



[http://www.aprh.pt/rgci/pdf/rgci-523\\_Calado.pdf](http://www.aprh.pt/rgci/pdf/rgci-523_Calado.pdf) | DOI:10.5894/rgci523

## Small Islands Conservation and Protected Areas \*

### *Áreas Protegidas e Conservação em Pequenos Territórios Insulares*

H. Calado <sup>@, 1</sup>, C. Fonseca <sup>2</sup>, M. Vergílio <sup>1</sup>, A. Costa <sup>1</sup>, F. Moniz <sup>1</sup>, A. Gil <sup>3</sup>, J. A. Dias <sup>4</sup>

#### ABSTRACT

Islands may have a diversity of classifications, however, on this paper we address the constraints that include these territories in the category of small islands: size and population. To this particular balance and relation between population and availability of the territorial resource it sums the particular economic structures and the peculiar social constructions that shape islands communities and their relation with the surrounding environment.

The particular biogeography, the ecological specific features on islands and the fragile equilibrium they present stress the need for Conservation policies and strategies. Among the most effective tools used on Nature Conservation, protected areas and its management has become one of the most popular. The aim of this paper is to give a framework and overview on the management of protected areas in small islands.

**Keywords:** Islands; Development; Nature; Management.

#### RESUMO

*As Ilhas podem apresentar uma enorme diversidade de classificações, contudo, neste artigo, são abordadas as características que as incluem na categoria de Pequenos Territórios Insulares: tamanho e população. Ao balanço específico entre população e disponibilidade do recurso território, somam-se as particularidades das estruturas económicas e as peculiares construções sociais que moldam as comunidades Ilhéus e a sua relação com o meio natural envolvente.*

*A biogeografia específica, as características ecológicas únicas e o frágil equilíbrio que apresentam, tornam mais premente a necessidade de políticas e estratégias de Conservação. Entre as ferramentas mais eficientes em Conservação da Natureza, as áreas protegidas e a sua gestão contam-se entre as mais populares. O objetivo deste artigo é apresentar um enquadramento e visão geral da gestão de áreas protegidas em Pequenos Territórios Insulares.*

**Palavras Chave:** Ilhas; Desenvolvimento; Natureza; Gestão.

@ - Corresponding author: [calado@uac.pt](mailto:calado@uac.pt)

1 - CIBIO - Research Center in Biodiversity and Genetic Resources / InBIO - Associate Laboratory, University of Porto, Portugal. Rua da Mãe de Deus, 13-A, 9501-801 Ponta Delgada, Portugal

2 - e-GEO - Research Centre for Geography and Regional Planning, Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa, 1069-061 Lisboa, Portugal

3 - Azorean Biodiversity Group (CITA-A), Department of Biology, University of the Azores, 9501-801 Ponta Delgada, Portugal

4 - CIMA (Centro de Investigação Marinha e Ambiental), Universidade do Algarve, Faro, Portugal.

## 1. INTRODUCTION

Small islands are defined as those with approximately 10.000 km<sup>2</sup> or less and approximately 500.000 or fewer residents (Beller *et al.*, 2004). Diversity of topics related to the islands is huge, making its simple mention incompatible with small texts as necessarily are papers in scientific journals (*e.g.*, Dias *et al.*, 2010). The complexity of the problems that they share demands for a more thematic approach. The option in this paper is to focus on Nature Conservation, namely Protected Areas.

The Convention on Biological Diversity (1992) emphasizes the importance of in-situ conservation, *i.e.*, “*the fundamental requirement for the conservation of biological diversity is the in-situ conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings*” (UN, 1992). Protected areas are a fundamental tool of such conservation, contributing to the maintenance and recovery of ecosystems’ reference conditions. In addition to their ecological value, protected areas have a large potential in cultural, recreational and economic terms. They protect landscapes and features which, at the local level, are often keystones to communities’ culture and identity. Local communities and visitors may also explore the multiple opportunities for outdoor sports and other recreational activities in these areas, enjoying a closer contact with nature. These characteristics make protected areas relevant tourism destinations thus promoting local economy, creating employment and business opportunities (SCBD, 2008).

The International Union for Conservation of Nature defines protected area as a “*clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values*” (Dudley, 2008). However, protected areas can be classified not only for the conservation of biological and ecological values but also for the protection of important geological, cultural and scenic features.

The role of protected areas in reaching sustainable development has been widely recognized by international and national organizations and currently there are more than 100.000 protected areas worldwide (IUCN, 2010). Nevertheless, these areas are insufficient to adequately shelter all ecosystems, habitats and species in need of protection (SCBD, 2004). One of the main difficulties is to ensure an effective management of these areas that can guarantee the achievement of the conservation objectives.

Challenges to planning and management of protected areas are numerous. Questions such as best configuration, priority objectives, required human and financial resources, evaluation of actions implemented, engagement of stakeholders, communication with local communities and conflicts’ resolution are familiar problems to those dealing with the implementation and management of protected areas (Fonseca *et al.*, 2011). In addition, the lack of available information, biophysical changes and socio-economic pressures require adaptive approaches and solutions tailored to the needs of the ecological, geological, cultural and landscape heritages at stake.

Small islands’ particular characteristics (namely their isolation, limited physical space and natural resources, closed systems, endemism, terrestrial/marine ecosystems linkages) add specific problems in terms of nature conservation. At the same time, economic and social development is a major concern in territories with small economies, seriously dependent on external markets, high transport costs and small populations (Hassan *et al.*, 2005). In this context, protected areas classification, planning and management is just as essential as demanding.

Currently, small islands are in the international spotlight with 2014 declared by the United Nations as the International Year of Small Island Developing States, trying to raise awareness on the unique value and challenges of these territories. Coinciding with this initiative, the International Day for Biological Diversity 2014 was dedicated to island biodiversity. Islands are considered biodiversity hotspots by harbouring a high number of endemic species in small areas (Hassan *et al.*, 2005; Deidun, 2010). Insular ecosystems are particularly vulnerable and in need of protection, however conservation measures may conflict with local communities’ expectations and land uses thus requiring special attention in terms of planning and management (Fonseca *et al.*, 2011).

This article aims to provide a framework overview regarding management of specific natural values on islands ecosystems. The main focus will be protected areas in small islands, as they represent a global tool and solution for Nature Conservation.

## 2. ISLANDS: SMALL TERRITORIES, BIG CHALLENGES

Throughout the History small islands have been extremely relevant on civilization development and international trading organization. As known, first civilizations were fluvial (as Mesopotamia, dependent on the Tigre and Euphrates, and Ancient Egypt, subordinated to Nile) being relatively scarce the use of the marine environment. However, it was on those ancient times that, more or less sporadically, first steps were taken to establish trading with distant regions using the sea. However, intensive use of the sea for communication between far lands only emerged about five thousand years ago with the development of the Minoan civilization, on the island of Crete, on the Oriental Mediterranean. As usual, this was no coincidence. On its origin there were several factors, such as the island morphology, the scarcity of agricultural productive soils, the shaped accident littoral that enclosures several natural ports and the richness of marine resources that led to the development of fisheries, shipping architecture and navigation skills (*e.g.*, Braudel, 1998; Dias, 2004).

Being familiar with the sea and having acquired good navigation skills, it is not surprising that the Minoan civilization had rapidly become the first world thalassocracy (*thalassa* = sea; *kratia* = power), the first success civilization deeply dependent from the sea. On the first half of the second millennium they dominated the entire maritime trading on the Oriental Mediterranean Region, being the link between the other regional civilizations. They were succeeded by the Mycenaean on the second half of the second millennium b.C. (who also had Crete as base), by the Phoenicians, the

Ionians and the Dorians (already on the first half of the first millennium b.C). In fact, all the maritime trading and connection links between the different civilizations that were going to shape the entire Occidental History had its origins in that small island of Crete.

Due to their specific characteristics (namely the location on ocean context), small islands have always been connected, somehow, to civilization development. As an example, one can point out the importance of the islands of Madeira, Canary, Azores and Cape Verde on the Portuguese maritime expansion (and the Iberia in general) lead to what has been considered as the first globalization. Small Oceanic Islands served (and still serve today) has essential support points for the international maritime trading. However, in most cases, the habitable space available is scarce (they are mostly steep slopes and mountains) with poor undevelopable soils (mostly rock). Until the second half of the XX century, these small islands fulfilled their role as supporting spots for navigation and international trading. The population surplus allied to isolation and difficult living conditions (and often natural disasters) originated intense migration fluxes that disperse throughout the world, as verified in Madeira, Azores and Cape Verde. However, those same natural conditions that inhibited the development of great urban centres and promoted emigration also ended to protect small islands from environmental predatory actions. It's a reason to say that *clouds do have silver linings*. Even with the consolidation of mass tourism, that seeks essentially sun and beach, small islands have remained, in general, relatively immune to negative environmental actions normally associated with that activity (extensive touristic resorts, deeply altered coastal ecosystems, etc)

The Industrial development consequences, the establishment of a global economy, the adoption of a highly consumptive model and the littoral allocation of societies and activities all around the world lead to the overcome of resilience limits on the larger part of our coastal ecosystems. On this highly worrying picture, some small islands still stand as environmental sanctuaries where often pristine ecosystems can be found.

Islands are particular territories, 'pieces' of land bounded by the sea and frequently isolated in relation to mainland, which can be perceived as self-contained systems. However they are strongly influenced by the surrounding ocean and atmosphere, and interaction processes may be established with adjacent islands and continental land areas (Cambers *et al.*, 2001). Islands characteristics turn these systems into natural laboratories for biogeography and ecology studies and other related disciplines (Whittaker & Fernández-Palacios, 2007). It was the analysis on the finches of the Galapagos Islands that pushed Darwin's theory of evolution a step further by linking origin with differences. Darwin carried other studies on island systems, namely geological works (Darwin, 1844) and studies on coral reefs found in the open sea and close to islands (Darwin, 1842).

The social, economic and political challenges posed by insular contexts have also been widely studied, particularly in what regards small islands territories (UNEP, 2013) Their isolation, small size and limited natural resources determine their socio-economic conditions, translated in

small economies of limited diversification, constraints on transport and communication, small populations prone to outmigration and lack of qualified personnel (Hassan *et al.*, 2005; Baldacchino & Niles, 2011).

Within the context of sustainable development, the international community recognized the unique challenges of Small Islands Developing States (SIDS) at the UN Conference on Environment and Development (1992). Chapter 17 of Agenda 21 includes a programme area on the sustainable development of small islands, further developed by the Barbados Programme of Action (BPOA, 1994). This instrument highlights the special challenges and constraints that have resulted in major setbacks for the socio-economic development of those States and translates Agenda 21 into specific actions and measures (UN, 2010).

Currently, the United Nations Department of Economic and Social Affairs lists 51 SIDS, including territories as diverse as Cape Verde, Cuba, Singapore and East Timor (UNDESA, 2014). However, according to the Commission on Sustainable Development (CSD), SIDS share remoteness, susceptibility to natural disasters, few and reduced resources, small populations, dependence on international trade and vulnerability to global developments, lack of economies of scale, high transportation and communication costs, and costly public administration and infrastructure. They also share some of the most fragile and vulnerable resources on the planet – their sheer beauty, unmatched opportunities for recreation and tourism, unique and exceptional biodiversity and remarkable human cultures (Bush *et al.*, 2008; UNEP, 2014).

The economies of most small islands have a limited resource basis, resulting in an excessive dependence on international trade and higher vulnerability to external forces, such as economic liberalization and migration flows (Mimura *et al.*, 2007). On the other hand, their geographic remoteness and dispersion place them at a disadvantage economically, as they are isolated from markets, thus reducing competitiveness (UNDESA, 2014).

## 2.1. Human activities and environmental issues

Small islands represent some of the most vulnerable regions in the world in what concerns intensity and frequency of natural and environmental disasters, as well as their increasing impacts, with high economic, social and environmental consequences (UNDESA, 2014). The geographical framework of small islands, as well as their morphological and ecological characteristics, leads to a higher vulnerability to certain threats and phenomena such as climate variability and changes, proliferation of invasive exotic species, natural catastrophes and overexploitation of natural resources (Rietbergen *et al.*, 2008), coastal erosion and landward seawater intrusion (Vivero, 1995).

Considering the specificities of small islands, the Millennium Ecosystem Assessment (2005) highlights the following environmental problems:

- scarce and vulnerable water resources: fresh water sources are limited to surface reservoirs and groundwater aquifers, highly dependent on rainfall, varying with the geographic location and the climate

of the island. Its scarcity and increasing demand make these resources more vulnerable to sea level changes, problems of overpumping of ground water (and consequent salination) and contamination through leaching of soil residues, pesticides and fertilizers;

- sensitive species: high number of endemic species, species with low competitive ability, limited distribution and small populations, with lower adaptive capacity and consequent tendency to extinction phenomena;
- vulnerability to invasive species: invasive species may compete directly or indirectly with native species and alter ecological processes, faster and in a more pronounced way than in mainland territories, thus causing serious ecological and economic damage, with high social costs.

In addition to these issues, economic and social particularities create other pressures on the ecosystems. On most islands, especially small oceanic islands, fishing has always represented an essential source of animal protein and an important economic activity. The constant demand associated with new fishing techniques puts into question the sustainability of this activity and the maintenance of stocks, already threatened by natural hazards and pollution.

The conversion of forested areas into agriculture or construction areas may jeopardize the sustainability of island systems, considering the crucial role of forests as regulators of hydrological cycles. Moreover, forests provide relevant products, food, wood, animal products and important protection services against natural and anthropogenic hazards.

With limited resources, many small islands developed in external dependence on fossil fuels. This dependency entails not only economic problems but also issues of pollution, demand for space and unsustainability. However, islands usually have renewable energy resources. The challenge lies in reconciling the exploitation of these resources with conservation objectives.

Tourism constitutes an important economical sector often dominant in small islands economy. The remarkable natural and cultural assets found in small islands can be major attractions for tourists and protected areas offer unique opportunities for visitors (Tisdell & Wilson, 2012). Historic, architectural and archaeological features commonly found in protected areas enrich tourists' experiences while contributing to preserve and promote local traditions (Eagles et al., 2002). The growing importance of nature tourism surely is a positive factor, with a huge potential for biodiversity conservation and to promote sustainable use of natural resources. However, tourism development must be carefully planned and managed to avoid the degradation and destruction of natural and cultural heritage.

Tourism as all other human activities such as agriculture, industry and construction, are a growing source of pollution all over the world. On small islands, the problem may be even more severe given the limited resources available for the treatment and disposal of waste and pollutants and the vulnerability of their ecosystems (Hassan et al., 2005).

## 2.2. Coastal Zones

Islands are strongly influenced by the surrounding ocean and atmosphere and their large ratios of coastline lengths to land area determine highly coupled terrestrial and marine ecosystems. In such conditions the impacts of natural and anthropogenic changes can be immediately visible (Millennium Ecosystem Assessment, 2005).

Coastal zone includes the terrestrial surface as far as tides, waves or winds reach and have an influence, and that is under the direct influence of sea activity (Velo-Gomes et al., 2008). The Protocol on Integrated Coastal Zone Management in the Mediterranean reiterates this approach (2009): "*coastal zone means the geomorphologic area either side of the seashore in which the interaction between the marine and land parts occurs in the form of complex ecological and resource systems made up of biotic and abiotic components coexisting and interacting with human communities and relevant socioeconomic activities*". Therefore, from an environmental impact perspective, small islands can be considered as being in its entirety coastal zones, and there is an immediate and direct impact of terrestrial socioeconomic activities on the marine environment (Pantin, 1994), as well as the opposite, as consequences of changes in the marine environment affect islands terrestrial territory.

Coastal zone in small islands is vital due to limited land availability and ocean exposure on all sides. It accommodates the majority of the population, supplies the majority of food and raw materials, it is a vital link for transportation, trade and communication with the outside world and it is a favourite destination for local people and tourists. It is therefore imperative to address unique coastal concerns of small islands, and to protect coastal environments while improving living standards within coastal communities (Calado et al., 2011; Calado et al., 2007).

The coastal vulnerability of island systems (particularly oceanic islands) results of the exposure of their extensive coastal areas to natural phenomena and dynamics, together with the inadequate infrastructures' development in the coastal zone, which may lead to serious problems of coastal erosion. In such conditions, the adverse effects of climate change and sea-level rise constitute high risks to the sustainable development of small islands (UNDESA, 2014). Climate change impacts will affect not only coastal communities but also important areas for conservation, considering the preponderance and relevance of coastal habitats on islands (Deidun, 2010).

Anthropological pressures are also a recognized threat to coastal and marine biodiversity, which has prompted intervention measures on behalf of environmental protection to ensure sustainability. Such measures try to restrict and prevent impacts of human and natural pressures on coastal and marine ecosystems and to assure a sustainable use of coastal and marine ecosystems. Coastal zone management plans and marine protected areas can play an important role in the conservation and sustainable use of such resources.

Natural resources, such as water, soil, air, shore systems and wildlife, can constitute important limits to the island' sustainable development depending on their level of exploitation, which can menace the ecosystem's functions.

Once destroyed these resources will hardly be restored due to the small capacity of these closed systems to recover (Goldsmith, 1991).

Islands systems represent one of the most pressing issues of our time: how to balance ecological integrity, economic development and collective wellbeing, illustrating the paradigm of sustainable development (Baldacchino & Niles, 2011). The main question is how to reconcile the need for space and resources for society and for conservation.

### 3. ISLANDS CONSERVATION: NEEDS AND TOOLS

Islands, and in particular oceanic islands, have been renowned for their extraordinary biota since Darwin studies and have, from then on, inspired scientists for the study of evolution, biogeography, ecology, and geology. In fact, ecology of island ecosystems is vastly different from that of mainland communities. Present-day islands' biotic assemblage's composition and functioning have been shaped by biogeographical, ecological and evolutionary processes dependent upon area, connectivity and isolation. Consequently they show particular patterns of colonization, adaptation, and speciation.

When islands emerge, ecological succession occurs as species that colonize the island by change events are prevented to leave due to isolation. High dispersal abilities are more likely to overcome distance which determines that plants, birds and certain insects are much more common on islands than poorly dispersing taxa like mammals. From the few new arrivals only some will be able to survive and establish populations. As a result, islands have fewer species than mainland habitats. Island populations are small, exhibit low genetic variability and are isolated from the predators and competitors that they initially evolved with. These new conditions provide opportunities to develop new strategies and adaptations. Different ecological pressures have dictated that some species become much more docile, may grow larger (island gigantism) or smaller (island dwarfism) Some of these unique adaptations are reflected in charismatic island species as Galapagos giant tortoise or komodo dragon. A high occurrence of endemism, where species are unique to a localized area, is also a consequence of this new environmental setting which acts upon the small genetic pool of the few successfully inbreeding colonizers thus resulting in the long run in a unique endemic species.

Oceanic islands, often rising from the deep ocean floor by volcanic activity, thus constitute favorable settings for speciation resulting in a remarkable high ratio of endemism when enough time has elapsed for selection processes to act upon first colonizers. Therefore age of the islands is an important factor to consider when addressing island biodiversity, also because older islands represent high probabilities for successful colonization by different organisms and a longer period for natural selection to take place. As result of their particular evolution processes, islands' ecosystems contribute to biodiversity disproportionately to their land area. Although islands constitute 3% of the land surface of the world, one in six of the earth's known plant species occur on oceanic islands (Fisher, 2004)

which comprise 30% of the world's biodiversity hotspots, representing 50% of marine tropical diversity with some unique and rare species (Myers *et al.*, 2000; Bellard *et al.*, 2014).

Island ecosystems are characterized by species scarcity, meaning fewer species per unit area than mainland, disharmonic assemblages as they tend to have a different balance of species compared to equivalent areas of mainland and this is enhanced with increasing isolation. These small populations, lower species numbers and simple ecosystem functioning represent increased vulnerability of islands biota both to natural disasters, such as hurricanes and earthquakes, and to human pressures like habitat destruction or pollution, due to their lower resilience when compared to mainland systems.

Island ecosystems have faced devastating effects of human colonization that has caused a high degree of extinction in the past and poses several severe threats in the present related to invasive species, climate change, natural and environmental disasters, land degradation and marine pollution.

Island conservation has become a vital international concern as islands display simple ecosystems, while providing natural laboratories to study evolution processes in action that can be extrapolated to larger ecosystems. Representing a microcosmos of the processes of threat and extinction in larger ecosystems, islands may also provide insights into effective management approaches.

#### 3.1. Protected areas management

As already mentioned protected areas play a key role in the conservation of threatened natural and cultural heritages, especially if properly managed. However, protected areas management entails a difficult balance between different objectives. Although conservation is the underlying objective, the successful management of these areas cannot forget the funding requirements of conservation actions neither the need to ensure the sustainability and well-being of local communities. To protect the natural values while ensuring opportunities for socio-economic development can be even more complex in island systems, where space is extremely limited and natural resources cannot be separated from the human activities. In such exiguous territories the classification of protected areas and the restrictions imposed will, most likely, conflict with populations' expectations and land uses (both inside and near these areas). In effect, protected areas are not isolated from their surroundings and therefore those involved in the management of protected areas or in any way likely to be affected by management decisions should be included in the decision-making process (Alexander, 2008). According to the IUCN Guidelines for management planning of protected areas (Thomas & Middleton, 2003) the main benefits of involving stakeholders in management planning are: increased sense of ownership, greater public involvement in decision-making and closer links between conservation and development. This promotes communication that allows problems' identification and resolution (Gil *et al.*, 2011). Furthermore, local stakeholders may contribute in different ways to the management of protected areas through local knowledge and traditional expertise (Alexander, 2008).

In addition to participative mechanisms, protected areas management must have into consideration the different dynamics of the system, be prepared to accommodate (unforeseen) changes and deal with uncertainty. In the particular case of natural resources' management, uncertainty may arise from the following issues (Allen *et al.*, 2011; Williams, 2011):

- i. Natural resources (ecosystems) are modified naturally over time through dynamic and not fully known processes;
- ii. Environmental variation is only partially predictable and often uncontrollable, inducing stochastic processes (e.g. climate variability);
- iii. The actual state of resources and systems is often unknown, in part because monitoring methodologies only allow partial observability (sampling variation);
- iv. The results of management interventions are not always properly assessed and such actions may change the system state, directly or indirectly, deliberately or not.

Some authors argue that the most appropriate approach to deal with the complexity of socio-ecological systems and inherent uncertainty is an iterative process of decision making and learning, adjustable as change occur and its effects are understood (Allen *et al.*, 2011; Williams, 2011). Such process of adaptive management seeks to promote a proactive attitude and a continuous adaptation to new conditions and needs, only possible if supported by mechanisms for monitoring and evaluation.

All the challenges discussed warrant international attention and action on these matters. For example, in 2004 the Convention on Biological Diversity adopted a specific program of work on protected areas to support the establishment and maintenance of comprehensive, effectively managed and ecological representative national and regional systems of protected areas. One of the goals established by the program of work was the effective management of all protected areas, in particular through the development of management plans (SCBD, 2004).

The World Heritage Convention (1972) has developed also operational guidelines for the implementation of the Convention (revised in 2012) in which advocates appropriate management plans for the nominated properties which often coincide, at least partially, with protected areas.

At the European level, article 6 of Habitats Directive (1992) request Member States to establish the necessary conservation measures involving, if need be, appropriate management plans specifically designed for the sites of community importance. As Natura 2000, the resulting European network of nature protection areas, is implemented at a national level by Member States, management plans can be an essential tool for achieving the conservation goals.

A management plan is a tool to guide managers and other interested parties so that they might follow a logical decision-making process both today and in the future (Rowell, 2009). In the specific context of protected areas it can be understood as a working document that guides and facilitates the management of protected area resources, controls the uses of the area and promotes the development of necessary infrastructures (Thomas & Middleton, 2003).

The first management plans for protected areas were developed by scientists, presenting a solid characterization of the area but lacking similar quality in business and organizational aspects such as costs, resources and results (RSPB, 2009). However, as practitioners struggled with implementation increasing attention has been paid to these aspects. The International Union for Conservation of Nature, for example, has developed the Best Practice Protected Area Guidelines series which includes publications on management planning, economic values, financing, sustainable tourism and effectiveness evaluation.

Although these guidelines for management planning of protected areas are not specific for island systems they are as important in these territories. Standard land use planning instruments, based only on systems for the control and zoning of uses and activities, have failed to fully promote the active management and conservation of protected areas (and Natura 2000 sites). Protected areas demand the highest possible levels of strategy, planning and activity programming. They further require managers to proceed with the utmost transparency and rigor while sharing management responsibilities, looking for the optimal utilization of human, technical, technological and financial resources of each of the stakeholders (Gil *et al.*, 2011).

Strategic planning on important environmental areas demands a strong involvement from citizens or the ones that depend of these areas. Stakeholders must be involved in all stages of the process, namely in the definition of the protected area's mission, vision for the future and goals. This process can succeed in unifying most of the divergent interests of public and private stakeholders by involving them directly in plan's conception and development. Protected Areas management can be more cost-effective when resulting from participation and co-responsibility of relevant stakeholders, distributing specific management actions among stakeholders that can be incorporated into their own annual activities schedules.

## CONCLUSION

Small Islands constitute a peculiar geographic entity. Diverse on their origins, locations and biophysical expressions they share common challenges and constraints. In general, oceanic islands are limited in space and isolated or remote. However, these conditions that limit their development patterns also dictate special biological and ecosystems features, with islands often being natural sanctuaries and presenting pristine conditions.

Natural resources, in general scarce, sensitive and vulnerable need special attention and management solutions in order to support islands development and to preserve good environmental conditions. Also, special attention must be paid to the unique living environments for some species worldwide.

All these challenges demand new debates and new strategic approaches to achieve sustainable development and environmental protection. While area-based management solutions like protected areas remain as the most efficient tool for this purpose their management needs to take into account the specificities of island territories. Instead of a conservation strategy focused only on species protection or areas/habitats management, a truly integrated approach must

be adopted, contributing to the sustainable development of the protected area and, ultimately, of the entire island. The compatibility and integration of the protected areas management with the planning system of the island must also be guaranteed, reflecting the effects of the planning policies and territorial management actions.

Such management strategy depends heavily on community-based solutions, strong public participation and stakeholders commitment in management actions implementation.

## ACKNOWLEDGMENTS

The authors would like to thank Fundação para a Ciência e Tecnologia (FCT) for funding the Project SMARTPARKS – Planning and Management System for Small Islands Protected Areas (PTDC/AAC-AMB/098786/2008).

The authors would like to thank Prof. António Frias Martins from CIBIO-Azores for his precious advices on islands environment.

## REFERENCES

- Alexander, M. (2008) - *Management planning for nature conservation: a theoretical basis and practical guide*. 426p., Springer, Dordrecht, The Netherlands. ISBN: 978-1402065811.
- Allen, Craig R.; Fontaine, oseph J.; Pope, Kevin L.; Garmestani, Ahjond S. (2011) - Adaptive management for a turbulent future”. *Journal of Environmental Management*, 92:1339-1345. DOI: 10.1016/j.jenvman.2010.11.019
- Baldacchino, G & Niles, D. (eds.) (2011) - *Island Futures: Conservation and Development Across the Asia-Pacific Region*. 183p., Springer, Tokyo, Japan. ISBN: 978-4431539896.
- Bellard, C.; Leclerc, C.; Courchamp, F. (2014) - Impact of sea level rise on the 10 insular biodiversity hotspots. *Global Ecology and Biogeography*, 23(2):203–212 DOI: 10.1111/geb.12093
- Beller, W.; D’Ayala, P; Hein, P. (eds.). (2004) - *Sustainable Development and Environmental Management of Small Islands*. (Vol. 5) 419p., UNESCO and The Parthenon Publishing Group, Paris, France. Available on-line at <http://pubs.iied.org/pdfs/7755IIED.pdf>
- BPOA (1994) - *Report of the global conference on the sustainable development of small island developing states*. Global Conference on the Sustainable Development of Small Island Developing States, United Nations General Assembly A/CONF.167/9. Available on-line at [http://www.un.org/esa/dsd/dsd\\_aofw\\_sids/sids\\_pdfs/BPOA.pdf](http://www.un.org/esa/dsd/dsd_aofw_sids/sids_pdfs/BPOA.pdf)
- Braudel, Fernand (1998) - *Les mémoires de la Méditerranée*. 399p., de Fallois, Paris, France. ISBN: 978-2877063043
- Bush, T.; Purvis, M.; Barallon, L. (2008) - Leadership Development in Small Islands States. In: Lumby, J.; Crow, G.; Pashiardis, P. (eds.), *International Handbook on the Preparation and Development of School Leaders*. pp. 452-464, Taylor and Francis, UK. ISBN: 978-0805863871.
- Calado, H.; Borges, P.; Phillips, M.; Ng, K.; Alves, F. (2011) - The Azores archipelago, Portugal: improved understanding of small island coastal hazards and mitigation measures. *Natural Hazards*, 58(1):427–444. DOI: 10.1007/s11069-010-9676-5
- Calado, H.; Quintela A.; Porteiro, J. (2007) - Integrated Coastal Zone Management Strategies on Small Islands. *Journal of Coastal Research* (ISSN: 0749-0208), SI50:125-129, Gold Coast, Australia.
- Cambers, G.; Mühlhig-Hofmann, A.; Troost, D.G. (2001) - Inter-regional initiatives for sustainable small-island development. *Proceedings of the Global Conference on Oceans and Coasts at Rio + 10*. UNESCO, Paris. Available on-line at <http://www.unesco.org/csi/smis/smisrio10.htm>
- Darwin, C. (1842) - *The structure and distribution of coral reefs*. 230p., Smith, Elder and Co., London, U.K. . Available online at <http://books.google.pt/books?id=qLsQAAAAIAAJ&printsec=frontcover&dq=intitle:coral+intitle:reefs+inauthor:Darwin&hl=pt-PT&sa=X&ei=j-OYU6OPBNSu7Abs1oHgBQ&ved=0CB8Q6AEwAA#v=onepage&q&f=false>
- Darwin, C. (1844) - *Geological Observations on the Volcanic Islands, Visited During the Voyage of H.M.S. Beagle*. 175p., Smith, Elder and Co., London, U.K. Available online at <https://archive.org/details/geologicalobser01darwgoog>
- Deidun, A. (2010) - Challenges to the Conservation of Biodiversity on Small Islands: the Case of the Maltese Islands. *International Journal of Arts and Sciences* (ISSN: 1944-6934), 3(8):175-187.
- Dias, J.A. (2004) - *A Conquista do Planeta Azul: o início do reconhecimento do oceano e do mundo*. 47p., Universidade do Algarve, Faro, Portugal. Available on-line at [http://w3.ualg.pt/~jdias/JAD/eb\\_CPAzul.html](http://w3.ualg.pt/~jdias/JAD/eb_CPAzul.html)
- Dias, J.A.; Carmo, J.A.; Polette, M. (2010) - Brief remarks on the islands and its management / Breves considerações sobre as ilhas e a sua gestão. *Revista de Gestão Costeira Integrada*, 10(3):243-253. DOI: 10.5894/rgci237
- Eagles, Paul F.J.; McCool, Stephen F.; Haynes, Christopher D.A. (2002) - *Sustainable Tourism in Protected Areas: Guidelines for Planning and Management*. 183p., IUCN – The World Conservation Union, Gland, Switzerland / Cambridge, UK. ISBN: 2831706483. Available on-line at [http://cmsdata.iucn.org/downloads/pag\\_008.pdf](http://cmsdata.iucn.org/downloads/pag_008.pdf)
- European Union (2009) - Protocol on Integrated Coastal Zone Management in the Mediterranean. *Journal of the European Union*, L 34/19-34/28, 4.2.2009. Available on line at <http://ec.europa.eu/world/agreements/downloadFile.do?fullText=yes&treatyTransId=12967>
- Fisher E. (2004) - Island ecosystems conservation and sustainable use: problems and challenges. *INSULA - the International Journal of Island Affairs*, Special Issue on Island Biodiversity, February, pp. 9–14.
- Fonseca, C.; Calado, H.; Silva C.P.; Gil, A. (2011) - New approaches to environment conservation and sustainability in Small Islands: The Project SMARTPARKS. *Journal of Coastal Research* (ISSN: 0749-0208), SI64:1970-1974, Poland. Available online at [http://www.ics2011.pl/artic/SP64\\_1970-1974\\_C\\_Fonseca.pdf](http://www.ics2011.pl/artic/SP64_1970-1974_C_Fonseca.pdf)
- Gil A.; Calado H.; Costa L.T.; Bentz J.; Fonseca C.; Lobo A.; Vergílio M.; Benedicto J. (2011) - A Methodological Proposal for the Development of Natura 2000 Sites Management Plans. *Journal of Coastal Research* (ISSN: 0749-0208), SI64:1326-1330, Szczecin, Poland.

- Goldsmith, F. (eds.) (1991) - *Monitoring for Conservation and Ecology*. 275p., Chapman & Hall, London, UK. ISBN: 978-0412356001.
- Hassan, R.; Scholes, R.; Ash, N. (eds.) (2005) - *Ecosystems and Human Well-being: Current State and Trends*. Volume 1, 23p., Millennium Ecosystem Assessment, Island Press, Washington, D.C., U.S.A. ISBN: 1559632283. Available on-line at <http://www.millenniumassessment.org/documents/document.766.aspx.pdf>
- IUCN WCPA (2010) - *50 Years of Working for Protected Areas - A brief history of IUCN World Commission on Protected Areas*. 23p., Gland, Switzerland. Available online at [http://cmsdata.iucn.org/downloads/history\\_wcpa\\_15july\\_web\\_version\\_1.pdf](http://cmsdata.iucn.org/downloads/history_wcpa_15july_web_version_1.pdf)
- Mimura, N.; Nurse, L.; Mclean, R.; Agard, J.; Briguglio, L.; Lefale, P.; Payet, R.; Sem, G. (2007) - Small Islands. Climate Change 2007: Impacts, Adaptation and Vulnerability. In: M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden & C.E. Hanson, (eds.), *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, pp.687–716, Cambridge University Press, Cambridge, U.K. Available online at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter16.pdf>
- Myers, N.; Mittermeier, R.; Mittermeier, C.; da Fonseca, G.; Kent, J. (2000) - Biodiversity hotspots for conservation priorities. *Nature*, 403(6772):853–858. DOI: 10.1038/35002501
- Pantin, D. (1994) - *The Economics of Sustainable Development in Small Caribbean Islands*. University of the West Indies Press, Trinidad and Tobago. Available on line at [http://gtuwi.tripod.com/chapter\\_2\\_-\\_the\\_economics\\_of\\_sustainable\\_development\\_in\\_small\\_caribbean\\_islands.htm](http://gtuwi.tripod.com/chapter_2_-_the_economics_of_sustainable_development_in_small_caribbean_islands.htm)
- Rietbergen, S.; Hammond, T.; Sayehg, C.; Mooney, K. (2008) - *Island voices - island choices: developing strategies for living with rapid ecosystem change in small islands*. 40p., Ecosystem management series, 6th Ed. IUCN. ISBN: 978-2831710303. Available online at <https://portals.iucn.org/library/efiles/edocs/CEM-006.pdf>
- Rowell, T. (2009) - Management planning guidance for protected sites in the UK: a comparison of decision-making processes in nine guides. *Journal for Nature Conservation*, 17(3):168-180. DOI: 10.1016/j.jnc.2009.03.002.
- RSPB (2009) - *Generic Site Management Planning Format and Guidance Notes*. 170p., Sandy, Royal Society for the Protection of Birds (RSPB), London, UK.
- SCBD (2004) - *Programme of Work on Protected Areas (CBD Programmes of Work)*. 31p., Secretariat of the Convention on Biological Diversity (SCBD), Montreal, QC, Canada. ISBN: 9292250264. Available online at <https://www.cbd.int/doc/publications/pa-text-en.pdf>
- SCBD (2008) - *Protected Areas in Today's World: Their Values and Benefits for the Welfare of the Planet*. 96p., Secretariat of the Convention on Biological Diversity (SCBD), Montreal, QC, Canada. Available online at <http://www.cbd.int/doc/publications/cbd-ts-36-en.pdf>
- Thomas, L.; Middleton, J. (2003) - *Guidelines for Management Planning of Protected Areas*. 79p., IUCN, Gland, Switzerland / Cambridge, UK. ISBN: 2831706734. Available online at <https://portals.iucn.org/library/efiles/edocs/PAG-010.pdf>
- Tisdell, C.; Wilson, C. (2012) - *Nature-based Tourism and Conservation: New Economic Insights and Case Studies*. 520p., Edward Elgar Publishing Limited, UK / USA.
- UN (1992) - *Convention on Biological Diversity*. In: *Treaty Collection*, United Nations (UN) Web site. Available on-line at [https://treaties.un.org/doc/Treaties/1992/06/19920605%2008-44%20PM/Ch\\_XXVII\\_08p.pdf](https://treaties.un.org/doc/Treaties/1992/06/19920605%2008-44%20PM/Ch_XXVII_08p.pdf)
- UN (2010) - *Five-year review of the Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States*. Report of the Secretary-General [A/65/115], United Nations, General Assembly, New York, NY, U.S.A. Available online at [http://www.un.org/en/ga/search/view\\_doc.asp?symbol=A/65/115](http://www.un.org/en/ga/search/view_doc.asp?symbol=A/65/115).
- UNDESA (2014) - *Small Island Developing States. In: Sustainable Development – Knowledge Platform*. Available online at <http://sustainabledevelopment.un.org/index.php?menu=203>
- UNEP (2013) - *Identifying Emerging Issues from the Perspective of the Small Island Developing States*. 42p., Outcome of the UNEP-UNDESA Workshop on SIDS Emerging Issues, Cambridge, U.K. Available online at <http://sustainabledevelopment.un.org/content/documents/1880sidsegm2.pdf>
- UNEP (2014) - *Small Islands. Regional Seas Programme*. UNEP - United Nations Environment Programme web site. Available online at <http://www.unep.org/regionalseas/issues/smallislands/default.asp>
- Veloso-Gomes, F.; Barroco, A.; Pereira, A.; Reis, C.; Calado, H.; Ferreira, J.; Freitas, M.; Biscoito, M. (2008) - Basis for a national strategy for integrated coastal zone management in Portugal. *Journal of Coastal Conservation*, 12(1):3-9. DOI 10.1007/s11852-008-0017-8.
- Vivero, J. (1995) - Atlantic archipelagic regions: self-government and ocean management in the Azores, Madeira and Canary Islands. *Ocean & Coastal Management*, 27(1–2):47–71. DOI: 10.1016/0964-5691(95)00028-3.
- Whittaker, R.; Fernández-Palacios, J. (2007) - *Island Biogeography: ecology, evolution, and conservation*. 416p., 2<sup>nd</sup> edition, Oxford University Press, New York. ISBN: 978-0198566120.
- Williams, B. (2011) - Adaptive management of natural resources – framework and issues. *Journal of Environmental Management*, 92(5):1346-1353. DOI: 10.1016/j.jenvman.2010.10.041.