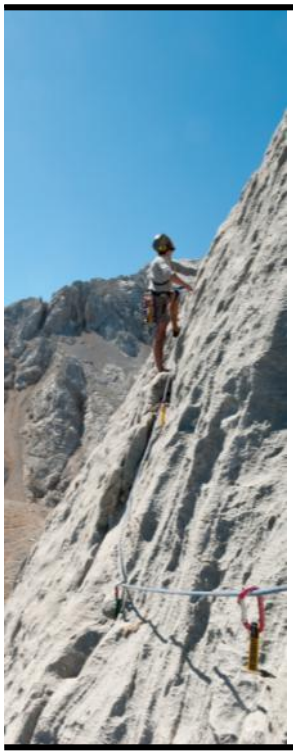

ENVISIONING PROTECTED AREAS THROUGH PARTICIPATORY SCENARIO PLANNING: NAVIGATING COVERAGE AND EFFECTIVENESS CHALLENGES AHEAD

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ABSTRACT

Protected area coverage targets are still far from being achieved and protected area effectiveness shows major deficiencies. Climate and land use changes and pressures from increasing human populations challenge the future of protected areas. In this research we analyse the trends and effects of these drivers of change on protected areas in Spain. This Mediterranean country, a biodiversity hotspot with many different systems of protected areas, is changing from focusing on increasing protected area coverage towards also improving conservation effectiveness. A Participatory Scenario Planning (PSP) approach was developed to create four scenarios in which the evolution of the protected area system was assessed and proposals to achieve a desirable future were agreed among participants. Results show that PSP facilitates exploration of complexity and uncertainty associated with the future of protected areas understood as social-ecological systems. We conclude that greater social and institutional support and active and adaptive management are needed for protected areas in Spain to meet the coverage and effectiveness challenges ahead.

Key words: climate change, effectiveness, landscape management, governance, participatory scenario planning, protected areas, Spain

INTRODUCTION

Protected areas are the main instrument to prevent biodiversity loss and ecosystem services degradation (Butchart et al., 2012; Larsen et al., 2012). Protected areas cover 14.7 per cent of the world's terrestrial area and inland waters and 10.2 per cent of the marine areas under national jurisdiction (UNEP-WCMC & IUCN, 2016). However, protected area coverage and effectiveness still need to improve considerably to mitigate the current ecological crisis (Watson et al., 2014). Coverage, which encompasses the area covered but also its representativeness, is still very far from the international targets of protection if species and ecoregions in all countries are considered (Butchart et al., 2015; Venter et al., 2014). Analysis of protected area effectiveness, or the extent to which their aims are achieved, continues to reveal major deficiencies in the management of about 40 per cent of protected areas (Leverington et al., 2010) and only 24 per cent of protected areas globally have sound management (Bertzky et al., 2012).

Several aspects are limiting protected areas in achieving these coverage and effectiveness targets. Climate change, urban and agricultural development in the surroundings of protected areas, and pressure for land as the global population rises are increasingly affecting protected areas (Hannah et al., 2007; Martinuzzi et al., 2015). These aspects challenge the governance of protected areas, increasing border effects or negative impacts from the outside of the protected area, leading to declines in biodiversity within some protected areas (Laurance et al., 2012). Moreover, protected areas are of diminishing

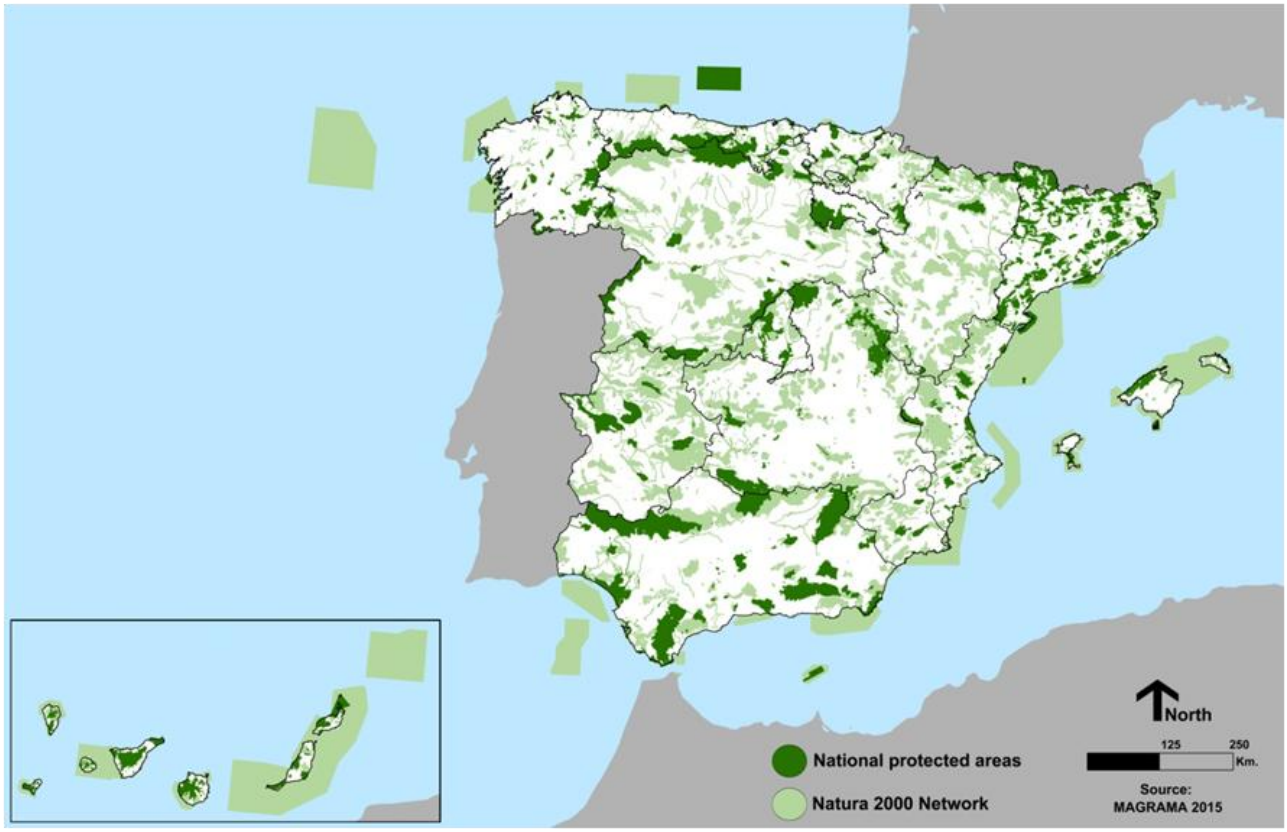

Figure 1. Distribution of nationally designated and Natura 2000 Network figures of protected areas in Spain.

priority in the political agenda in certain places, and Protected Area Downgrading, Downsizing and Degazettement (PADDD) threaten their status (Mascia et al., 2014; Watson et al., 2014). All these issues, together with the need to increase protected area coverage and effectiveness can be better understood by exploring how drivers of change will affect protected areas and how protected area governance can respond to these changes (Lockwood, 2010).

An increasingly used tool that facilitates exploration of the future evolution of complex systems for conservation in an uncertain world is Participatory Scenario Planning (PSP) (Peterson et al., 2003; Oteros-Rozas et al., 2015; Mitchell et al., 2016). PSP enables drivers of change and uncertainty to be collectively analysed, providing visions of the future that can inform decision-making today.

Early protected area scenario studies at the global scale analysed how protected areas could cope with pressures and suggested different evolution paths for protected areas in the future (Holdgate, 1994; McNeely, 1994; 2005). More recent studies have applied PSP in case studies at the local scale that include terrestrial and marine protected areas (MPA) in order to assess how complex social-ecological systems might evolve (Brown et al., 2001; Mitchell et al., 2015; Palomo et al., 2011). However, it still remains largely unexplored how: (1) different drivers of change can influence the future model of protected areas at intermediate scales (i.e. country scale) considering the current protected area coverage and effectiveness challenges, and (2) what actions can be taken within protected areas strategies in order to adapt to future changes.

We explore these challenges for a country within the Mediterranean Region, one of the world hotspots for biodiversity, but also one of the regions most affected by climate change (IPCC, 2013). Spain is a world hotspot of biodiversity that contains more than 30 per cent of European endemic species and it is the country that contributes the most in area to the European Natura 2000 Network (the largest coordinated protected area network in the world) (Europarc-Spain, 2014; Myers et al., 2000).

In this paper we assess the threats and challenges that Spanish protected areas face today, how they will be shaped by different drivers of change in the future, and how protected areas can adapt their planning to respond to these influences. Our main aims are to (1) analyse current protected area roles and challenges; (2) develop a PSP process and create scenarios to assess how drivers of change and protected areas might evolve in different plausible futures; and (3) to identify different planning proposals that protected areas could put in place in order to cope with future changes and arrive at a desired future.

STUDY AREA

Spain has 12.91 per cent of its area declared as protected areas (nationally) and 27.21 per cent if Natura 2000 sites are added (Europarc-Spain, 2014) (Figure 1). Despite the important increase of area protected during the past decades in Spain, many coverage deficiencies exist. For example, while five Spanish regions have over 20 per cent of their area protected, six regions have less than 10 per cent of their area protected if we only consider nationally designated protected areas (SOM: Table S1). Increasing the coverage of Marine Protected Areas (MPAs) is still needed as these cover around 8 per cent of the Spanish marine jurisdictional areas (MAPAMA, 2017).

Protected area location also presents several challenges. In common with many countries worldwide (Joppa & Pfaff, 2009), Spanish protected areas are biased towards higher altitudes, resulting in the alpine ecosystem being the most protected with more than 50 per cent of its area protected (Europarc-Spain, 2012). The Natura 2000 network has increased the protection of agrarian and marine ecosystems and has also increased the percentage of private land protected. Although studies show that species coverage by protected areas is reasonable in Spain, this has only been tested for plants and vertebrates (Araujo et al., 2007). Most protected areas in Spain belong to Category V of the IUCN, Protected Landscapes, and many of them support traditional uses or contain cultural landscapes (Figure 2).

Protected area governance has many challenges too, especially for regional governments who are in charge of the legislation, planning and management of most terrestrial protected areas. Less than 50 per cent of Natural Parks (category V of IUCN) have updated

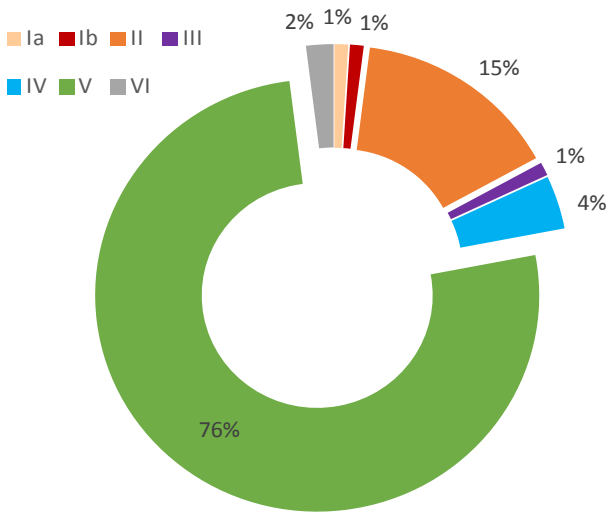

Figure 2. Percentage of area protected in Spain belonging to the different IUCN protected area categories. Data includes the 43% of nationally designated protected areas. Natura 2000 sites are not included in this analysis. The relevance of Category IV will increase when considering Natura 2000. Source EUROPARC-Spain, 2013.

management plans and only 32 per cent of Natura 2000 protected areas have approved management plans or plans in preparation (Europarc-Spain, 2014). Many protected areas are relatively young, having been created during Spanish democracy, and the pace at which protected areas are being created is outstripping the rate at which management plans are being developed (Figure 3). Moreover, there has been a widespread lack of evaluation of the management effectiveness of protected areas in Spain.

Spanish National Parks receive around 14 million visitors every year (Europarc Spain, forthcoming). No clear estimation of visitors exists for all protected areas, but the number might be closer to 30 million. However, due

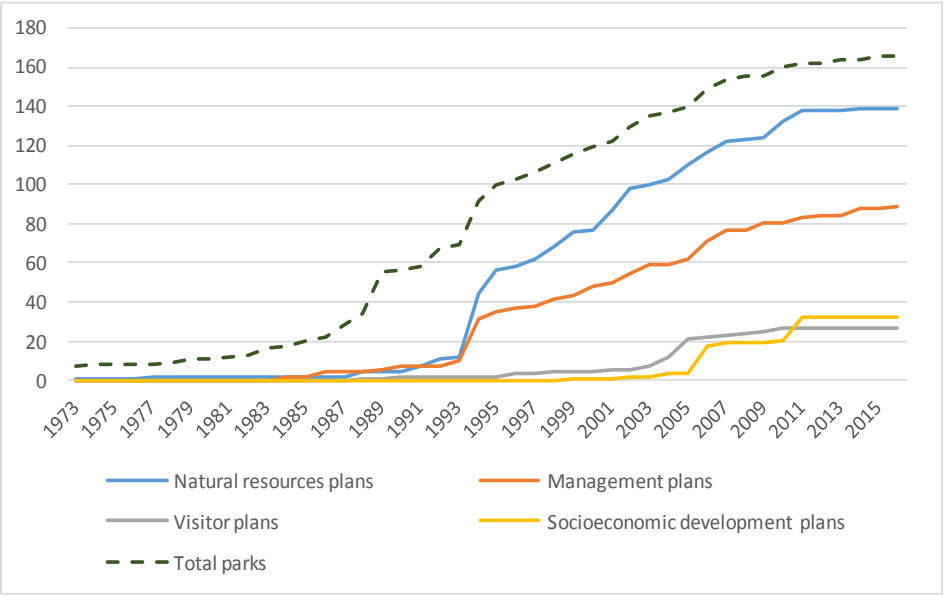

Figure 3. Total number of protected areas (considering National and Natural Parks) in Spain and of different management plans (natural resource plans, management plans, visitor plans and socioeconomic development plans). Several protected areas still do not have management plans.

The Sierra Nevada is the largest National Park in Spain, it is rich in plant endemism and cultural heritage infrastructure from grazers or water management such as the acequias used to transport water and recharge the aquifers © Ignacio Palomo

to the current economic crisis, staff numbers and budgets are leaner than in 2010 and big differences in investment exist among Spanish regions (Europarc-Spain, 2014). The growth in the number of Natura 2000 sites has not brought increased funding and staffing to cope with the increased demand for planning and management.

In addition to the current coverage and governance challenges described above, several drivers of change will affect protected areas in Spain in the near future. Climate change will severely impact biodiversity in Europe, as shown for the Natura 2000 Network (Araujo et al., 2011). Spain, as part of the Mediterranean ecoregion, will suffer shifts and impacts on biodiversity which will demand different adaptation measures (Klausmeyer & Shaw, 2009; Ruiz-Labourdette et al., 2013). PADDD is also challenging the status of some protected areas and several examples of urban encroachment on protected areas have been documented (Viñas, 2012). Finally, land use change in the surroundings of protected areas, which is already negatively affecting some protected areas, will continue to challenge the conservation of biodiversity and ecosystem services within protected areas (Martín-López et al., 2011; Martínez-Santos et al., 2010; Zorrilla-Miras et al., 2014). All this brings us back to the core questions about protected areas: how much coverage is enough (Brooks et al., 2004) and what should be the role of protected areas in the future?

METHODS

Our results are based on a participatory process that included five in-depth interviews, 47 online questionnaires and a two-day PSP workshop with 31 participants with significant knowledge and expertise in protected areas. A total of 83 stakeholders and 10 facilitators participated in the process. Semi-structured interviews were conducted with experts in protected areas with academic, institutional and organizational backgrounds. Questionnaires (SOM: Appendix 1) were answered by professionals in the field of protected areas

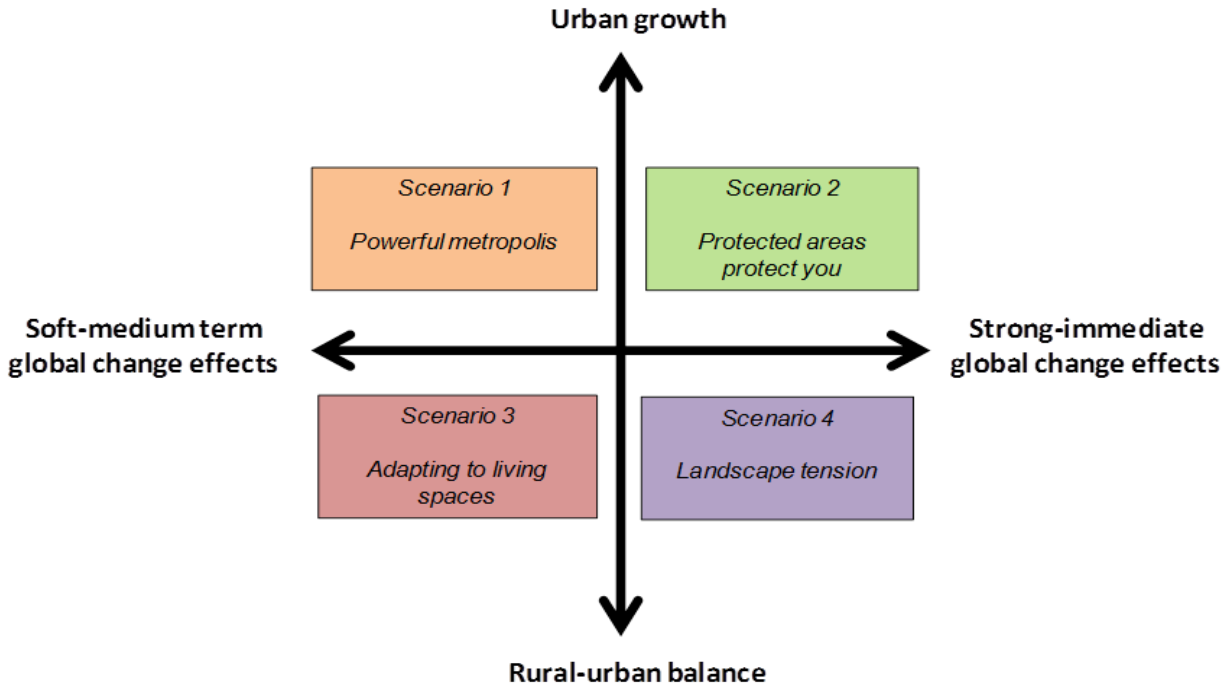

Figure 4. Axes of drivers of change (strong–immediate global change effects vs. soft–medium term global change effects and greater urban growth and rural depopulation vs. greater urban–rural population balance) and the names of the four scenarios developed by participants.

and environmental planning working in academia, in protected areas and other public institutions, in environmental companies and in non-governmental organizations. Interviews and questionnaires addressed protected areas in the present, aspects relevant to the future of protected areas (aspects that lead to the identification of drivers of change for the scenarios) and possible future roles of protected areas.

The two-day PSP workshop was designed based on the information provided by the interviews and questionnaires, and included 31 participants from different sectors related to protected areas: professionals from regional protected area offices (n=8), environmental consultants (n=5), universities and research centres (n=4), environmental entrepreneurs (n=3), organizations related to land stewardship (n=2), farmers (n=2), environmental educators (n=1), forest rangers (n=1), non-governmental organizations (n=1), legislators (n=1), private landowners (n=1), and consumer organizations (n=2). Participants were chosen to cover institutional and territorial diversity. During the workshop, four scenarios for the year 2035 were created by participants using the following two driver-axes that had emerged as most relevant from an analysis of the interviews and questionnaires: global change effects (strong and immediate versus soft and medium term) and demography (greater urban growth and rural depopulation versus greater urban–rural population balance) (Figure 4). Scenarios were developed through discussion in four groups of 7/8 persons, each with a diversity of professionals from different disciplines related to protected areas, and was guided by a facilitator to achieve a consensus in the storyline of each scenario. The group discussions were recorded and typed, and a narrative of the scenario was presented to participants during the second day to ensure that group discussions were adequately covered.

The scenarios created were analysed by participants who identified the most desired and undesirable aspects of each scenario for four different aspects: governance, funding, protected area model and biodiversity and ecosystem services. Red (undesirable), yellow (mixed desirability) and green (desirable) dots were used by participants to mark the desirability of the different aspects within scenarios individually. A discussion to achieve consensus on desirability followed. Then, participants, following a backcasting approach (Carlsson-Kanyama et al., 2008; Dreborg, 1996) proposed and ranked several proposals for protected areas (as desirable, undesirable or mixed desirability) in order to achieve desirable aspects of the scenarios and avoid undesirable ones. These proposals were agreed within the working groups. After the workshops, the report containing the results was uploaded to the website of EUROPARC Spain[1] and sent to participants to obtain their feedback. The picture shows the participants and the facilitation methods used (individual questionnaires, small-group discussions, identification of proposals on sticky notes and presentation of results) in various moments of the scenario workshop.

Moments of the workshop showing the participants and the different methodologies used: individual questionnaires (1), small-group discussions (2,3), classification of the desirability of the scenarios (4), identification of management proposals on sticky notes in the backcasting exercise (5), and presentation of the results (6).

RESULTS

- **Exploring the future of protected areas: protected area roles and scenarios**

According to the survey results about the future role of protected areas, biodiversity conservation was seen as having the most important future role (78 per cent of answers). The main roles that followed in decreasing order of importance were: being examples of a win-win model for conservation and development (53 per cent), the sustainable use of natural resources (47 per cent), fulfilment of local social needs (36 per cent), rural development (33 per cent), and promoting local employment (20 per cent) (Figure 5).

Scenario 1 – Powerful metropolis

Urban growth concentrates people in cities, depopulating rural areas. As a result, a new governance model dominated by private protected areas is established in areas far from cities, while public protected areas remain close to urban areas. Public investments decline and private funding increases. Protected areas are managed with a strong focus on economic profits from tourism (pay for certain services, entrance fee, etc.). Only in protected areas close to cities is there an increase in participation, land stewardship and voluntary work. These areas are managed with a strong emphasis on ecosystem services delivery for water provision, human health, ecological agriculture, cultural identity, and tourism. As a result, two differentiated protected area types exist. Water scarcity due to climate change and agricultural use leads to the downgrading or degazettement (loss of protected status) of some protected areas in the most affected ecosystems.

Scenario 2 – Protected areas protect you

Rural depopulation intensifies the loss of cultural landscapes, some of which are maintained only inside protected areas. A general re-naturalization and rewilding takes place on the rest of the land. Rural depopulation weakens the public administration, fostering the diversification of protected area governance to include non-governmental organizations (NGOs), private companies and the European Union, which is increasing its competencies in member states. As a result, protected areas are managed for diverse aims. The economic value of services delivered by protected areas is measured and funding sources are diversified through taxation, sponsorship, and offering services within protected areas. Intense climate change effects produce shifts in some ecosystems. As a result, general awareness of our dependence on nature grows, protected areas are considered critical for health and well-being and recreational activities within them increase. Protected area coverage remains stable.

Scenario 3 – Adapting to living spaces

The economic crisis and the greater importance placed on human well-being fosters migration to rural areas and maintenance of the population levels there, a process facilitated by information technologies and home-working. This process increases farming and recreational activities in the rural areas that maintain traditional cultural landscapes. More contact with nature raises environmental awareness resulting in more political attention to environmental aspects. Governance of protected areas becomes more important, there is strong co-management, and increased consideration of

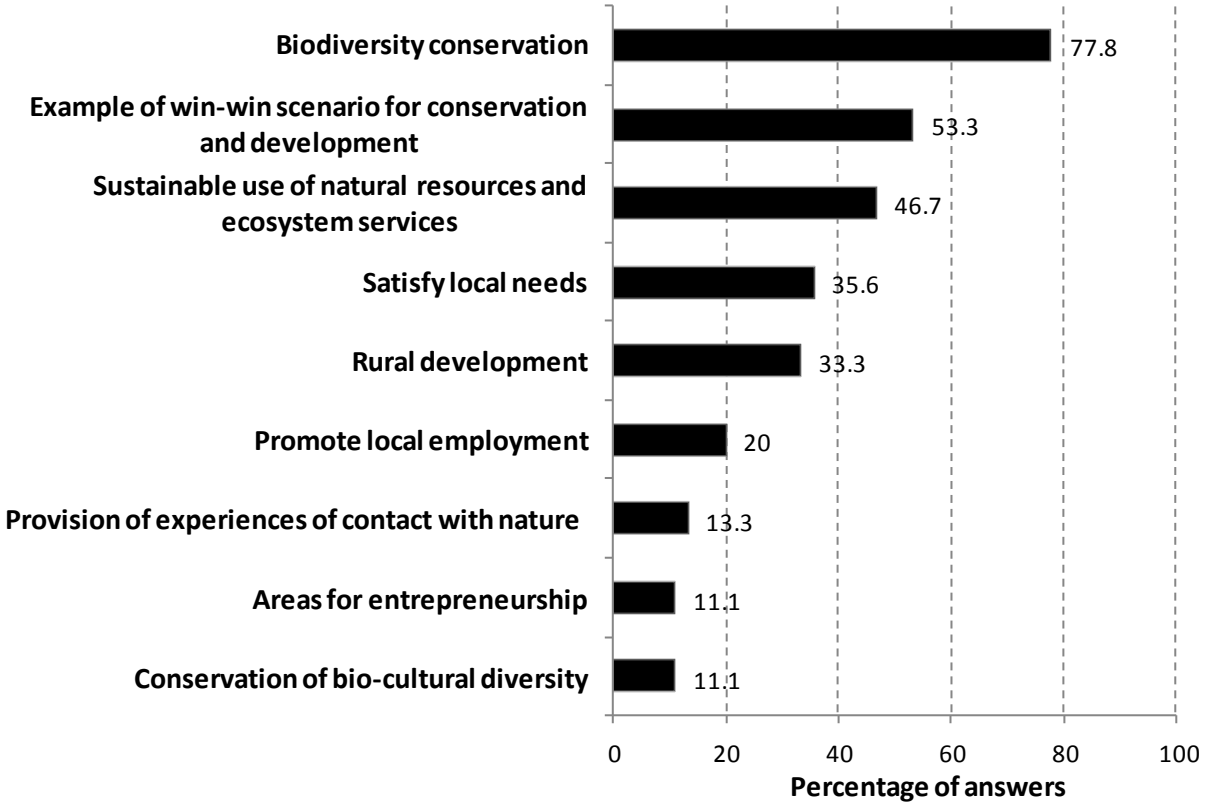

Figure 5. Answers to the question "what should be the role of protected areas in the near future (2020-2025)?" which included a list of possible answers. The numbers indicate the percentage of respondents supporting the indicated role.

protection needs in the different sectoral policies. Funding is diversified to include self-funding, increased environmental taxes for polluters, and EU funds for the Natura 2000 Network. Protected areas coverage increases considerably, big protected areas are promoted and large buffer zones established, increasing protected area resilience. Ecosystem services provided by protected ecosystems are widely recognized, but tourism is regulated to avoid excessive impacts.

Scenario 4 – Landscape tension

Climate change effects and a dryer climate create multiple challenges for agriculture and worsen economic conditions. Deteriorating living standards in cities force migrations to rural areas. Climate change effects negatively affect several ecosystems and species and protected area limits become flexible to adapt to climatic shifts. Severe droughts fostered by climate change lead to strong control of water and the creation of water supply protected areas and the protection of watersheds. Some protected areas with sufficient water resources allow increased areas of sustainable farming and grazing within their boundaries. Migration to rural areas increases farming in areas surrounding protected areas, creating border effects. As a result, connectivity aspects between protected areas receive increasing importance. Public entities are essentially the only bodies in charge of protected areas given the context of the economic crisis, participation is scarce as well as the role of other institutions such as NGOs due to the difficult economic conditions. A fee is established for tourists to enter in several protected areas.

- **Analysing the desirability of different scenarios and management proposals**

The desirable and undesirable aspects of the four scenarios and the main management proposals agreed by participants are shown in Table 1. Desired aspects from the four scenarios include: diversification of management, more participation and local empowerment, diversification of funding and implementation of environmental accounting, more flexibility and an increased importance of ecosystem services. Undesirable outcomes include lack of participation, entrance fees to protected areas, lack of consensus about the protected area model and reduction of research about biodiversity and ecosystems.

The management proposals suggested by participants include immediate actions that could be put in place to achieve a desirable future and avoid an undesirable one. These range from fostering participation in protected

Table 1. Synthesis of aspects of the protected area scenarios and main management proposals identified by participants to achieve the desired outcomes, classified in the four categories designated in this study: governance, funding, protected area model and biodiversity and ecosystem services delivery.

Category	Desired aspects within the four scenarios	Undesired aspects within the scenarios	Management proposals to achieve the desired aspects
Governance	Multiple governance types adapted to different contexts; Strong public role; More participatory processes fostered by information and communication technology; Presence of environmental aspects in all sectoral policies; Empowerment of citizens, land stewardship, and voluntary work; Protected areas foster socio-economic balance in rural areas; Increased presence of companies; More coordination among sectors; More flexibility in protected area management.	Scarce participation of civil society in protected areas governance; Limited management of secondary protected areas.	Foster participation in protected area management and land stewardship. Monitor and support new governance models adapted to the current ecological, social and economic context.
Funding	Diversification of financial resources (not 100% public); Economic evaluation of ecosystem services provided by protected areas to show their importance; More use of taxation to fund protected areas.	Existence of two financial models, public and private in which private charges entrance to protected areas for tourism; Scarce public funding due to the existence of other priorities; Dichotomy between big corporations and SMEs in protected areas.	Acknowledge instrumental values of nature. Incentivize patronage and mixed funding (public and private). Create systems beyond economic valuation to support protected areas.
Protected area model	More connectivity and importance of corridors; More use of landscape planning tools, such as watershed protection and land stewardship; Flexibility of the structure of management and management teams; Diversification of uses (not only tourism); Importance of the demonstrative role of protected areas; Upper watersheds tend to be protected.	Scarce regulation of protected areas; Lack of consensus to tackle global change impacts on protected areas; Scarce infrastructures.	Review existing protected area planning and management models. Create opportunities beyond eco-tourism.
Biodiversity and ecosystem services	Acknowledgements of the delivery of ecosystem services by the ecosystems of protected areas; Acknowledgements of the importance of protected areas for human health and well-being; Provisioning and regulating services gain importance in protected areas (with more sustainable agriculture and farming activities); Recreation and tourism in protected areas lose importance in comparison to other services, and protected areas closer to urban settlements gain importance in ecosystem service provision.	Lack of an active and preventive management of biodiversity and ecosystems; Reduction of research about biodiversity and ecosystems.	Articulate sustainable production activities (i.e. traditional grazing or forest management) that conserve habitats and species. Establish stable systems of biodiversity and ecosystem services monitoring and communicate these results.

area management, acknowledging ecosystem services delivered by protected ecosystems, reviewing existing protected area planning and management models, and articulating sustainable production activities that conserve habitats and species (Table 1).

DISCUSSION

- **Visions of the future of protected areas**

The PSP approach applied to protected areas facilitates identifying drivers of change and the multiple paths that the evolution of protected areas might follow (McNeely, 2005). As seen in the scenarios created, the future of protected areas is determined by ecological and social aspects on multiple scales (Cumming et al., 2015). The PSP process allows collectively exploring these paths, analysing uncertainty, thresholds, dead-end paths, and hidden opportunities for protected areas. This co-production of knowledge between scientists, policy-makers and citizens has been identified as one successful strategy for connecting knowledge and action to inform adaptive governance (Wyborn, 2015).

In Mediterranean countries like Spain, climate change might impact not only protected biodiversity, but also protected areas as sources and reservoirs of highly demanded water for multiple uses. Freshwater protected

A climber in the Picos de Europa National Park, the first National Park created in Spain in 1918. Some protected areas in Spain are pioneers in the regulation of the climbing practice © Ignacio Palomo

areas might become more common in order to protect scarce water resources (Saunders et al., 2002), but water could also be diverted from conserving biodiversity to other pressing needs (agriculture production) as happens in Scenario 4. Previous studies have shown that, when other objectives are put before conservation, protected areas might reduce their conservation standards (downgrading), or the land area protected by the protected area (downsizing) (Mascia et al., 2014). This has already been the case for some protected areas in Spain with aquifers lying beneath them (Martínez-Santos et al., 2010), and might be intensified in the near future due to climate change. As shown in Scenario 4, strong institutions (in this case public institutions) with adequate social support are essential to safeguard the general interest of society (in the long term) and to manage protected areas in times of profound crisis.

Climate change effects on protected areas can be seen as a major challenge, but opportunities might emerge (Dudley et al., 2010). In Scenario 2, climate change contributes to create awareness about how coupled human and natural systems are, increasing societal understanding of our dependence on nature. As a result, protected areas gain recognition as crucial assets for a healthy planet, increasing societal awareness of their benefits. This brings increased support for protected areas funding and governance which is one of the main deficits of Spanish protected areas currently (Europarc-Spain, 2014) and of other protected areas worldwide (Waldron et al., 2013).

Population dynamics and the rural–urban balance can affect protected areas in multiple different ways. High human population density has been associated with negative border effects on protected areas (Packer et al., 2013). However, urban concentration can accelerate re-wilding processes in rural areas, a phenomenon that is already happening in multiple places in Europe (Navarro & Pereira, 2015). This also has associated effects, such as the loss of cultural landscapes that could only be maintained inside protected areas. These changes have already been observed in reality. For example, the Sierra Nevada protected area in Spain protects cultural landscapes and has been associated to the maintenance of local ecological knowledge (Iniesta-Arandia et al., 2015). The opposite situation, a more balanced rural–urban population in Scenario 3, shows an increased awareness of our dependence on nature and greater presence of environmental aspects in politics which could be positive for protected areas in the long term. Finally, the human population distribution also affects visits to protected areas which can lead to differences in revenues, such as those from tourism, among protected areas.

Economy and funding are major aspects for conservation. Low per capita GDP, for example, has been identified as a major limiting factor for the creation of new protected areas in some countries (McDonald & Boucher, 2011). Protected area effectiveness is also highly dependent on protected area funding (Leverington et al., 2010; Waldron et al., 2013) and there is evidence that

Herd of horses in the Doñana Protected Area in Southwestern Spain. Grazing exists in several protected areas in Spain and contributes to shaping protected cultural landscapes © Ignacio Palomo

many governments are reducing their commitments and funding to protected areas (Watson et al., 2014). An assessment of protected area effectiveness in the Catalonia region, the first to be carried out in Spain based on the IUCN-WCPA Framework, showed that besides resources, other factors such as administrative coordination, pressures and impacts affect effectiveness (Mallarach, 2006). In Scenario 2, environmental accounting is implemented to create awareness of protected areas as important socio-economic assets. This could lead to more governmental support, better management and possibly new protected areas. Several studies indicate that economic benefits of protected areas are much higher than the funds invested in them. This is the case in Australia where the budget for the Great Barrier Reef Marine Park was approximately Aus$50 million in 2012–13, but tourism to the reef provided revenues of more than Aus$5.2 billion annually (Watson et al., 2014). A study of 16 protected areas in the Spanish region of Catalonia reported that these generate 192 million Euros/year associated to services and tourism and other sectors and 5,110 jobs (Instituto Cerdá, 2015). However, estimating the economic value of ecosystem services entails certain risks. For example, one meta-analysis in Spain revealed that the lowest values are attributed to the best conserved but low population density areas (Gómez-Baggethun & Ruiz-Perez, 2011; Quintas-Soriano et al., 2016). Integrating multiple values of biodiversity and ecosystem services, including relational values, has been proposed to avoid the dominance of economic values and more materialistic reasons for conservation (Martín-López et al., 2014; Chan et al., 2016). In any case, previous qualitative approaches to ecosystem services evaluation in Spain show the multiple ecosystem services that protected areas provide and how this can serve towards a more integrated management of protected areas (Palomo et al., 2013; Moreno et al., 2014; García-Llorente et al., 2016).

Some limitations exist to the usefulness of these scenarios for protected area systems in other countries with less protected area coverage, which might tend to emphasize protected area creation in PSP processes. In such countries, supra-national organizations might play an important role in the creation of new protected areas, as has been the case in European countries with the creation of the Natura 2000 Network. Other challenges might differ as well. Whereas in other countries illegal hunting and settlement might be major impacts within protected areas, in Spain illegal construction of tourist infrastructures or illegal extraction of water for agriculture purposes (occurring outside the protected area but diminishing the aquifer beneath them) are more significant.

- **From the past to the future: scenario desirability and backcasting**

There is no single adequate path for protected areas' evolution but rather multiple context-dependent options (Dearden et al., 2005). Analysing future scenarios in terms of their desirability allows for a collective planning strategy that incorporates complexity and uncertainty (Bügl et al., 2012), and therefore different contexts in which protected areas might be embedded. Several positive aspects within the scenarios were identified according to stakeholders' perceptions. Some of these aspects deal with protected area coverage such as protecting watersheds in which protected areas are located (Postel & Thompson, 2005) and an integrated management of the surrounding landscape of protected areas (De Fries et al., 2010). Others, refer to protected area governance and effectiveness and greater use of taxation to fund protected areas and diversification of financial resources (McCarthy et al., 2012; Watson et al., 2014), the need to acknowledge the importance of nature for human well-being (Russell et al., 2013) and the roles of protected areas close to cities. These visions can facilitate more informed decisions that could be taken today to achieve a desirable future.

Participants' preferences lean towards a diversification of protected area governance, funding, protected area models and a broader approach towards biodiversity and ecosystem services. These recommendations are aligned with previously observed trends in protected area evolution. Regarding protected area governance, the total protected area managed or co-managed with non-governmental actors increased from 4 per cent to 23 per cent from 1990 to 2010 globally (Bertzky et al., 2012). Previous studies have shown that diversification in the managing institutions of protected areas also increases their resilience (Jones et al., 2013), improves conservation and socioeconomic outcomes (Oldekop et al., 2016), and addresses the need to include local communities and an integrated landscape approach in protected area governance (Kothari & Neumann, 2014). In Spain, the Doñana protected area shows that the lack of alignment of multiple actors and institutional scales can lead to conflict (Gómez-Baggethun et al., 2013). Funding increasingly comes from a broader range of sources (Dearden et al., 2005), although it remains a critical aspect for protected areas and a limiting resource to achieving the objectives of the Convention on Biological Diversity and adequate management of protected areas, especially in developing countries (Bertzky et al., 2012). The protected area model is being diversified as well. Protected areas that support sustainable use of natural resources are expanding, and today 18 per cent of protected land falls within IUCN

A tourist points to small crevasse in the Monte Perdido Glacier in the Ordesa and Monte Perdido National Park in the Pyrenees. Climate change has diminished glaciers in the Pyrenees at an alarming speed © Ignacio Palomo

Category V and 21 per cent within category VI (UNEP-WCMC & IUCN, 2016). Finally, wider acknowledgement of the ecosystem services delivered by protected areas is also a well-recognized trend, and the engagement of people is critical to move towards protected area co-management in which multiple value types, knowledge systems and stakeholders are included (Tallis & Lubchenco, 2014; Martín-López & Montes, 2014). These diversification trends reflect the transition from the island, network, landscape and social-ecological approach that the protected area concept has followed; a similar trend to the evolution of views of conservation (Mace, 2014; Palomo et al., 2014).

Initially created to protect iconic landscapes and species, protected areas are now also expected to fulfil diverse social and economic objectives (Watson et al., 2014). This shift in expectations, instead of demanding lowered protection standards, will require a closer look at conservation status since more human activities (or of higher magnitude or extent) will take place within and around protected areas. Questionnaire results show that despite these multiple emerging expectations, biodiversity conservation should be the main role of protected areas in the future, followed by demonstrating new approaches to development or to the sustainable use of ecosystem services. As questionnaire respondents were mainly environmental professionals, different results could be obtained if a different group of actors (i.e. protected area visitors) were surveyed.

Spanish protected areas must undergo multiple changes to be able to cope with the limitations identified, the on-going diversification of expectations and roles and the challenges ahead. First, several regions have to complete their coverage, especially marine areas. But beyond this, there is an overall need to strengthen protected areas and

their mechanisms to achieve conservation effectively. For example, according to one study, 8 out of 10 protected areas in Madrid do not achieve a minimum level of effectiveness (Rodríguez & Martínez, 2013) and several National Parks still do not have approved management plans (OAPN, 2012). Improved governance, human resources and funding are needed as well as better transfer of scientific knowledge regarding climate change adaptation and ecosystem services governance. The reduction in support that Spanish protected areas faced after the last economic crisis is a serious impediment to achieving these goals.

CONCLUSIONS

The first modern protected areas originated about 150 years ago (100 years ago in Spain) and they have spread all over the world. Initially created to protect iconic landscapes and charismatic species, they are now expected to fulfil diverse social objectives as well. These demands, especially in Mediterranean countries, will be shaped by drivers such as land use change surrounding protected areas, climate change and population dynamics. Our work shows that Participatory Scenario Planning (PSP) allows approaching these pressing needs considering the inherent complexity of protected areas. In the case of Spain several coverage and effectiveness challenges lie ahead. A greater consideration of protection in its multiple forms, reviewing protected area models, greater participation, acknowledgement of protected area values and stronger institutional support will be needed to maintain protected areas as a key and respected component of society in the next decades.

ENDNOTES

[1] see www.redeuroparc.org/

SUPPLEMENTARY ONLINE MATERIAL

Appendix S1: Surface in the different Spanish regions from nationally designated protected areas and the Natura 2000 Network. Source: EUROPARC-Spain.

ABOUT THE AUTHORS

Ignacio Palomo is a Postdoctoral researcher at the Basque Centre for Climate Change (BC3). He is Fellow of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and Editor of the *One-Ecosystem* Journal. His research is framed within Sustainability Sciences and spans social-ecological systems with a focus on protected areas, ecosystem services flows, landscape planning, future scenarios and equity.

Marta Múgica has a Ph. D. in Biology and has been in charge of the Technical Office of the Spanish section of EUROPARC since 1994. She has carried out a number of research projects in nature conservation, protected areas and landscape ecology. She has also edited, coordinated or co-authored several collective works, mainly related to EUROPARC Spain (www.redeuroparc.org). She is one of the leaders of the Master in Protected Areas managed by Foundation Fernando Gonzalez Bernáldez for protected areas (FUNGOBE, www.fungobe.org), where she has been Executive Director since 2010.

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Carlos Montes is Full Professor of Ecology at the Universidad Autónoma of Madrid and head of the Laboratory of social-ecological systems. He is President of FUNGOBE and Director of the School of Sustainability at the International University of Andalucía. He is coordinator of the Millennium Ecosystem Assessment in

Wetland in the Sierra de Guadarrama National Park, the last National Park created in Spain making a total of 15 National Parks © Ignacio Palomo

Spain. His research focuses on the interface between ecological and socioeconomic systems. This includes function-analysis and valuation of ecosystem services, territorial planning and sustainability and resilience of social-ecological systems.

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RESUMEN

Las áreas protegidas a nivel global aún distan de alcanzar los objetivos internacionales de superficie y su gestión muestra importantes carencias. El cambio climático, los cambios de uso del suelo y presiones debidas al aumento poblacional suponen retos importantes para el futuro de las áreas protegidas. Este trabajo presenta las tendencias y consecuencias de estos impulsores de cambio sobre las áreas protegidas en España. Este país mediterráneo y *hotspot* de biodiversidad que incluye varios sistemas de áreas protegidas, está cambiando de aumentar considerablemente la superficie protegida a centrarse en aspectos de gobernanza y gestión. La Planificación Participativa de Escenarios de Futuro (PPEF) se aplicó para crear cuatro escenarios que evalúan la evolución del sistema de áreas protegidas y para desarrollar propuestas consensuadas encaminadas a un futuro comunmente deseado. Los resultados muestran que la PPEF permite explorar la complejidad e incertidumbres asociadas con el futuro de las áreas protegidas entendidas como sistemas socio-ecológicos. Un mayor apoyo institucional y una gestión activa y adaptativa son necesarias para que las áreas protegidas de España alcancen los objetivos de superficie y avancen hacia una mayor efectividad.

RÉSUMÉ

Les objectifs de superficie et d'efficacité assignés aux aires protégées sont encore loin d'être atteints. Les changements climatiques, les changements d'affectation des terres et les pressions exercées par l'augmentation des populations humaines remettent en question l'avenir des aires protégées. Dans cette étude, nous analysons les tendances et les effets de ces facteurs de changement sur les aires protégées en Espagne. Ce pays méditerranéen, point névralgique de la biodiversité qui dispose de nombreux systèmes d'aires protégées, a d'abord cherché à augmenter la couverture des aires protégées, et vise désormais une amélioration de l'efficacité de la conservation. Une approche de Planification Participative des Scénarios (PPS) a été élaborée afin de créer quatre scénarios pour évaluer l'évolution du système des aires protégées et faire émerger des propositions visant à assurer un avenir favorable. Les résultats montrent que la PPS facilite la compréhension des complexités et des incertitudes liées à l'avenir des aires protégées en tant que systèmes socio-écologiques. Nous concluons qu'un soutien social et institutionnel plus important et une gestion active et adaptative sont nécessaires pour que les aires protégées en Espagne répondent aux enjeux de superficie et d'efficacité à venir.