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Original Articles

The relationship between heritage, recreational quality and geomorphological vulnerability in the coastal zone: A case study of beach systems in the Canary Islands

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ABSTRACT

The relationships between geomorphological vulnerability, recreational quality and heritage at beaches in the Canary Islands (Spain) are studied using three sets of indicators. Processes and their interactions are analysed at urban, semi-urban and natural beaches. Natural, cultural and landscape heritage acts as an attractor of recreational activity, which has intensified significantly on Canarian beaches in recent decades. Overcrowding has negatively impacted conservation of the natural and cultural heritage of the beaches, and has increased human pressure, leading to an increase in geomorphological susceptibility. The resulting reduction in geomorphological resilience has had a negative impact on beach facilities. Despite this common pattern, the relationships between these processes have particularities associated with the different types of beach (urban, semi-urban and natural). In order to establish new priorities in coastal public policy, these beach diagnoses and indices should be discussed and debated by the different actors involved in beach management.

1. Introduction

Beaches are highly complex and dynamic environments characterized by changing physical condition on time scales that are typically shorter than in other coastal environments (Cowell and Thom, 1995). These modifications generate fragility and make beaches extremely sensitive to human interventions (Paskoff, 1993; Barragán, 1994; Woodroffe, 2002) that attempt to meet the needs for provision of ecosystem services (Barbier et al., 2011). Thus it is not surprising that population densities in the first 10–30 km along the coastline are higher than found further inland (Cendrero and Fischer, 1997).

Several authors have reported on the significant degradation that these systems have suffered in different countries in recent decades (Pilkey and Dixon, 1996; Cooper et al., 2009; Defeo et al., 2009), resulting from coastal development, inadequate management practices, and an academic approach that has not sufficiently considered social processes and their interactions with bio-physical processes. Beach management should therefore be established as an adaptive process that leads to continuous improvement in the overall state of the beach (Garnåsjordet et al., 2012). This process should, as far as possible, account (Folke et al., 2007) for internal changes (Anderies et al., 2004; Janssen et al., 2007; Ostrom et al., 2007) and external forces (Turner et al., 2003) that cause dynamic changes. These changes are interrelated and lead to the evolution of natural and social elements (Adger, 2006). Thus, the uncertainties in beach process dynamics (Mayumi and Giampietro, 2006) must be collectively managed by all stakeholders in the socio-ecological system (Funtowicz and Ravetz, 1990; Max-Neef, 2005), where the academic community is an essential element that aims to improve the quality of policy deliberations (Funtowicz and Strand, 2007).

Multidimensional analyses of socio-ecological systems to facilitate political deliberation are greatly aided by indicator systems (Gomiero and Giampietro, 2005; Nardo et al., 2005). However, their development poses significant challenges (McCool and Stankey, 2004) that are not always addressed successfully (Böhringer and Jochem, 2007). It is necessary to first clearly define the narratives linked to the indicators (perception of the problem), the external reference (context), and the measurement system (Garnåsjordet et al., 2012).

In recent years, different authors have developed management indicators for beaches which generally can be classified into three categories: recreational quality, heritage (natural, cultural and landscape), and geomorphological vulnerability. With some exceptions (Cervantes

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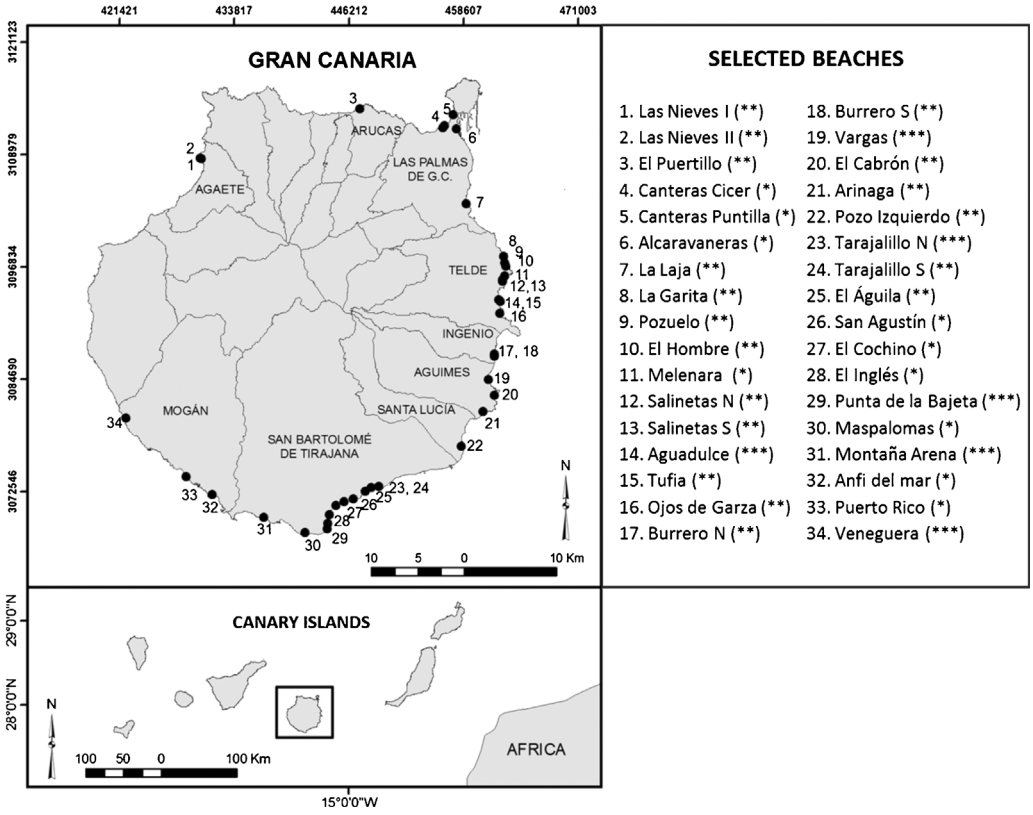

Fig. 1. Locations of Gran Canaria (Spain) beaches analyzed.
Key: * urban beaches; ** semi-urban beaches; *** natural beaches.

and Espejel, 2008; Ariza et al., 2010; Mclachlan et al., 2013; Botero et al., 2015), these schemes all partially consider these three components and, therefore, do not allow understanding of the cross-dimensional and accumulated impacts and their evolution.

The main objective of this research is to analyse the co-evolution of recreational quality (RQ), heritage value (HG), and geomorphological vulnerability (GV) on the beaches of the Canary Islands, following the intensified pressure from mass tourism that began in the 1960s. To achieve this we use a set of indicators for each of the concepts designed by Peña-Alonso (2015). In this context, recreational quality refers to those elements of the beach that increase user satisfaction; the heritage value is based on natural, cultural and landscape elements that are worthy of protection; and geomorphological vulnerability is related to agents that generate disturbances in the system (of natural or human origin), considering their intrinsic capacity to deal with these perturbations, and the variation of their geomorphology over time.

2. Background

2.1. Geomorphological vulnerability, recreational quality and heritage

The development and integrated use of these three sets of indicators allows us to analyse the relationships between natural processes and human activity in beach systems in the Canary Islands.

Geomorphological vulnerability is a function of the exposure factors to which the system is subject, its susceptibility and resilience (Cardona and Barbat, 2000; IPCC, 2007). Generally, it has been approached from the perspective of the risks associated with global climate change (Füssel, 2007) and its impact on increases in average sea level (Gornitz et al., 1994; Abuodha and Woodroffe, 2007; Ojeda et al., 2009; Klein and Nicholls, 2010; Pendleton et al., 2010; Fraile-Jurado, 2011); and also considering the action of storms (Pethick and Crooks, 2002; Jiménez et al., 2009; Bosom and Jiménez, 2011; Lozoya et al., 2011); or alteration of the coastline by anthropogenic causes (construction and artificiality, pollution, beach profile modification, inadequate management, etc.) as pointed out by Malvárez et al. (2000) and Mclaughlin and Cooper (2010), among others.

Recreational quality of beaches refers to the provision of services and infrastructure that enable beach users to relax, have fun and be entertained. Hence, the adequate provision of such services by managing bodies, landscape preservation, pollution controls, and the existence of adequate levels of comfort are necessary. In the last two decades, research into methods to evaluate recreational beach quality has been carried out (Leatherman, 1997; Morgan, 1999; Nelson et al., 2000; Ariza, 2007; Barbosa and Da Costa, 2008; Cervantes and Espejel, 2008; Williams and Micallef, 2009; Ariza et al., 2010; Ergin et al., 2010; Botero et al., 2015). These studies have mainly focused on beaches located in urban areas, where interaction between people and the environment generates the most intense conflicts (Nonn, 1987). In contrast, studies of recreational quality at natural beaches have so far been scarce, even though they are very much needed.

Assessment of territorial heritage has its origins in the so-called ecological planning (Mcharg, 2000) and reveals the value of a territory. This type of approach, developed by various authors from the 1960s (Godrón, 1963; Mcharg, 1969), was key to improvements in territorial planning through the valuation of natural resources by territorial units. In some studies, conservation quality is defined from the number of natural elements (flora and fauna) by environmental unit, which represents quality, fragility and uniqueness of the natural environment, and also from the degree to which heritage elements are present in each unit (Cendrero et al., 1990; Sánchez et al., 1995). The cultural and landscape dimensions are also included in valuation models (Sánchez et al., 1995; Tavío et al., 2002). In the present study, these models are applied to beaches for the first time.

2.2. Beach systems of the Canary Islands

The Canary Islands (Spain) consist of seven islands and four islets of volcanic origin. They are located in the eastern mid-Atlantic, just 95 km from the African continent (Fig. 1). At a geomorphological level, they