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Overview of erosion and beach quality issues in three Southern European countries: Portugal, Spain and Italy

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ABSTRACT

Climate change and intensive coastal development place beaches under significant pressures, both natural and anthropogenic. Coastal erosion and deterioration of beach quality decrease the attractiveness of coastal areas leading to economic impacts. The societal response to these issues has resulted in application of hard/soft engineering methods to mitigate erosion and provision of quality awards to support the recreational beach value. This paper reviews the approaches to erosion and beach quality issues in three Southern European (Portugal, Spain and Italy) countries, discusses effectiveness of the approaches, and analyses the impacts of applied approaches on environmental quality and human welfare. An analysis of used management approaches demonstrates the inefficiency of hard measures to stop erosion and their negative impact on environmental quality. Such management approaches have been used as an emergency response to problems, and were not supported by the adequate knowledge of possible consequences. In contrast, successful experiences in application of soft methods allowed preservation of the natural status of beaches and improvement of tourism quality. Beach quality awards allowed to fulfil tourism requirements and promoted a good image of beaches. Examples of good and bad practices contribute to proper onsite management, and thereby encourage sustainable development of coastal areas.

1. Context and scope

The tourism industry is an important economic driver in coastal regions, generating employment and contributing a high percentage of regional incomes. Annually coastal countries invest in the provision of quality awards and systems in order to enhance the recreational quality and improve the environmental status of beaches. There is also a costly investment in the provision of different hard and soft engineering works in order to protect beaches from erosion and maintain good recreational conditions.

The geographical focus of the paper is on mainland coast of three Southern European countries (Portugal, Spain and Italy). These were chosen due to the popularity of countries as destinations for seaside tourism and to give a range from the Atlantic to the Mediterranean. Greece was not included because of the large number of islands. This paper reviews the approaches to erosion and beach quality issues in three Southern European countries, discusses the effectiveness of the approaches, and analyses the impacts of applied approaches on environmental quality and human welfare.

2. Introduction

Beaches are valuable natural resources that provide key ecosystem services, such as coastal buffering, nutrient cycling, water purification, biodiversity, recreational and cultural value (Nel et al., 2014). Human pressures on coastal resources compromise the delivery of many ecosystem services crucial to the human well-being and national economies (Dayton et al., 2005). The degradation of beaches due to growing popularity of tourism and rapid coastal development may be intensified by the predicted increases in storminess and sea-level rise (Brown and McLachlan, 2002;

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Schlacher et al., 2008; European Commission, 2013). The most common problems of modern beaches include coastal erosion, water and sand pollution, deterioration of coastal dunes and harmful effects on biota (Brown and McLachlan, 2002; Calvã et al., 2013).

The importance of beach management for the sustainable development of coastal areas has been recognised by the municipalities and local governments (Phillips and Jones, 2006). Improving beach quality is a shared goal for all stakeholders and an essential aspect of Integrated Coastal Zone Management (ICZM) (Duvat, 2011). Beach management should be aimed to achieve the optimal physical usage and development of beach resources that respects the natural physical elements of a beach environment while satisfying basic social needs within that environment (Williams and Micallef, 2009). Therefore, the beach management should include both aspects: i) protection of coastal environment and ecosystem and ii) quality improvement (development) for recreational uses.

Within this context, the paper aims to identify the nature of beach uses and main issues in the 3 countries, (Portugal, Spain, Italy), to review management approaches to coastal erosion and recreational quality, to analyse the main shortcomings and advantages of used approaches and their effect on environmental quality and human welfare. Finally, recommendations for future beach management are suggested.

3. Beach uses and issues

3.1. Beach tourism and coastal development

Beaches are the main focus of global holiday tourism and a well-managed beach is considered to be an icon of the attractive seaside destination (Holden, 2000). The growing popularity of seaside tourism influenced the development of coastal areas, including large-scale infrastructure, transport, industry, energy production (Suarez di Vivero and Rodriguez Mateos, 2005). Southern Europe was accounted for the highest number of international tourist arrivals within Europe (UNWTO, 2013). Portugal, Spain and Italy are one of the most visited countries, where tourism is almost exclusively concentrated around the "*Sun, Sea and Sand*" (3S) model (Ariza et al., 2008a; Dodds and Kelman, 2008: Marrocu and Paci, 2013; Presenza et al., 2013; Vareiro and Ribeiro, 2007).

Portugal: The Portuguese coast is very diverse and it has all type of beaches, ranging from urban developed and crowded beaches to less developed, wild and deserted (e.g. the islands of the Ria Fromosa). Approximately 85% of the GDP is generated within 60 km of the coast, where tourism is the main activity (Andrade et al., 2004). The total contribution of 'Travel and Tourism' to country's GDP was 15.6% in 2013 (WTTC, 2014a).

Spain: Spain is ranked 4th within Europe and also 4th of all 140 countries included to the Travel and Tourism Competitiveness Index 2013. 'Travel and Tourism' activity in Spain represented 15.7% of the country's GDP, mostly concentrated in coastal areas (WTTC, 2014b). As well as in Portugal, Spanish beaches are very diverse and free for public use.

Italy: Italy has excellent tourism infrastructure (equal with Austria for 1st place) (Blance and Chiesa, 2013). The total contribution of 'Travel and Tourism' to country's GDP was 10.3% in 2013 (WTTC, 2014c). Coastal tourism is a leading segment for Italian tourism (European Comission, 2014). Contrary to Portugal and Spain, most of the Italian beaches are not free but bound by 'concessions'—temporary properties occupied by beach establishment and relative facilities, that can be used for a daily fee.

3.2. Vulnerability and coastal erosion

Vulnerability is defined as 'the degree to which a system is susceptible to or unable to cope with, adverse effects of climate change' (IPCC, 2001). Coastal vulnerability, especially of urban coasts, is a growing global problem (Brown and McLachlan, 2002; Newton et al., 2012; Sekovski et al., 2012; Newton and Weichselgartner, 2014). Natural disasters intensified by anthropogenic pressures potentially increases vulnerability, risks and losses (Munich Re, 2012). Most of European sandy shores are affected by growing erosion, with retreat rates in some instances of up to a few metres per year (European Commission, 2009a). Coastal erosion is a natural process, which represents landform recession or lowering brought by natural actions, often trigged or intensified by human actions (Pranzini and Williams, 2013). Modern coastlines suffer from erosion, due to a sediment deficit as fluxes are disrupted by human actions, through damming, quarrying, sediment retention in reservoirs, agricultural practices, land reclamation, urbanization and coastal engineering (Crossland et al., 2005; Defeo et al., 2009; Nordstrom, 2000; Renaud et al., 2013; Sherman et al., 2002; Syvitski et al., 2005). It was estimated by the Eurosion project (2004) that about 20,000 km of the European coast (which is over 20% of the total coastline) suffers from serious coastal erosion. Coastal erosion may induce a wide variety of negative ecological and socio-economical impacts such as increased loss of property and potential loss of life, damage to infrastructure, loss of tourism and recreation, contamination or disappearance of water storage wells, loss of costal and benthic flora and fauna.

Tourism and coastal erosion issues in the three countries are summarised in Table 1.

Portugal: Positioned in the southwest of Europe, mainland Portugal is exposed only to the Atlantic Ocean. The archipelagos of Azores and Madeira, which are also popular tourist destinations, are autonomous regions of Portugal and also Atlantic. The Portuguese coastline is about 1187 km, from which approximately 44% are beaches. The coast is diverse in its geomorphologic features including sandy beaches and dunes, high cliffs and low-lying rocky shores, coastal lagoons and barrier islands. High energy waves and the intense long-shore sediment drift make the continental Atlantic coast naturally vulnerably to erosion and flooding, with Lisbon and Algarve being the most exposed regions (Martins et al., 2013). It was estimated that 349 km of Portuguese coastline was impacted by erosion (Eurosion, 2004). Most of sandy beaches experience shoreline retreat of more than one meter per year (Ferreira et al., 2008).

Spain: Spain is located in south-western Europe on the Iberian peninsulas with borders to the Mediterranean Sea and the Atlantic Ocean. The Spanish territory includes the Balearic (Mediterranean) and Canary (Atlantic) Islands. Of the 6584 km of coastline, about 50% consists of hard and soft cliffs (particularly in Atlantic), around 28% of sandy beaches and 17% of low-lying areas such as deltas and lagoons (Gracia et al., 2013). The Spanish coastline is highly vulnerable to flooding and erosion. It was estimated that 824 km of Spanish coastline was impacted by erosion (Eurosion, 2004). The most effected and vulnerable regions are Andalucía with erosion along 41% of its coastline, Catalonia with 33% and Valencia with 26% (European Commission, 2009c). Spain is among the top five countries in terms of coastal protection and climate adaptation expenditure for the period 1998–2015 along the Atlantic Ocean (31%) and Mediterranean Sea (35%) (European Commission, 2009a).

Italy: Italy is a peninsular country with two large islands in the Mediterranean, Sicily and Sardinia. The Italian coastline borders the Adriatic, Ionian and Tyrrhenian seas (subdivisions of the Mediterranean) and includes both rocky coasts and low-lying sandy beaches (European Commission, 2009d). The Italian coastline is about