed coast-protection structures along the coast, which interrupt the sediment transport, create new sedimentary deficit and generate erosion). During the recent years most of the Bulgarian beaches have progressively eroded and their areas have significantly been decreased.

ii) Dunes that have been reduced/damaged and lost due to expanded tourist and housing infrastructures/developments and due to afforestaion activities. The principal sources of human impacts on sand dunes in Bulgaria are rapid coastal urbanization over the recent years (i.e. hotel and residential constructions, roads, parking structures, and other related infrastructure), unregulated camping and “temporary” constructions on the dunes, a lax regulatory environment that tolerates the re-zoning of protected sand dunes to “agricultural” areas. At most recreational sites there were wide coastal dunes, which however have been destroyed during tourist constructions. Such are dunes at the most famous Bulgarian sea resorts of Golden Sands and Sunny Beach in the areas of Varna and Nessebar. As a consequence, major areas along the Bulgarian coast were completely urbanized by hotels and other infrastructures and large sand dune systems were damaged.

iii) Dunes located at still undeveloped coastal sections: yet they are naturally preserved and unthreatened by human pressure boom. These are just a few dune sites: at the northernmost portion of the Bulgarian coast (in the area of Durankulak), at the central part in the region of the largest Bulgarian river, Kamchia River, and along the southernmost coastline (in the area of Veleka River).

Although sand dunes in Bulgaria are protected areas and national reserves they have been exposed to large anthropogenic pressure in particular over the last decade. There is an increased demand now of proper management and urgent conservation activities. Such measures first require an accurate understanding of dune properties/behaviour, assessment of anthropogenic factors affecting dune persistence and identification of coastal areas most sensitive to risk of destruction.

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