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Review

Strategies for conservation planning and management of terrestrial ecosystems in small islands (exemplified for the Macaronesian islands)

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ARTICLE INFO

Article history:
Available online 5 April 2015

Keywords:
Conservation planning
Ecosystem-based management
Management paradigms
Social drivers for conservation
Governance
Contracting for nature conservation

ABSTRACT

The present paper addresses the conservation planning and management issues of terrestrial ecosystems with particular insight to small islands (with examples of application in the Macaronesian archipelagos of Cape Verde, Canaries, Madeira and Azores). It analyses specific conservation planning and management approaches and proposes concrete characterization and evaluation frameworks able to support decision and management processes ensuring an active and participative involvement of all concerned stakeholders. These methodological perspectives involve not only new paradigmatic approaches to the process of characterization and evaluation of environmental elements and processes as well as their use and disturbance through land use, but also regarding the individual and collective perspectives regarding benefice and supporting management behaviours. Some examples from islands of the Macaronesian archipelagos, in particular Pico in the archipelago of Azores and Santiago in the Cape Verde archipelago, are used to illustrate some possible management approaches, involving the consideration of the entire island as a conservation object and mobilizing their actors (individuals, groups, administrations or other organizations) as conscious, participative stakeholders. These examples involve possible land use and management changes and trade-off processes specific to each island that are listed and explained.

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http://dx.doi.org/10.1016/j.envsci.2015.03.006
1462-9011/

1. Introduction

When reviewing the literature on systematic conservation planning, ecosystem-based management and conservation management in general, searching for applications to small islands, we face a lack of references when compared with continental areas. In fact, islands build a particularly difficult challenge for nature conservation and sustainable development policies (Caujapé-Castells et al., 2010; Gil et al., 2012). This fact derives, foremost, from the high heterogeneity of island environments (e.g. Weigelt et al., 2013; Cabral et al., 2014) and the difficulty of building general conceptual approaches to such a diversified subject.

This situation is even more critical because, although they represent only 5% of the global land area of the planet, islands are biodiversity hotspots including particular biotopes with specific ecological characteristics and dynamic patterns, when compared with mainland ecosystems (Myers et al., 2000; Kreft et al., 2008). These differences involve structural, functional and evolutionary dimensions.

Islands terrestrial ecosystems are (more or less) isolated systems and communities with particular characteristics due to their natural evolution in a context of remoteness and low level of disturbance. Their degree of ecological isolation was critical for naturally limiting the genetic exchanges that can ensure viable populations for the different target species (Weigelt and Kreft, 2013). These circumstances lead to a type of biodiversity that is comparatively more limited, when compared with mainland, but extremely rich in endemic species due to the particular conditions of isolation and speciation processes (Kier et al., 2009; Steinbauer et al., 2012).

In most island ecosystems the occurrence and viability of biogenetical and ecological drivers and characteristics are also affected by physical and ecological factors. At the island scale, the physical factors (essentially of geomorphologic and edapho-climatic nature) influence the establishment and development of the propagules and resulting plant communities, as well as their ability to promote habitats and niches for particular animal species or communities (Irl and Beierkuhnlein, 2011; Lloret and González-Mancebo, 2011). Furthermore, these factors determine the existence of complementary ecological niches which are necessary to ensure viable populations and the dispersion and recolonization mechanisms either of individual plant species or communities (e.g. Nogales et al., 2012).

Furthermore, from a human perspective, islands build specific social, economic and cultural differentiated identities as a result of the particular conditions related with the combination of size, resources and characteristics of each island, as well as its isolation degree and character (Rackam, 2012; Polido et al., 2014). When humans first arrived to each island, their main problem was the transformation of landscapes able to provide the necessary resources (mainly agricultural) for new communities to settle, to survive and to grow. These resources involved, not only products for self-consumption, but also staples for exportation (e.g. sugar and wine in Madeira, blue dye in Azores). These survival and economic needs determined a pattern of exploration of the islands resources with no (or rarely very little) consideration to the conservation of nature. The anthropic transformation of the former landscape through the clearing of the original vegetation resulted in the direct destruction of particular habitats (de Nascimento et al., 2009; Triantis et al., 2010; Connor et al., 2012). Moreover, the introduction of new species with unexpected invasive behaviour also affected the size of native populations and, therefore, their viability, compromising specific ecological niches of other species and communities (Lourenço et al., 2011; Gil et al., 2013). On the other hand, new ecological conditions were determined by these land cover changes (Connor et al., 2012), occurring many times within short periods due to the drastic change of the market for staple products.

These changes led to the reduction of conditions for the survival or maintenance of viable populations (Donázar et al., 2005; Triantis et al., 2010), both for plants and animal, determining an overwhelming pressure on natural areas and habitats, endangering even more, their survival ability (Caujapé-Castells et al., 2010). To reverse this trend, one needs to ensure the preservation and recovery of an adequate genetic and habitat pool, broad enough to endure present and predictable disturbances, and also to support the restoration of viable populations and communities (Francisco-Ortega et al., 2000; Caujapé-Castells et al., 2010). The conjunction of all these factors, in the particular context of islands habitats, and general lower economic development and resources, pose complex challenges to conservation policies, in which the factor isolation is a critical factor to consider (Weigelt and Kreft, 2013).

The overall effectiveness of protected areas for biodiversity protection has been largely studied, discussed and also questioned (Bruner et al., 2001; Rodrigues et al., 2004; Ferraro and Pattanayak, 2006; Hayes, 2006; Hockings, 2006; Joppa et al., 2008; Leverington et al., 2010). In fact, traditional approaches to conservation policies based mostly on the creation of protected areas (e.g. Calado et al., 2009), with more or less strict land use restrictions, may have been counterproductive and generally insufficient, as the increasing global surface included in protected areas and the correlative biodiversity loss illustrate (Wiens, 2009; Butchart et al., 2010; Gómez-Baggethun and Ruiz-Pérez, 2011; Mora and Sale, 2011).

In the particular case of island systems, and especially in small islands, this is due to the lack of an integrated global approach towards the island as a single management unit and even ensemble of the archipelago. Also of particular importance is the small size, as well as the susceptibility and vulnerability to disturbances of the protected areas in a geographically confined space (Oldfield et al., 2004; Bergsten et al., 2013), determining that the segregation measures prove useless and give a false sense of safety. As a consequence, the extinction curve in islands habitats tends to be even steeper than in continental areas, independently from the growing extent of protected or classified areas (Ricketts et al., 2005; Cardillo et al., 2006).

It is on the comprehension of this reality that the Integrated Island System Management (Wong et al., 2005) was proposed. It consists of an adaptive management strategy, addressing simultaneously resource-use conflict and human effects on the physical environment of islands and its effectiveness depends on an institutional and legal framework that

coordinates the activities of all public and private sectors. In short, the question is: should the conservation efforts be focused in the integrated protected area network of each island without much consideration for the remaining unclassified areas or should the island (archipelago) conservation policy be based on the integrated management of the entire surface (and coastal areas) involving in this processes the entire society and particular users? The above mentioned experience and problems point clearly to the first hypothesis. This implies the conscientious involvement of all stakeholders (Lagabrielle et al., 2010; Gil et al., 2011a, 2011b) based on the growing perception of the different types of advantages they can derive from such an involvement.

These advantages derive from the perspective of ecosystem services (Aretano et al., 2013), defined as all the ecosystemic processes and functions that support or promote human activities (Daily, 1997; de Groot et al., 2010). They derive also from a growing ability to measure and to implement constructive trade-offs between human activities and biodiversity protection (Nelson et al., 2009), in order to efficiently allocate conservation actions minimizing potential losses to human activities (Stewart and Possingham, 2005; McShane et al., 2011). To ensure this, one must be able to identify, in relation to the existing values (use and non-use values), what are the threatening factors and, consequently, clearly focus and localize the management and protection measures and policies (Lagabrielle et al., 2009; Riera et al., 2014). Regarding the potential values, it must be possible to determine the viability and interest (added value in terms of nature conservation) of their recovery or restoration (Lagabrielle et al., 2011; Fonseca et al., 2014). One will, therefore, be able to manage nature conservation values in the sense of the promotion of a new curve of viably restored values, which reverses the trend of the previous extinction curve.

In this context, it is of critical importance that this broadening management perspective is fully accepted and adopted by all stakeholders. This means a clear comprehension of what are the management objects and targets, and an active involvement in their identification and definition, as well as their application to the whole island, by clearly identifying the systems and processes determining the threat or the increase of value of each element. This is only possible through the effective and committed involvement of the population and all economic and social actors as active managers, and not as passive (or reluctant) targets of the classic segregate or restrictive conservation policies.

This active, effective and committed involvement of all stakeholders implies the availability of two complementary instruments. Firstly, a systematic characterization and evaluation framework able to represent the different and complementary characterization levels (e.g. resources, pressures, thresholds, values, functions). Such a framework must be capable of representing the existing conjunctural objects and processes and also the stable non-conjunctural resources, processes and systems. It must also establish their value, functionality and threat (Fernandes et al., 2014). Secondly, a governance structure and praxis able to build management, decision-making and law-making practices and systems, in a concerted and interactive form with the above mentioned characterization and evaluation framework. These instruments must have the capacity to portray the ecosystem and landscape management process as a form of government, based on profound but commonly and sincerely accepted and adopted changes in values, goals, human and institutional behaviours (Olsen et al., 2006). This obviously requires a common process for defining the fundamental goals, the institutional processes and the structures that build the basis for planning and decision-making.

This paper will, therefore, present a proposal for such a strategic approach and supporting frameworks, illustrating its application to the particular context of island terrestrial ecosystems and particularly, the islands of the Macaronesian archipelagos.

2. Macaronesian islands: context and main characteristics

The Macaronesian region in mainly composed of the central Atlantic volcanic islands including the archipelagos of the Azores, Madeira, Canary Islands and Cape Verde (Fig. 1).

A distinguishing feature of the region is the historic and present importance of the volcanic activity, with resulting special landscape components such as steep mountain slides and lava flows (Feraud et al., 1980; Cole et al., 1999; Czajkowski, 2002; Azevedo and Ferreira, 2006). The area is geologically young and still active, and volcanic eruptions have occurred in the region in recent times (Cole et al., 2001; Amelung and Day, 2002; Forjaz, 2007; Hildner et al., 2011). The ongoing seismic activity and recent eruptions, together with high-reaching mountain peaks creates an extremely complex and varied landscape and determine important land use constraints and environmental hazards (Valadão et al., 2002; Malheiro, 2006; Fragoso et al., 2012; Mitchell et al., 2012).

While in continental systems the pedologic and bioclimatic characteristics are the main ecological zoning factors, in islands systems those factors are normally strongly simplified due to the tendentially homogeneous lithology. Therefore, elevation and topography-related variables constitute the predominant differentiating factors (Marler and Boatman, 1952; Haggar, 1988; Fernández-Palacios and Nicolás, 1995; Dias et al., 2005; del Arco et al., 2010; Lloret and González-Mancebo, 2011; Steinbauer et al., 2012). This is due to their direct influence on the critical climatic factors (water and temperature-related) (Azevedo et al., 1999; Sperling et al., 2004; Prada et al., 2009, 2015; Couto et al., 2012).

Occurrences determined by the influence of the soil and other forms of subtract variations are marginal and small-scale. For example, the main types of such occurrences in the case of the Santiago Island (Cape Verde archipelago) are water courses and drainage lines, open valleys, beaches, and wetlands (Diniz and Matos, 1986). In the case of Canaries, there are important areas of absent zonal vegetation associated with particular geological occurrences, rocky substrates, areas subject to salt influence and particular sandy subtracts (del Arco et al., 2010).

These volcanic islands present an array of ecosystems ranging from deserts and xerophytic scrubs in arid and rocky areas in Cape Verde and eastern Canary Islands to humid mountain evergreen broadleaf forests and sand dunes in

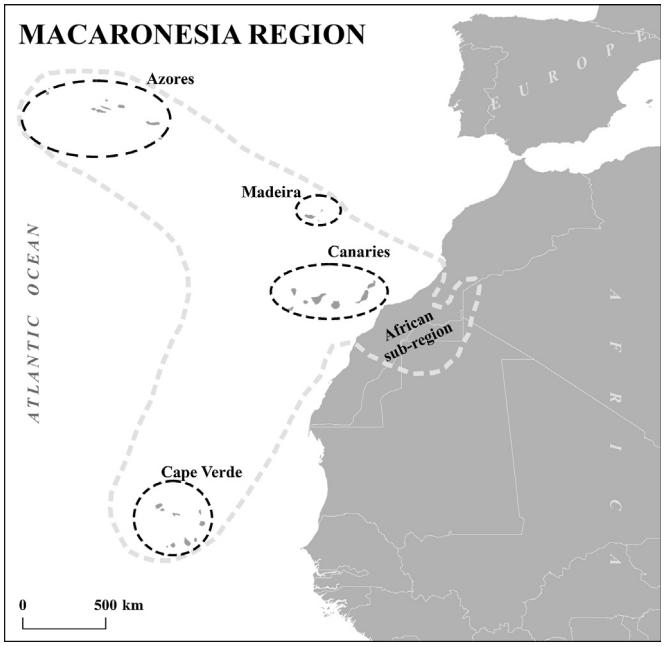

Fig. 1 – Location of Macaronesia with Azores, Madeira, Canarias and Cape Verde archipelagos.
***Source*: The boundary of the biogeographic region of Macaronesia was adopted from Kim et al. (2008).**

Madeira and the Azores (Tutin, 1953; Klötzli and Walther, 2003; Aguiar et al., 2004; Duarte et al., 2005; del Arco et al., 2009; Arévalo et al., 2012). The observed heterogeneity in the vegetation distribution is strongly influenced not only by the above-mentioned characteristics at island scale, but also by distance relationships within islands and between islands and mainland, resulting in a mixture of neo- and palaeo-endemisms which characterizes the flora of Macaronesia (e.g. Nicolás et al., 1989; Carine et al., 2004; Trusty et al., 2005; Vanderpoorten et al., 2007; Whittaker and Fernández-Palacios, 2007; Fernández-Palacios et al., 2011; Schaefer et al., 2011). Despite these differences, human pressure has shaped the present landscapes in Macaronesian islands.

With the exception of the Canary Islands (with a human occupation about 4000 years old) all other islands were uninhabited until the early 15th century. The rich volcanic soils and a favourable climate allowed a rapid expansion of areas used for agriculture production for local use and mainly export. By the end of the 15th century, Madeira was the worlds' leading producer and exporter of sugar. Other products included wheat, wine, maize and sweet potatoes. The expanding agricultural industry had a major impact on topography and original biodiversity. Large native areas, including forests, were transformed into cultivation (at places to monocultures of sugar cane) and extensive irrigation systems were constructed to bring water from mountainous areas to dry lowlands. Agricultural activities also developed on the Azores, first producing cereals for the ships sailing the Atlantic, then (already in the XV century) the blue dye "pastel" plant (*Isatis tinctoria* L.) and, presently, with an intense dependence on the production of cattle and dairy products. Cape Verde, due to its dryer climate was never an important producer of exporting goods, maintaining always predominantly subsistence agriculture (Condé et al., 2009). It functioned more as a scale for slave traders then as a producer of staple products.

The introduction of grazing animals, especially rabbit, sheep and goats, had a particularly devastating effect on the ecosystems of some islands (Gangoso et al., 2006). Fragile forest ecosystems have been irreversibly degraded. One good example is Porto Santo in the Madeira Archipelago where the original vegetation of low-lying forests composed by *Phoenica juniper*, *Dracaena draco* and *Appolonias barbujana* is no longer present, another example is the destruction of the primitive vegetation of the Canaries due to the introduction of sheep and goats 2500 years ago (Gangoso et al., 2006).

The land use dynamics resulted in changes in ecological conditions. Among the changes in land use with remarkable effects on landscape pattern and ecological conditions, one must stress the cases of the extensive grazed meadows in the Azores islands (Silva et al., 2013); the intensive agriculture and touristic infrastructures and use in the lower elevation areas of Madeira and Porto Santo islands (Moreira, 1988; Almeida and Correia, 2010); the production forests, overgrazing and hugely differentiated forms of tourism activities in the Canaries (Arévalo and Fernandéz-Palacios, 2005; Gangoso et al., 2006; Domínguez-Mujica et al., 2011); and the dominantly semi-arid conditions associated with past over-exploitation and new touristic resorts in the main Cape Verde islands (Lindskog and Delaite, 1996; López-Guzmán et al., 2013). One must nevertheless stress that throughout their history, these islands were predominantly marginal areas with strongly constrained economies and societies.

3. Challenges to planning and management in the context of small Atlantic islands of Macaronesia

The human land use history of these islands leads generally to a culture where survival is the critical factor, strongly emphasized by the risks associated with isolation, and where the option between anything contributing to survival or opposing it, is very clear and deeply imbibed in the island culture and behaviour. Scarcity is, to these populations, a critical object of concern, even when benefiting of modern communication and transport networks (Calado et al., 2011a, 2013).

One good illustration of the particular challenges the islands colonizers had to face in the first centuries of colonization is the example of water management in the Madeira Island. Here the scarcity of water in the fertile southern lands led to the construction of an extensive channel system (''levadas'') with a length of 1400 km in a 736 km^2 island to bring the water rainfall from the wet regions on the north of the island to the drier more fertile parched agricultural area of the south (Malmqvist, 1988). The costs were justified by the higher level of survivability and wealth they brought in, ensuring the critical economic activities. These constraints lead to the need of different more participated and engaged land management procedures than in the mainland.

In an island environment, with strictly limited resources, consensual management approaches are of critical importance (Calado et al., 2014; Cárcamo et al., 2014). Therefore, the ability to sample all information in a coherent framework where all evaluation procedures can be lead in a reproducible way with a comprehensive reference system (Fernandes et al., 2014), will allow an active involvement of all stakeholders in a participatory process to optimize the solutions for each local and moment. It will also encourage a permanent and coherent re-evaluation of these solutions (Lagabrielle et al., 2009, 2010).

Such instruments are critical for a conservation policy and management that does not constitute a burden to the islands inhabitants and economy but, on the contrary, achieves their active involvement through knowledge and experience exchange. Moreover, practical involvement in the management and development of the entire island allows the insurance of individual benefits, maintaining the autonomy, individuality and cultural particularities of each one. These challenges are still enhanced by the foreseeable disturbances related with climate change and the increasing resource use associated with economic growth and intensification of the pressures on different natural resources (Olsen, 2003; Olsen and Nickerson, 2003; Walter, 2004; Wong et al., 2005; Lane, 2007; van Beukering et al., 2007; González et al., 2008; Clarke and Jupiter, 2010; Caujapé-Castells et al., 2010; Gil et al., 2012; Calado et al., 2013).

In humanized insular environments, the identification natural of values and threats, as well as the definition of management objects and targets regarding nature conservation, has to take into consideration criteria and perspectives, as well as systems of values, different from those adopted in mainland systems (van Beukering et al., 2007). For example, when considering island biodiversity, it is necessary to give particular attention to genetic diversity and to the factors promoting its evolution and differentiation within each *taxa*, allowing the conservation of micro-niches to preserve the required isolation for the maintenance of that speciation (e.g. Sosa et al., 2010; Schaefer et al., 2011). This question is critical when analysing continuity and heterogeneity at the island level, determining that, as important as the preservation of a viable population, it is critical to ensure, simultaneously, its intrinsic micro-diversity and the resulting ability to respond biologically and physically to disturbances.

This implies individual approaches to each problem and the consideration of the entire island environment, factors and actors, as the conservation object. Another critical issue is that each island must be regarded as an individual case, and practical approaches must be adopted to that particular case (Wong et al., 2005). In this context, it is crucial to consider in which way land resources are appropriated by given land uses, and consequently changed, and their existence conditioned or even compromised. Simultaneously, it is important to know how natural systems respond to these new environmental factors and processes (for example by observing colonization patterns in recently abandoned areas), particularly with regard to target species (e.g. Tzanopoulos and Vogiatzakis, 2011).

We consider, therefore, that it is precisely in this context, that mainly focusing nature conservation in protected areas is particularly inadequate in small populated islands, where the segregation between protected areas and production areas is very complex, if not impossible. Protected non-populated islands like Desertas and Selvagens (Archipelago of Madeira) deal with minor issues to fulfil their conservation targets, because they are preserved from human interaction and were never colonized and permanently occupied and have no economic use. This is not the case of the large majority of the islands of the archipelagos of Cape Verde, Canary, Madeira and Azores, where the population density is generally high, and the production activities intense, implying the appropriation and transformation of important proportions of the islands surface and its resources (Parsons, 1981; Marcelino et al., 2014).

Thus, the concept of governance (considered by Hufty (2011) as ''the processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions'') seems to assume here a critical role, implying the implementation and preservation of the structure and functional integrity of the system and the maintenance of biodiversity as basic principles of ecosystem management, recognizing the inevitability of change and that people are an integral part of most ecosystems (Gruby and Basurto, 2013; Metcalf et al., 2014). The governance process is related to the establishment of conditions for ordered rule and collective action (Stoker, 1998) to solve problems and to facilitate cooperation. It comprises societal structures and processes of decision-making and power sharing (Davoudi et al., 2008; Cárcamo and Gaymer, 2013). According to Westgate et al. (2013) this can only be achieved by incorporating a knowledge-based adaptive management approach. This implies the need to consider ecosystem-related uncertainty

and complexity in governance, due to the rapidly ecosystem changes, as well as social–ecological interactions (Renn et al., 2011; Rijke et al., 2012) implying dynamic participation and decision processes.

Consequently some authors as well as the IUCN and UNEP postulate that, ecosystem management must be flexible in its approach, obligatorily committing economic, social and cultural factors affecting the communities concerned with an ecosystem management project (e.g. Pickett et al., 1992; Pirot et al., 2000; Hobbs et al., 2006; Olsen et al., 2006; UNEP, 2009). Moreover, it is also considered that the only way to ensure the sustainability and success of the stakeholder-based participation process, requires an effective involvement and a reliable form of social contracting, ensuring therefore a comprehensive clarification of all the responsibilities involved, and their accountability (Jepson, 2005; Gil et al., 2011a, 2011b; Bebbington and Larrinaga, 2014). The particular character of islands with their strictly limited resources, lower resilience, particular social–cultural characteristics and relation, pose particular challenges to this process (Tompkins, 2005; Agardy et al., 2011; Game et al., 2011; Levin and Möllmann, 2015). At the same time, they build a particularly good micro-cosmos where these methodological approaches for conservation management (other than the simple creation and adequate management of protected areas) can be evaluated and its advantages assessed, as well as the relative limited critical variables can be easily appraised and dealt with.

4. Development of governance and sustainable planning and management systems for conservation and sustainability

One of the main problems in setting up and developing governance processes is ensuring that the involvement of the different core stakeholders will be adequate and conscious. This is a critical question because, when considering the different abilities of each stakeholder for decision and action in a management context, as illustrated in Fig. 2. In fact, those capable of regulating, planning, allowing or forbidding land uses and practices (the administrations, law makers and planers) are not the ones able to perform those land use-related practices and actions (the land owners and their associations). This fact determines, therefore, contradictions between the sphere of decision and the sphere of action that leads normally to conflicts (Forst, 2009; Cárcamo and Gaymer, 2013) and mutual negative results.

Thus, when developing a governance system for systematic planning and management of small islands especially addressed to their intrinsic values and constraints, the stakeholders and their relative importance and role, as well as their different forms of involvement, must be clarified before beginning the development and application of such a system. van Beukering et al. (2007) stress that including all decision makers in the process at an early stage, ensures their better understanding of the global approach and expected results.

To foster the advantages of adopting new attitudes and to highlight their contribution to an improved welfare and security, the framework aiming at integrate conservation issues and promote conservation attitudes and practices must involve the conscience and founded knowledge of each islander in his multiple beings: as a simple citizen, as a politician or as an investor or developer (Benedicto, 2014).

The predominant aspects to take into consideration, when handling with these particular groups of actors, are the motivations of individuals and organizations to act. These motivations are fundamentally associated with the perception of the benefit (be it material or immaterial) obtainable from each action or decision. This perception acts in both directions. It can drive towards the immediate and primary satisfaction (hereinafter referred to as α-perception) or it can lead to a more mediate and complex consideration of satisfaction, implying long-term perceptions and collective benefits beyond the individual interests (hereinafter referred to as k-perception) (Fig. 3). This proposal to describe the two behavioural patterns is inspired in the α and k strategies from

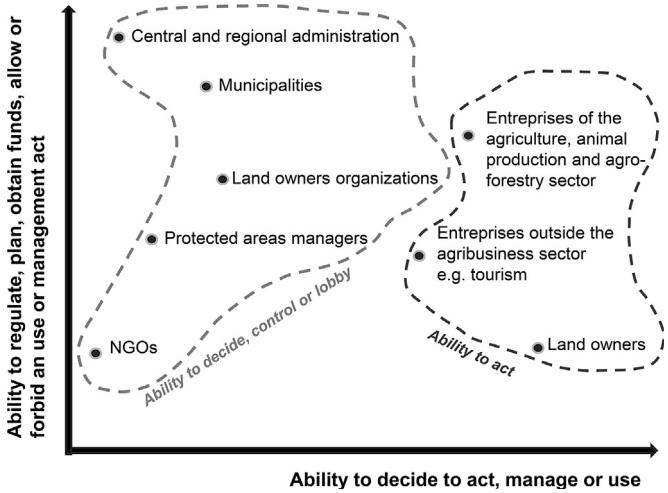

Fig. 2 – Different abilities of the different stakeholders to control and to act.
***Source*: Modified from Carvalho (2011).**

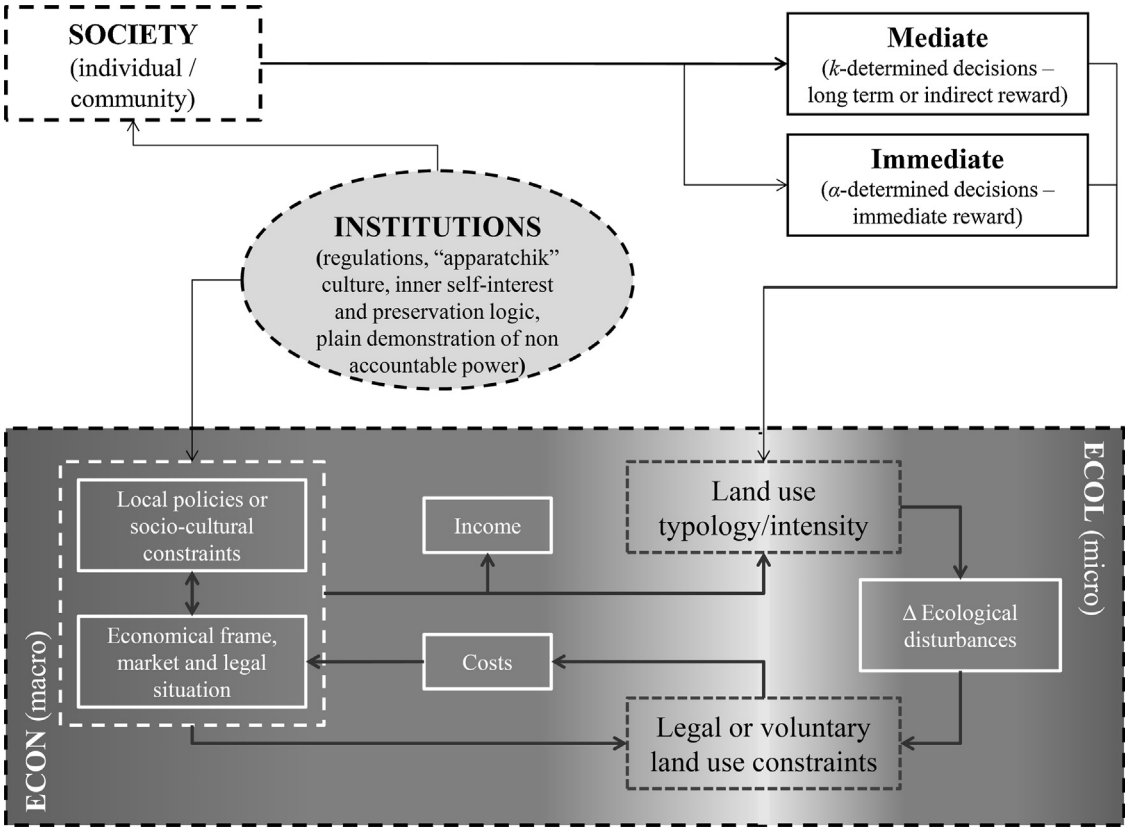

Fig. 3 – Main factors and drivers affecting the decision and action processes.
***Source*: Authors.**

the ecological theory (MacArthur and Wilson, 1967). It can be exemplified by the transition from hunter-gatherers to agriculture implying the perception that the work and time investment that agriculture implied, would be compensated by a larger availability of food and other basic products, enhancing, therefore the survivability of the human group.

α-Perception is the dominant driver and the main factor for the pressures on biodiversity and natural resources determined by human activity deriving from its ecological nature and innate impulses (''give short-term individual interests more weight than long term common goods'', Vlek and Steg, 2007:10). *k*-Perception, on its side, involves a higher level of individual and social conscience, self-control and aims at ensuring larger benefits at all involved temporal, institutional and spatial scales (Bürgi et al., 2004; Vlek and Steg, 2007), determining, for mankind, a profound change through culture in its basic biological and ecological impulses, as we represent in Fig. 4.

The tendency of nature conservation policies to segregate specific areas from all other areas devoted to economic development, called ''fortress conservation policies'' (Gómez-Baggethun and Ruiz-Pérez, 2011), enforces the α-perception by denying the consciousness of the benefits related with other perspectives or behaviours. This is due to the emphasis given to conservation policies as tendentially repressive policies, aimed at more or less arbitrarily restrict or constrains human activities. The same can be observed when considering the predominant antropophobic character of most of the organized environmental associativism (Fernandes, 2000a; Ehrlich, 2002). This tendency is being reversed on paper (e.g. Millennium Ecosystem Assessment, 2003), but the institutions and policies, as well as the political and social culture, remain dominantly unchanged. Nevertheless, the ''win–win'' perspective where it is perceived that it is possible to ensure equal degrees of satisfaction (both in nature and in time) is clearly being proven wrong, and leading to a paradigm of concerted complexity and convergence of dominantly contradictory interest groups (McShane et al., 2011).

Therefore, it is necessary to enforce the *k*-perception, by developing conservation policies and praxis that involve all areas and land uses. This implies taking into consideration the social, economic and political imperatives that determine more or less drastic changes in the strict scientific prescriptions that ordinarily support conservation planning and management procedures (Margules and Pressey, 2000; Wallace, 2012). The challenge is not how to control these other domains, but to develop methods that, founded on sound scientific bases, ensure the different conservation targets in the context of an ecosystem-based management (Slocombe, 1998; Knights et al., 2014). In this process the entire islands habitats (natural, semi-natural, productive and strongly disturbed) must all be integrated in the social and economic activities planning and management strategy and praxis and particularly in the cultural dimension of the population.

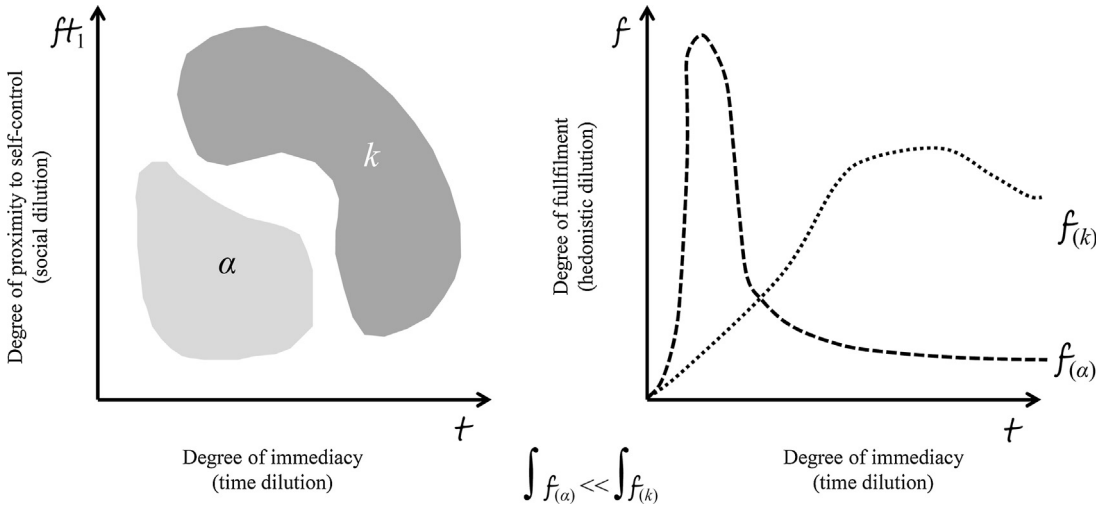

Fig. 4 – Conceptual spaces of α- and k-perception. Comparison of corresponding satisfaction curves. *Source*: Authors.

This leads to the need of adequate approaches in handling the different types of stakeholders to guaranteeing their involvement in the resources planning and management processes. Effectively, stakeholders are differentiated according to their power to influence a decision, and its resulting effect. Primary stakeholders are those primarily responsible for influencing or be affected by the main decisions (Edum-Fotwe and Price, 2009; Razali and Anwar, 2011). They comprise key decision-makers such as regulatory agents and therefore they need to be reached and encouraged to actively participate in the process as soon as possible. If possible, they should be brought together to create an active steering or consultative group. Secondary stakeholders include those who are indirectly affected by the decision. Nevertheless, they are able to influence the decision-making by influencing the affection of their interests and/or by mobilizing public opinion (Mitchell et al., 1997; Edum-Fotwe and Price, 2009; Razali and Anwar, 2011). Examples of secondary stakeholders are local communities, local government, media, non-governmental organizations and business-support groups. Finally, external stakeholders tend to be more masterful and powerful and, be able of intimidating those with less access to resources (van Beukering et al., 2007; Edum-Fotwe and Price, 2009; Razali and Anwar, 2011). They are not directly part of the decision team, but they can add values to the project from outside or simply inhibit and dominate meetings by shaping the dialogue to their agenda. Examples of external stakeholders include national governments and inter-governmental organizations, great investors and developers, who should be kept permanently informed of the on-going process. Their participation and influence must also be carefully managed. Razali and Anwar (2011) also refer extended stakeholders as anyone who is often helpful in assisting above-mentioned stakeholders to reach their visions.

Nevertheless, this involvement presents several problems, mainly regarding primary stakeholders. When working at the island level, their number implies the need for democratic representation and an even more accurate work of conciliating the multiple interests, targets, perspectives and expectations of all members of the community. Therefore, there should be no confusion between common concepts of public participation and integrated management. Integrated management implies the active and committed involvement of all primary stakeholders, given the fact that, ultimately, they are responsible for the effective use and management of each land parcel. If they do not perceive their effective benefice from a certain type of management, they will not change their experienced management praxis or they will resist passively or actively to the accorded new guidelines. Here lies the normal reason for failure of the common practice of protected areas planning and management, which is mainly based on prohibition and restriction, with small or no influence of the primary stakeholders in the administration decisions, leading to conflicts and to a general or partial mismanagement of large stretches of the protected areas, compromising therefore their conservation goals.

To avoid the risks mentioned before, the present study reached the conclusions that three main approaches must be combined and carried out. The first one consists of contracting, and leads to the establishment of different forms of contracts between different groups of stakeholders (Tikka, 2003; Blackmore and Doole, 2013). This approach involves the definition of responsibilities, compensations, forms of accountability and guaranties able to ensure the different contractors the ability to account and control all agreed questions. These contracts can vary from classic trade contracts (e.g. post-service payment) to trust contracts. They must ensure the compliance of given rules, targets or other form of action and imply accepting effective mechanisms of control and sanction without the need of law suits.

The second approach is related to accountability (Jepson, 2005; Bebbington and Larrinaga, 2014; Metcalf et al., 2014). Whenever a given restriction, prohibition or constraint is imposed or proposed, it must not only be soundly based and supported on comprehensive models and simulations, but it

must also be subject to mechanisms of follow-up and accountability. It is very common in nature conservation processes, that strict restrictions and prohibitions be imposed on citizens, communities or enterprises, without a sound justification and without accountability instruments. These instruments would ensure that, if that restriction or prohibition proved erroneous, it will be changed or removed and the affected people communities and organizations compensated. Only in this way can trust among stakeholders, and especially between them and the administrations, be built up.

Finally, to establish contracts on resources management practices, where reproducible methods of valuation allowing a clear perspective of the costs, benefits or eventual compensations (e.g. subsidies or payment of non-commodity outputs) must be developed. Normally, when speaking of valuation in the context of integrated management and systematic conservation, the total economic value proposed by Pearce et al. (1989) is one of the most adopted concepts. It comprises use values and non-use values (Remoundou et al., 2009; García-Llorente et al., 2011; Ojea et al., 2012), and it integrates conservation values (option values and existence values).

The pertinence of combining these approaches derives from the fact that ecological and other services provided by ecosystems with high biodiversity are not necessarily financially valuable (Marris, 2009). This issue implies the need for implementing subventions to particular cases and ecosystems, together with other approaches for retribution and/or compensation actions towards increasing integrated ecosystem total value. These approaches must be a dynamic process of permanent adaptation according to the gathered experience and the integration of the perceptions of the different intervenient groups (Grantham et al., 2009). Only in this context it may be possible to build the foundations for concept functional governance process.

5. Developing a framework to support a strategy for sustainable governance in small islands (exemplified for cases in the Macaronesian achipelagos)

Small islands, as already mentioned, build a particular good environment to illustrate these integrated approaches. The concept of Island Natural Park (Calado et al., 2011b; Fonseca et al., 2014) defined as an ''integral management entity integrating the entire small island and its surrounding waters in the global process of planning and management'' and including and articulating all conservation areas existing in the island in a single management structure and policy definition system and authority, is a good example of the possibilities small islands allow in terms of conservation policies.

This figure (already fully in power in all islands of the Azores archipelago) assumes a stronger management perspective than standard protected areas networks and, therefore, its full implementation in Atlantic small islands should constitute a priority towards a more effective and sustainable conservation management of insular environments.

Nevertheless, this ecosystem-based approach will only be successful if it will be able to set up and to implement a stakeholder-based conservation planning and management governance system. To reach this goal, five main conditions must be ensured: (1) clear identification of the values, threats, disturbance thresholds, promoting and damaging factors; (2) clarification for each island of the global objectives, and integration of all planning and management processes into a multifunctional, multi-thematic and multi-scale process integrating all active and passive actors; (3) articulation between all land, coastal and other resources users in order to turn them into active and prolific managers (instead of passive and/or aggressive negative managers); (4) development of an integrated island management system in alternative or coordinating municipal or local authorities (Wong et al., 2005); (5) promotion of multifunctional economic instruments aiming at set up and develop an adequate retribution for the different types of services (economic, environmental or ecosystemic) that each land user provides or benefits from.

Given the fact that archipelagos show a low degree of ecological connectivity and complementarity among their islands, this integrated approach should also be extended to the whole archipelago or sub-archipelago units, to maximize at each moment the viable plant or animal populations and to reduce the risks associated with local disturbances.

This will only be effective if each island is considered and managed as a whole single complex target area within the wider scope of the archipelago. The leading management idea must be the maximizing of the conservation efforts, the cost-effectiveness through the maximization of stakeholder engagement and, through the promotion of all welfare benefits associated to multifunctional conservation management.

In order to achieve this target, one has to consider first the core issues addressing the basic conservation planning requirements as stated by Davis et al. (2003) (Box 1), taking into consideration the multidisciplinarity of the problems facing the conception and implementation of conservation policies (Knight et al., 2013; Moon et al., 2014).

Then one must consider the social and economic drivers that must be taken into consideration in the implementation of the management strategy and governance model. These imply ensuring the accordance with following principles (Knight et al., 2013): accountability, adaptability, collaboration, defensibility, equity, feasibility, pragmatism, resilience, social learning and transparency.

It is at this level that the importance of possible trade-offs between conservation targets and socio-economic realities (including individual and social incomes, and development aims) must be identified and highlighted, given the fact that any conservation policy will only be successful if the community and all individuals are actively engaged. That is only possible if there is a clear perception of benefit, even if it may involve certain sacrifices perceived as just and morally balanced (Sandman, 1993).

Another relevant issue is related to the fact that all processes of characterization and evaluation in a management context imply the ability (and capacity) to accurately translate reality, as well as be able to present a clear and unbiased transmission of the adequate representations of this same reality to all stakeholders. This process of communication is always a translation process (as the representation), in which it is critical to produce thorough, comprehensive and

Box 1. Questions to be answered by conservation planning (Davis et al., 2003)

a) What resources (ecological features and processes) do we seek to conserve in the planning region?
Islands have normally a more or less longer history of human colonization that leads to profound changes in their ecology. In some cases it caused the almost total destruction of the previous native vegetation and also the introduction of new species and new ecological processes. On the other hand, islands are ecologically isolated (or almost completely isolated), determining that there is little chance of natural restoration of the previous ecosystems and communities without human intervention. Finally, islands are more or less densely occupied by human activities, determining that there is little availability for finding suitable areas for conservation or restoration purposes. Therefore, the central issue is the identification of the remaining values, if there are new values or values susceptible of restoration and how to address the opportunity of each particular policy (e.g. Wong et al., 2005; Kreft et al., 2008; Triantis et al., 2010; Lagabrielle et al., 2011; Mora and Sale, 2011; Tzanopoulos and Vogiatzakis, 2011; Nogales et al., 2012; Rackam, 2012; Steinbauer et al., 2012; Weigelt et al., 2013).
b) What is the current extent and condition of these resources?
The resources in an island must be determined to clearly evaluate the real extension and assets derived from the existent stable environmental factors, and to pinpoint areas showing conditions where target species and communities are able to survive. Also critical is the identification of micro-elements and habitats, as well as existent (or possible) interactions with eventual source of propagules (e.g. Donázar et al., 2005; Kreft et al., 2008; Kier et al., 2009; Lagabrielle et al., 2009; Caujapé-Castells et al., 2010; Schaefer et al., 2011; Weigelt et al., 2013).
c) What are the key environmental and social drivers affecting resources extent and condition?
The pressure on the values varied throughout history. Many resources and values were strongly affected or compromised by abandoned land uses, determining that there are ecosystems and values disturbed, endangered and even compromised by land uses that do not exist anymore and others endangered by present land uses. It is therefore necessary to determine how the first ones are evolving and regarding the latter, what are the disturbance factors, evaluating, simultaneously, how their reduction or exclusion would cause social-economic losses which are unable to be compensated in a sustainable and acceptable way. Intermediary solutions must also be evaluated, together with the minimal conditions which are necessary for the sustainable maintenance of the ecosystem values (e.g. Lindskog and Delaite, 1996; Olsen, 2003; Olsen and Nickerson, 2003; Hughes and Malmqvist, 2005; van Beukering et al., 2007; González et al., 2008; Kier et al., 2009; Remoundou et al., 2009; Caujapé-Castells et al., 2010; Lagabrielle et al., 2010; Irl and Beierkuhnlein, 2011; Connor et al., 2012; Nogales et al., 2012; Gruby and Basurto, 2013; Weigelt and Kreft, 2013; Cabral et al., 2014; Cárcamo et al., 2014; Riera et al., 2014; Levin and Möllmann, 2015).
d) How are resource extent and condition likely to change in the future?
This evaluation may have into account the evolution scenarios of the different sources of disturbance. These scenarios' characterization must be spatially explicit, to hierarchize the different disturbances intensities and characters (e.g. Tompkins, 2005; González et al., 2008; Kier et al., 2009; Caujapé-Castells et al., 2010; Triantis et al., 2010; Lloret and González-Mancebo, 2011; Mora and Sale, 2011; Tzanopoulos and Vogiatzakis, 2011; Riera et al., 2014).
e) What conservation tactics are available for different places and conservation concerns, and how do they compare in terms of cost and likelihood of success?
This issue implies a balance between the conservation targets, the available or potential values and the ability to build a societal involvement on the conservation process, trough adequate mechanisms of trade-off, compensation, contracting, development of non-commodity outputs, and creation of alternative sources of income associated, among others, with the conservation praxis (e.g. Olsen, 2003; Olsen and Nickerson, 2003; Ricketts et al., 2005; Tompkins, 2005; Lane, 2007; Forst, 2009; Clarke and Jupiter, 2010; Lagabrielle et al., 2010; Game et al., 2011; Gil et al., 2011b; Lagabrielle et al., 2011; Aretano et al., 2013; Gruby and Basurto, 2013; Calado et al., 2014; Fernandes et al., 2014; Fonseca et al., 2014; Polido et al., 2014; Levin and Möllmann, 2015).
f) What are the highest priority areas for investing today's limited conservation funds?
Due to the complexity of the existing resources and disturbances, a careful balance must be made between short, medium and long terms feasible targets, ensuring, at the same time, that emblematic values receive proper attention. In this sense, the value of some currently low value areas with high recovery potential can be covered with limited resources. Simultaneously, long term and cost-effective investments on the maintenance and recovery of present high value areas must also be conducted (e.g. Olsen, 2003; Lane, 2007; González et al., 2008; Martín, 2009; Remoundou et al., 2009; Caujapé-Castells et al., 2010; Agardy et al., 2011; Lagabrielle et al., 2011; Robinson et al., 2011; Weigelt et al., 2013; Weigelt and Kreft, 2013).
g) Are ongoing conservation projects effective?
This is a critical issue in any conservation and management policy. Particular attention must be given to the need to very clearly predefine what are the monitoring objects and the evaluation variables in the planning and execution phases. The involvement of all stakeholders in these processes is indispensable, as in any other stage of the process (e.g. Olsen, 2003; Olsen and Nickerson, 2003; Wong et al., 2005; Gangoso et al., 2006; Agardy et al., 2011; Mora and Sale, 2011; Gruby and Basurto, 2013; Polido et al., 2014).

permanently verifiable information (not data). Thus, the decision-support framework to be developed must integrally and consistently face these issues. However the quality and accuracy of any characterization and evaluation tool are always dependent on quality and character of the available information.

Data gathering, processing, evaluation and assessment are, therefore, the primary tasks of any management process, particularly for these highly demanding governance contexts. To effectively implement ecosystem-based management, decision-makers and managers require a reference or benchmark to evaluate landscape changes and policies (e.g. Gibbons et al., 2008; Winter et al., 2010). To achieve these goals adequate characterization and evaluation tools able to support the decision and management processes, as illustrated in Fernandes (2000b) and Fernandes et al. (2014) must be available. These characterization systems are more reliable when based on nature-determined stable reference system able to support the evaluation and comparison of different land use distribution scenarios (both current and simulated). Such systems allow a transparent and adaptable framework for an integrated social-economic and ecological assessment of each management scenario or decision. The scale, evaluation framework and variables considered depend only on data availability. However, the development of characterization models able to support ecosystem-oriented management processes in small islands faces several difficulties related not only with data availability, but also with the specificities of their environments.

These characterization systems must incorporate the form in which the ecological and economic drivers of land use and land cover interact within each socio-economic context, and also the factors determining each management decision. On this basis it is then possible to implement multifunctional management systems by integrating all factors in a clearly defined geographical framework. Based on the sampled information, on the resources suitability and on eventual incompatibilities with present land uses, scenarios for the identification of management strategies can be formulated, assessed and developed (Calado et al., 2013). These management strategies must be spatially explicit and able to integrate and to operate criteria combining conservation and societal targets. Furthermore, a stakeholder-based management support framework must be set up for each island (Polido et al., 2014), according to the multiple landscape functions and the need to develop participative, integrative approaches to governance based on contracting, accountability, valuation and consequently, mutual trust (e.g. Gil et al., 2011a, 2011b; Fonseca et al., 2014).

It is at this level, that issues such as conservation opportunities (Moon et al., 2014) and paradigm changes at the personal, social and institutional level (Grantham et al., 2009) must be addressed. They have to be considered in the frame of the different drivers and integrate the pertinent universes of values. These drivers, be it economic, ecological or social involve a wide set of variables that must be adequately characterized and build the basis for the evaluation processes. These processes are not necessarily linear and depend from the predominant values of that society or community, the ecological and economic constraints and the perspectives of the involved stakeholders. This is the global context determining the process of decision and action (Fig. 5).

To build such a planning and management framework, the production and management of data, scenarios and criteria are of critical importance. Therefore, the ability to identify present and potential values (among others, conservation, production, aesthetical), as well as presenting those values by themselves and in the frame of alternative management scenarios to openly discuss evaluation criteria, constitute the basic foundation for a comprehensive planning and management. Most of the factors involving a consistent systematic conservation planning and management of costal and terrestrial ecosystems in the above mentioned islands are connected with agriculture, forest production, touristic activities (many of them based on coastal protected resources, such as whale watching or scuba diving), fisheries and invasive species control and management.

Studies like the ones developed by Diniz and Matos (1986) and Fernandes et al. (2014), in Santiago island (Cape Verde archipelago) and in Pico island (Azores archipelago) respectively, illustrate how it is possible to build coherent characterization, evaluation and simulation tools by using information of very different quality, spatial resolution and precision (Fig. 6).

The characterization and evaluation system must consider the main zoning factors (particularly altitudinal belts together with lithology and morpho-topography variables) and the form in which they determine the existence of resources and the occurrence of biophysical processes.

Of particular importance in this cartographic and data sampling process, is the need to identify and map all particular elements with ecological, socio-cultural or other significance, in order to have a complete sampling, not only of the macro habitat structure, but also from microhabitats, particular elements of special cultural significance, ecological structures and their interrelations as well as its nature, etc. Aspects like connectivity and connectedness have to be evaluated, for example, through clusters analysis and complementarity referred to particular species or groups of species.

One particular aspect of primary importance is the patches (normally resource-patches) that are associated with particular habitats (normally of high faunal significance) because they present unique conditions that favour the presence of exclusive specialized species (animals and plants). Examples of such patches are springs, small volcanic formations (old chimneys) or processes (fumaroles), areas of extreme morphological conditions (slope, exposure to wind or radiation), wet patches (associated with the micro-morphology or with micro variations in the soil profiles, such as located impermeable clay layers).

Based on such characterization it will then be possible to determine the way in which each land use and land cover affects the corresponding resources and processes. The characterization proposals developed by Diniz and Matos (1986) for the island of Santiago (as well as for the entire Archipelagos of Cape Verde and São Tomé and Príncipe) and the Integrated Landscape Approach (Fernandes, 2000b) are examples of characterization and evaluation frameworks which are able to support a governance approach such as described above (Fig. 5).

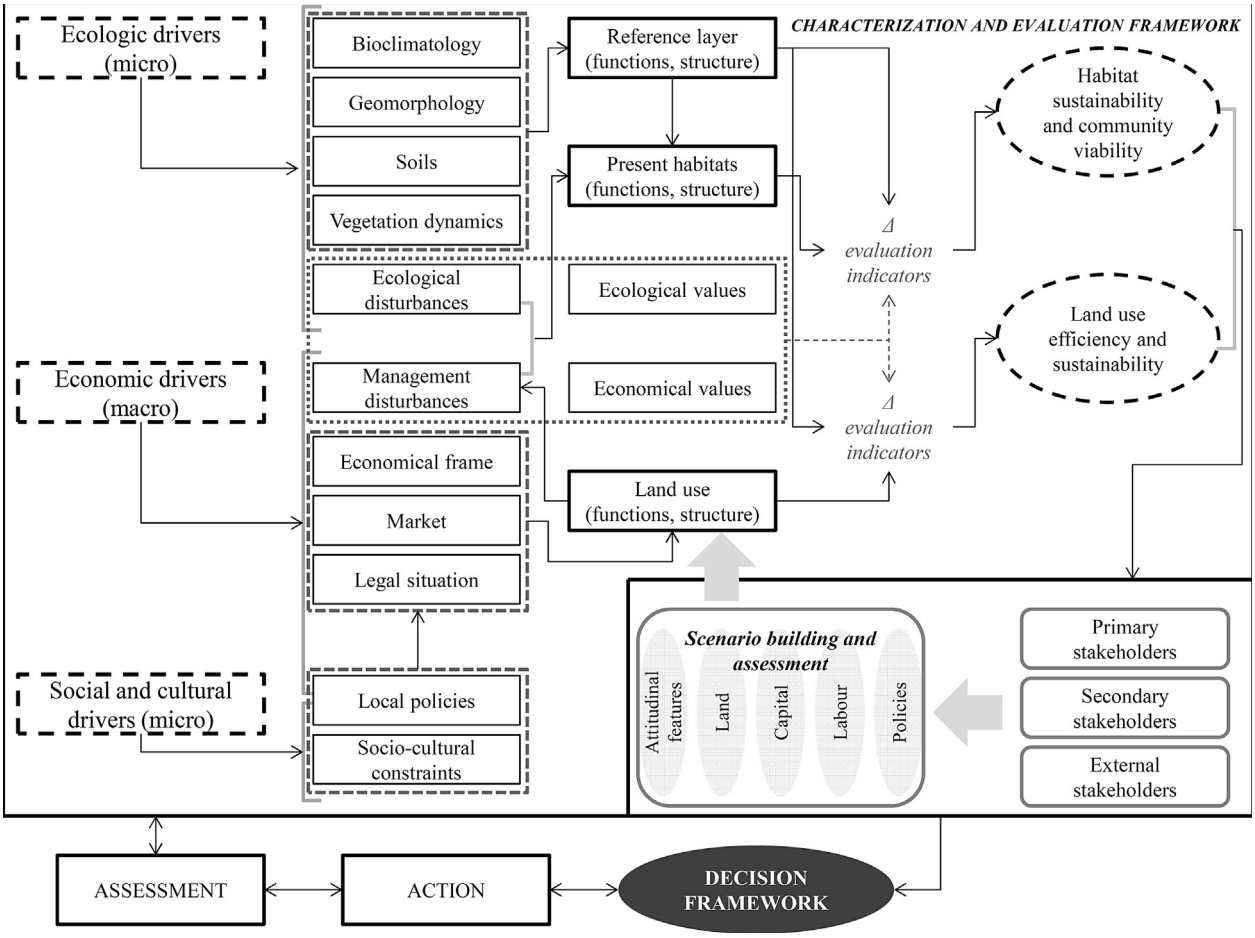

Fig. 5 – Illustration of an integrated governance model applicable to any geographical level of decision (island, archipelago or continental region)
***Source*: Authors.**

These methodologies associate the layer characterizing the relevant geographical elements with other layers characterizing the dynamic processes occurring in each site, such as hydrology, macro- and micro-climatology, erosion and sedimentation patterns, among others. Particular importance is given to the need to ensure that all these characterization layers and databases have common descriptors as if applied to the present landscape are able to represent the critical factors determining that landscape. Only in this way can they be compared, and evaluation procedures conducted using this reference layer as the reference for all evaluation processes.

The process of valuation is critical for the evaluation and scenario building procedures. Therefore it is essential to clarify the criteria inherent to the way values were attributed to the different information and objects. This is of particular importance in the context of the development of systematic conservation planning and management practices, ensuring systems of governance open, and involving an informed and involved participation of all stakeholders.

Consequently there are two main valuation criteria to be simultaneously considered: (1) present and potential conservation value, related to the interest for the preservation and promotion of nature, natural functionality and biodiversity value; and (2) societal value, corresponding to the present potential economic and welfare value.

Both these criteria are not absolute, as illustrated in the Pico island (Azores) (Fernandes et al., 2014) where large areas occupied by pasture have no adequate soil productivity for that land use and can, even, be degraded by erosion if the pasture management and the grazing intensity are not adequately conducted. So, considering the present land use as corresponding directly to high values, when these land uses have an important economic significance, is clearly wrong, although it must always be taken into account that it still builds the base of subsistence of an important number of families and to the global economy of the island.

These distinct approaches to the value of each site build the main source of conflicts in conservation procedures as illustrated in the Pico (Azores; Fernandes et al., 2014) and Santiago (Cape Verde; Diniz and Matos, 1986) islands. In both cases the occupation by pastures or agriculture of many sensitive areas (mainly associated with wetlands and mires) and with high erosion risk are clearly the main problems to be solved. However, a simple acquisition or trade of the

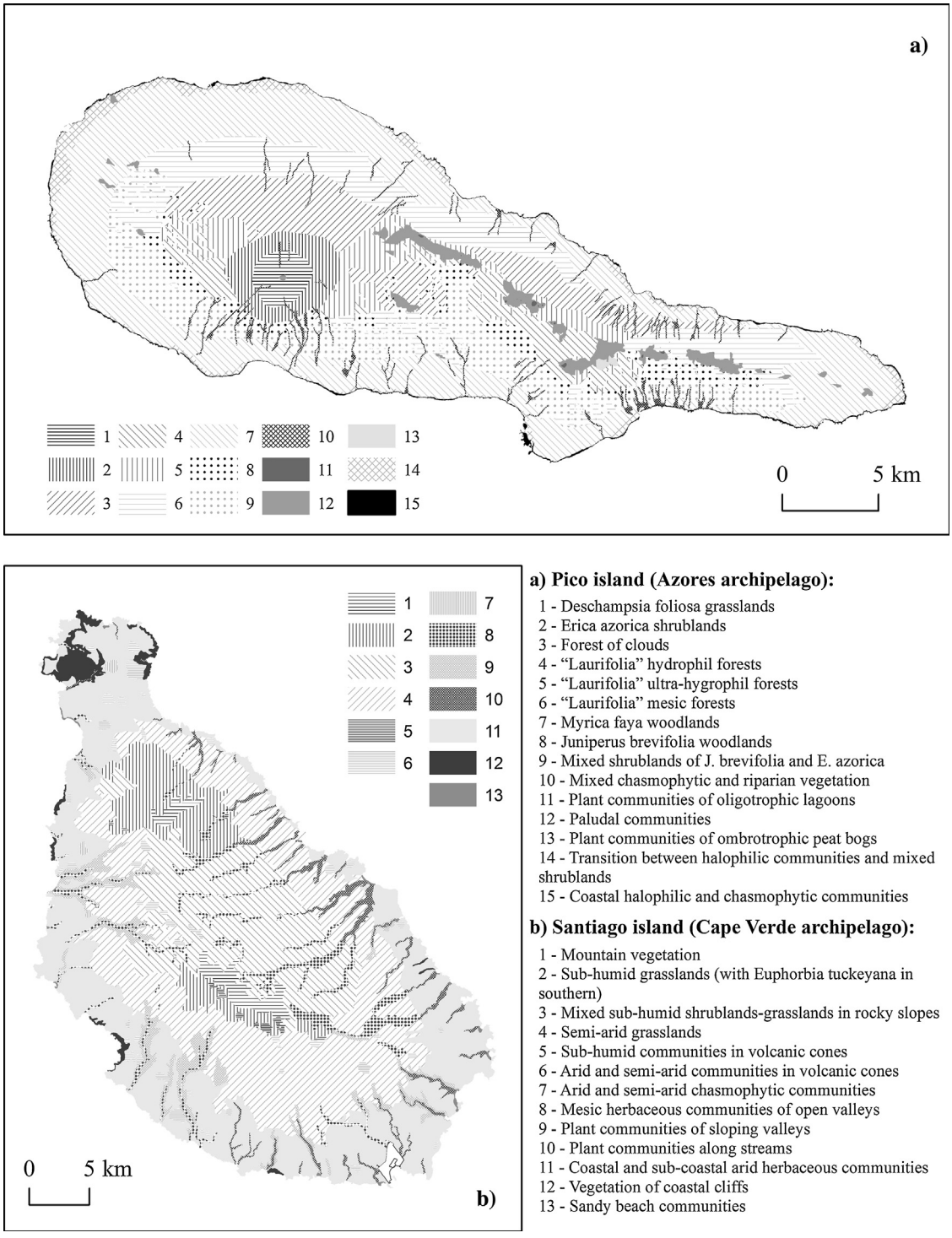

Fig. 6 – (a) Ecological units expressed as most probable natural vegetation in Pico Island (Azores; Fernandes et al., 2014); (b) agro-ecological and vegetation map of Santiago island (Cape Verde; Diniz and Matos, 1986). These units are one of the reference objects for the characterization and evaluation procedures of both studies and evaluation methodologies.

concerned proprieties is not a direct solution because of the strong sense of ownership existing between the land owners and their parcels, turning processes of land redistribution and the definition of grazing management practices very difficult and complex. It is on this information basis that one must build the decision and management framework. This decision support system must turn the different decision drivers into understandable and acceptable policies, by making the adequate and acceptable trade-offs and ensure the contracts and accountability processes that ensure their viability.

6. Implementing the framework at the decision and management level

As Knight et al. (2013) illustrates, any conservation process needs to integrate, not only the main conservation issues, but also the social and economic constraints affecting each decision process (either at the planning design or management level). This builds a fundamental challenge to the process of developing the decision framework, because this type of decision making process clearly implies a paradigm shift involving complex transition processes, that integrate, rearrange and qualify the present structure of though and action (Geels and Schot, 2007).

These transition processes must be based on innovative technological approaches (e.g. the above mentioned characterization and evaluation instruments and their dynamic interaction with all stakeholders), on the ability to understand that new social and ecological landscapes are being built that must be incorporated in the mental models of all involved (e.g. Hobbs et al., 2006; Lindenmayer et al., 2008; Hobbs et al., 2009), These new mental models must also involve concepts such as:

- Contractualization: Establishment of different forms of contracts between different groups of stakeholders involving the definition of responsibilities, compensation, forms of accountability and guaranties that ensure the different contractors the ability to account and control all agreed question. These types of contracts can vary from classical trade contracts (provision of a service followed by payment) to trust contracts (e.g. one guarantees the compliance of given rules, targets or other form of action accepting effective mechanisms of control and sanction without the need of law suits).
- Accountability: Whenever a given restriction, prohibition or constraint is imposed or proposed, it must not only be soundly based and supported on comprehensible models and simulations, but it must also be subject to mechanisms of follow-up and accountability. It is sadly very common in nature conservation processes that impositions and prohibitions be imposed on citizens, communities or enterprises without a sound justification and without instruments of accountability that ensure that if the basis for that imposition or prohibition proved erroneous it will be changed or removed and the affected people communities and organizations compensated.
- Valuation: To establish contracts on resources, management practices and decision, reproducible methods of valuation must be developed that allow a clear perspective of the costs, benefits, eventual compensation (e.g. subsidies or payment of non-commodity outputs). Normally, when speaking of valuation in the context of integrated management and systematic conservation, the total economic value, comprising use values and non-use values, integrating conservation

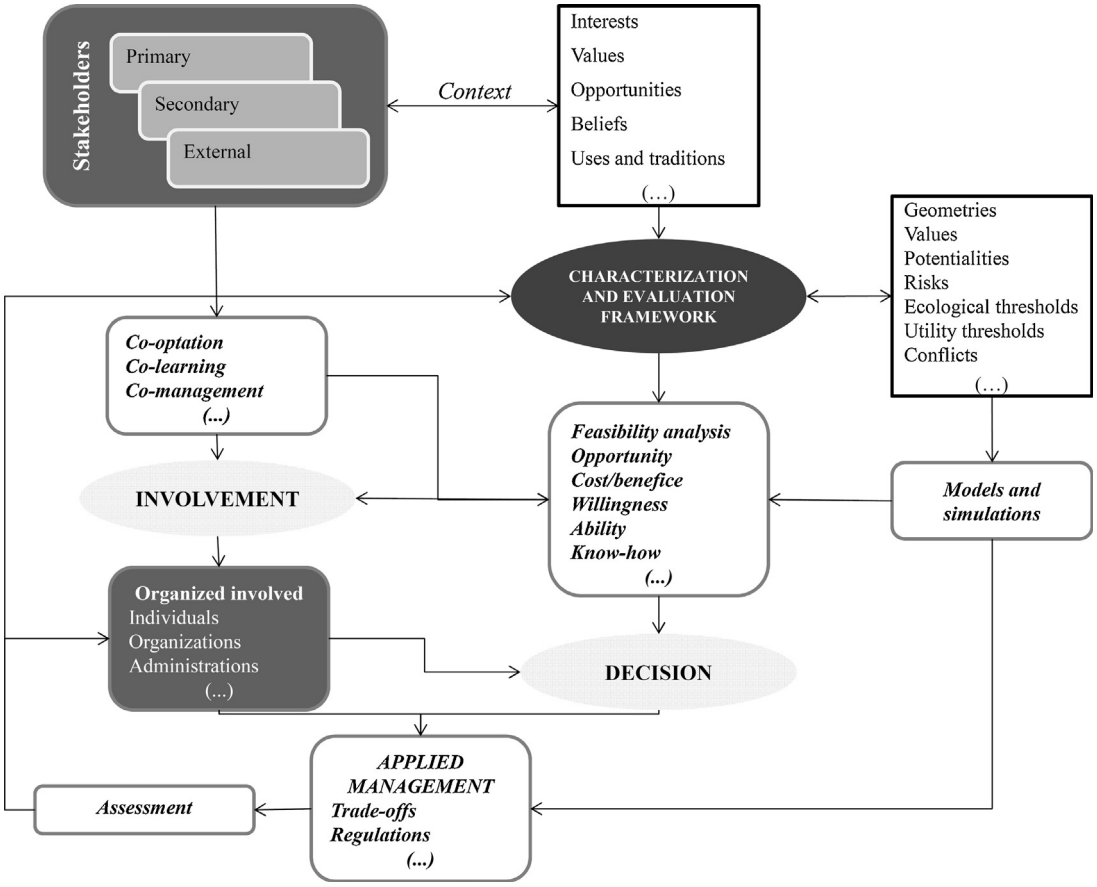

Fig. 7 – Simplified structure of an involved decision-making and management framework.
***Source*: Authors.**

values (option values and existence values) is the most adopted concept.

It is therefore necessary to evolve to a perspective, where the entire landscape is perceived as a conservation object, and where naturalness is assessed according to gradients, and conservation targets are focused in the potentiating of values and their integration in a constructive approach to land management (Wiens, 2007, 2009). This implies comprehending that "in the broader sense conservation is about preserving the full range of the earth's biodiversity – *preserving*, not just protecting" (Wiens, 2009:1062), implying an active perspective instead of the dominant reactive attitudes. Underneath and primary condition for this approach is the conscientious involvement of all stakeholders, based on the growing perception of the different types of advantages they can derive from such an involvement (not only derived from the perspective of ecosystem services but also through the improvement of conscience and praxis of the contribution of the preservation and promotion of biodiversity to development and human well-being (Costanza et al., 2007; de Groot et al., 2010)).

Applying these perspectives and tools requires a very pragmatic and participative praxis (given the fact that these transformation processes involve not only different coordination and participation intensities and modes (Lynam et al., 2007), but also different resources (Geels and Schot, 2007) and opportunities (Moon et al., 2014)), incorporating all available instruments, such as multi-criteria analysis (Moffett and Sarkar, 2006) or structured decision-making (Martin et al., 2009) (Fig. 7).

Considering the examples displayed in Box 2, one can see a small illustration of the way in which this management process could be lead. In fact, the characterization of the different environmental characteristics, land uses and driving factors, allows, between other examples, the observation that, in many cases, a significant portion of areas with higher land use pressures in the studied islands lie outside the areas of main conservation interest. This situation allows a greater degree of freedom in the application of innovative territorial governance approaches within these areas, due to the relative lack of conflicts and to the limited and well identifiable number of potential stakeholders to be involved. The main variables to be handled, particularly in the case of Azores, will then be the sustainable management of the disturbing land uses as well as the bargaining, restoration and land use change of areas presently invaded by alien species. This bargaining process must be developed on the basis of the preservation of the sense of ownership of each land owner and by ensuring simultaneously, its awareness-based full and active involvement in the new management praxis. Nevertheless, there remain important areas of direct conflict where decisions must be taken in terms of absolute or partial use restriction, which must always be compensated by equivalent sources of income and/or satisfaction. One must clarify the concept of "bargaining" as a more or less informal trade-off process without "moral restrictions" or, more correctly conjunctural restrictions.

Additionally, it must be taken into account the issue of the micro-target habitats, whose characterization must be carried with utmost detail. This issue requires a case-by-case approach based on innovative methods for conservation management. For instance some habitats are able to be used for economic purposes during large periods of the year and require therefore only a strict control of these uses' occurrence

Box 2. Examples of application of these processes to the Macaronesian islands of Pico (Azores) and Santiago (Cape Verde)

In Pico island there is an important soil reserve that must be taken into account: the areas infested with alien vegetation. Although these areas occupy mainly soils of very low quality, they also cover areas that can be turned into pasture land and be therefore used in the compensation process of negotiation with the land owners (Fernandes et al., 2014).

In Santiago Island, this land reserve is much more constrained, due to the difficulties of vegetation restoration in the prevalent semi-arid ecological conditions. At the same time, the growing population of this island (in opposition to what happens in Pico island) and its tendency to mostly concentrate touristic related tertiary activities in the coastal fringe, may determine a tendency of reducing the anthropogenic pressure on the higher areas with a consequent and direct reduction in the demand and intensive land use of these areas (Semedo, 2012).

Considering the several constraints associated with the processes of ecological restoration in both islands, the balance of available areas is still positive, due to the possibility of using other areas for restoration or agricultural use, and considering also that some pasture area is not effectively under use and can therefore be more easily negotiated.

Thus, it can be stated that, in the Pico example, the compensation regime that would result from transforming good soils presently invaded by alien invasive species into pasture land and agricultural areas (in conjunction with further compensation and management measures), may constitute a strong basis for the process of reconfiguring some land use patterns and promoting the recovery of viable patches of native vegetation (Hortal et al., 2010).

In Santiago the availability of the agro-ecological characterization and evaluation framework from Diniz and Matos (1986), allows similar approaches within the particular conservation targets defined for the island. Nevertheless, the touristic development along the shoreline builds the main source of conflict by occupying simultaneously some of the most productive soils and putting a significant stress on important coastal ecosystems (either terrestrial as marine). Areas of particular importance for conservation in areas not subjected to these pressures can eventually be left free by their abandonment due to the migration to the coast and the better employment possibilities that are developing in those areas. This abandonment is not necessarily immediately positive if it is not integrated in the global management system that must be implemented according to the proposed governance model.

and intensity during limited periods. The identification of these micro-habitats and the comprehension by all involved, of their significance and functionality is critical for the development of new management behaviours, independently from administrative constraints.

7. Conclusions

The present tendency of biodiversity loss is not being inversed through the creation and enlargement of protected areas. To reverse this trend, one has to approach the biogenetic and ecosystem resources of islands, as well as the disturbance mechanisms (and respective agents) in a more integrated and systemic way. Such an approach must base itself in two complementary processes: the first one, allowing the identification of all present or potential values (biogenetical, ecological, social, cultural, political and economic); and the second one, regarding the identification and characterization of the patterns and processes determining and conditioning each local, value and resource. It is therefore necessary to evolve to a perspective where the entire landscape is perceived as a conservation object (Wiens, 2007), focusing primarily on preserving (and developing), not just protecting, implying an active perspective, instead of the dominant reactive attitudes.

In this active approach, naturalness is assessed according to gradients (and even accepted in terms of novel forms (Hobbs et al., 2006)), and conservation targets are focused on the potentiating of values and their integration in a constructive way to land management (Wiens, 2009). Nature conservation policies to be implemented must, therefore, be able to perform an integrated management of all classified areas, and its integration in a consensual management of the entire island, balancing all interests (social, economic and environmental). This implies a total inversion of the limitations associated to the lack of integration and cooperation among different land administration levels and domains. This is critical to prevent the existence of conflictive agendas and the focusing on the priority of a full and integrated involvement of all relevant stakeholders into the conservation planning and management process.

Thus, the ability to identify present and potential values (for conservation, production and recreation), the capacity to present those values by themselves in the frame of alternative scenarios, and the potential for discussing concepts and criteria like value, cost or targets (as examples) constitute the main support for a comprehensive planning and management decision support system.

Building an integrated tool addressing the integrated sustainable management and effective governance systems must also take into account the need to develop mechanisms able to develop *k*-perception behaviours with all their multidimensional and long term satisfaction dimensions. This process implies the availability of adequate characterization and evaluation systems, able to support decision and management frameworks that will then be able to dynamically integrate all involved stakeholders in the management of any type of area.

Small islands like the ones of the Macaronesian archipelagos build an excellent proving ground for the implementation of such systems, due to the fact that they build micro cosmos where bringing together the environmental and the social, cultural and economic perspectives can be more easily achieved, because of the clear boundaries of the systems to manage and the universe of involved actors. Simultaneously, this limited universe determines also the critical environment to build new individual and collective perspectives of benefice and achieve, therefore, a more sustained and sound involvement in the whole of the management and conservation process.

Acknowledgments

This project was developed in the frame of the SMARTPARKS project funded by the FCT (Portugal) under the project reference PTDC/AAC-AMB/098786/2008. This research paper was partially developed on behalf of a Post-Doctoral Research Project (M3.1.7/F/005/2011) lead by A. Gil and supported by the FRC/Azorean Regional Government. This study was partially funded by FEDER as part of the Operational Programme for Competitiveness Factors – COMPETE and also received National Funding from the FCT – Foundation for Science and Technology as part of the PEst-C/AGR/UI0115/2011 strategic project.

We also wished to thank two anonymous referees for their valuable critics and suggestions.

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