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PARKS is published to strengthen international collaboration in protected area development and management by:

- exchanging information on practical management issues, especially learning from case studies of applied ideas;
- serving as a global forum for discussing new and emerging issues that relate to protected areas;
- promoting understanding of the values and benefits derived from protected areas to communities, visitors, business etc;
- ensuring that protected areas fulfill their primary role in nature conservation while addressing critical issues such as ecologically sustainable development, social justice and climate change adaptation and mitigation;
- changing and improving protected area support and behaviour through use of information provided in the journal; and
- promoting IUCN's work on protected areas.

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IUCN PROTECTED AREA DEFINITION, MANAGEMENT CATEGORIES AND GOVERNANCE TYPES

IUCN DEFINES A PROTECTED AREA AS:

A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

The definition is expanded by six management categories (one with a sub-division), summarized below.

Ia Strict nature reserve: Strictly protected for biodiversity and also possibly geological/ geomorphological features, where human visitation, use and impacts are controlled and limited to ensure protection of the conservation values.

Ib Wilderness area: Usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, protected and managed to preserve their natural condition.

II National park: Large natural or near-natural areas protecting large-scale ecological processes with characteristic species and ecosystems, which also have environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.

III Natural monument or feature: Areas set aside to protect a specific natural monument, which can be a landform, sea mount, marine cavern, geological feature such as a cave, or a living feature such as an ancient grove.

IV Habitat/species management area: Areas to protect particular species or habitats, where management reflects this priority. Many will need regular, active interventions to meet the needs of particular species or habitats, but this is not a requirement of the category.

V Protected landscape or seascape: Where the interaction of people and nature over time has produced a distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.

VI Protected areas with sustainable use of natural resources: Areas which conserve ecosystems, together with associated cultural values and traditional natural resource management systems. Generally large, mainly in a natural condition, with a proportion under sustainable natural resource management and where low-level non-industrial natural resource use compatible with nature conservation is seen as one of the main aims.

The category should be based around the primary management objective(s), which should apply to at least three-quarters of the protected area – the 75 per cent rule.

The management categories are applied with a typology of governance types – a description of who holds authority and responsibility for the protected area.

IUCN defines four governance types.

Governance by government: Federal or national ministry/ agency in charge; sub-national ministry/agency in charge; government-delegated management (e.g. to NGO)

Shared governance: Collaborative management (various degrees of influence); joint management (pluralist management board; transboundary management (various levels across international borders)

Private governance: By individual owner; by non-profit organisations (NGOs, universities, cooperatives); by for-profit organsations (individuals or corporate)

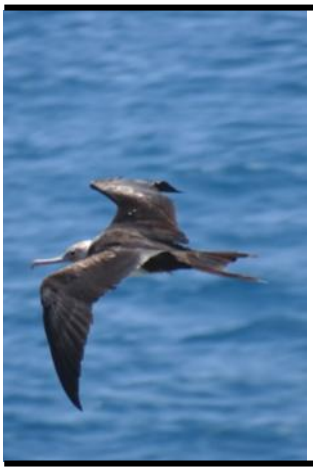
Governance by indigenous peoples and local communities: Indigenous peoples' conserved areas and territories; community conserved areas – declared and run by local communities

For more information on the IUCN definition, categories and governance type see the 2008 *Guidelines for applying protected area management categories* which can be downloaded at: www.iucn.org/pa_categories

IUCN WCPA'S BEST PRACTICE PROTECTED AREA GUIDELINES SERIES

IUCN-WCPA's Best Practice Protected Area Guidelines are the world's authoritative resource for protected area managers. Involving collaboration among specialist practitioners dedicated to supporting better implementation in the field, they distil learning and advice drawn from across IUCN. Applied in the field, they are building institutional and individual capacity to manage protected area systems effectively, equitably and sustainably, and to cope with the myriad of challenges faced in practice. They also assist national governments, protected area agencies, nongovernmental organisations, communities and private sector partners to meet their commitments and goals, and especially the Convention on Biological Diversity's Programme of Work on Protected Areas.

A full set of guidelines is available at: www.iucn.org/pa_guidelines
Complementary resources are available at: www.cbd.int/protected/tools/
Contribute to developing capacity for a Protected Planet at: www.protectedplanet.net/



PARKS: THE INTERNATIONAL JOURNAL OF PROTECTED AREAS AND CONSERVATION

Edited by Marc Hockings and Sue Stolton, IUCN WCPA

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PARKS: EDITORIAL TRANSITION

Marc Hockings

PARKS first appeared in 1990 and published papers largely authored by members of the IUCN World Commission on Protected Areas. After ceasing publication in 2008, it was re-launched as a peer-reviewed, open access journal for the IUCN World Commission on Protected Areas in 2012 after a gap of four years. It has been edited since then by Sue Stolton and Nigel Dudley of Equilibrium Research.

Sue and Nigel established the new format and edited the journal for the five years since 2012. They established standards, guidelines for authors and processes for review, a website and publication of the journal. During this time the journal has published 105 papers from 456 authors in 65 countries. Nearly 50,000 people have visited the journal website, where all papers can be freely downloaded. Authorship has expanded well beyond the membership of the Commission and the papers have addressed a wide variety of issues relevant to protected areas. *PARKS* is a different style of journal – as editors, Sue and Nigel established a strong relationship to authors, seeking to enable publishing of important lessons of general relevance to managers and researchers. The journal publishes many more papers from field practitioners than is the norm in peer-reviewed journals in the field.

As outlined in the journal website *PARKS* aims to be "a rigorous, challenging publication with high academic credibility and standing. But at the same time the journal is and should remain primarily a resource for people actively involved in establishing and managing protected areas, under any management category or governance type. We aim for the majority of papers accepted to include practical management information. We also work hard to include authors who are involved in management but do not usually find the time to report the results of their research and experience to a wider audience. We welcome submissions from people whose written English is imperfect as long as they have interesting research to report, backed up by firm evidence, and are happy to work with authors to develop papers for the journal." As editors, Sue and Nigel have lived up to this aim, assisting many authors from non-English speaking backgrounds to develop their papers to publication standard. In this, they have been assisted by many WCPA members and other IUCN Commission members who have supported *PARKS* by refereeing papers, mentoring authors as well as through publication of their own material.

After five years of hard work, Sue and Nigel are stepping back from their roles as Editors although they will join the Editorial Board where they will continue to provide support, advice and guidance. Marc Hockings is now taking over the role as Managing Editor, supported by a group of co-editors (Sarah Casson, Shailyn Drukis, Olivier Chassot, Helen Newing, John Waithaka and Bas Verschuuren) as well as the Editorial Board.

PARKS will continue to be published twice a year but the timing of issues will change to May and November from 2018.

EDITORIAL: BUILDING CAPACITIES FOR CONSERVATION OF NATURE: CAN THIS BE DONE AT DISTANCE?

Geoffroy Mauvais

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Recent journal papers and other reports on biodiversity in Africa underline its incredible richness and yet its extreme fragility. Although the continent is home to some of the largest and most famous protected areas on the planet such as Serengeti, Kruger, Nakuru, Comoé, Aïr or Virunga National Parks, wildlife continues to decline at an unprecedented pace (Mallon et al., 2015). More effective management of protected areas is seen as a potential solution, but this is impeded by a lack of appropriately skilled staff. But what can be done when the number of people to be trained is enormous (several thousand or tens of thousands if one simply considers state-governed protected areas), the competencies needed by managers are numerous (see Appleton, 2016) and the training structures are so scarce, most of the time inadequate or remain inaccessible to most potential candidates? Distance learning, via the Internet, may help to meet this challenge.

If so, protected area managers and their partners wishing to strengthen their capacities will have to get used to new acronyms: MOOC, LMS, OCW, ECTS, COS… These are just a few among many acronyms that could soon offer tremendous potential for improving the future of all stakeholders involved in conservation.

DISTANCE LEARNING?

Distance learning is not new. Until recently, we would simply use the daily mail to receive course documents and to return our examination copy. This is now mostly in the past and training is largely available online thanks to the development of Learning Management Systems (LMS), which allow the management of training resources directly on the web. The open-source Moodle platform[1] is a good example but proprietary solutions also exist, such as Blackboard[2]. Obviously, the Internet is full of other possibilities for users wishing to access or create open educational resources. Some of these initiatives are collaborative, like Wikipedia, while some provide more limited access. Some resources are also specifically developed for didactic use such as Open Courseware[3] (OCW) but with generally few interactive functions. There are as many options as there are developers, which means that the field of online learning is extremely innovative and evolving constantly. Massive Open Online Courses (MOOCs) are just the latest development in distance learning.

WHAT ARE MOOCS?

MOOCs have emerged as a common learning solution to share knowledge and experience in interactive networks. They were first called connective knowledge MOOCs. But soon, order took over and MOOCs evolved into a more traditional form of education, with teachers on one side and learners on the other. They have multiplied since 2012 both in format and in number. These online courses provide access to the best resources (as well as the worst, everything is about selection) and several thousand are now available on the Internet (Kizilcec et al., 2017). They are offered, in particular, by the biggest universities; and some cover nature, conservation and sustainable development issues. Thanks to them, everyone now has an equal chance of accessing training (not just information), even from institutions that were previously out of reach due to location, price or scarcity of places.

As the selection of learners is not made on the basis of a diploma or prior test, it is the subject matter that sorts the audience. The introductory MOOCs have a wider audience but often bring together very disparate targets which may make the cohesion of the course somewhat difficult. The more specific a MOOC becomes in academic focus, the more likely it is to reach a smaller but more appropriate audience.

Grey crowned cranes (*Balearica regulorum*) © Geoffroy Mauvais

MOOC-GAP

While there is no single recipe for managing protected areas around the world, there are common principles, shared knowledge and similar approaches that can be taught, learned and understood. Since 2009, IUCN-Papaco (Programme on African Protected Areas & Conservation) has been developing training programmes for protected area actors in Africa. They are composed of different courses, from short, targeted training spread over one to two weeks to a full Master's degree which lasts two years. In between, there also exist eight-week training sessions called university diplomas. All of them are taught on-site. In all cases, the number of applications for registration far exceeds the numbers that can be accommodated (often by a factor of 20 to 30 times). The logical conclusion was that in response to the explosion in demand for training in protected areas in Africa (not to mention all those who actually do not ask

BOX 1: ESSENTIAL CHARACTERISTICS OF A MOOC

A MOOC is a distance education system that has certain characteristics, as expressed by its acronym:

Massive: it is a massive course. It can reach a large number of learners, from different cultures, coming from different backgrounds. The number of participants is virtually unlimited, so the course must be developed with this reality in mind. MOOCs allow for a change of scale, both in the impact of the course, but also in the feed-back sent by the students.

Open: it is a course open to all. It is free (in some cases, additional services such as issuing a certificate, may be charged) and there is no choice on who signs up (no possibility to select and no academic prerequisites in most cases). This openness gives free access to everyone, which presents a huge opportunity for new learners and a complete paradigm shift in the selection process that usually applies to courses.

Online: this is an online course. It can therefore be followed anywhere if Internet access is available, at any time, under all conditions. This removes the barriers of distance, schedules, time-differences, availability, language or even simply timidity of the participants. Everyone is welcome and everyone has the same chance to succeed.

Course: it is a course. There is therefore a pedagogical objective, a determined path to progress, teaching materials, exams, etc. It does not only offer online resources, but rather a constructed approach, generally leading to academic recognition.

The MOOC-GAP identity card

for anything because they do not have access to training), we needed to promote new channels for the much-needed capacity-building of stakeholders in and round protected areas. This is why IUCN-Papaco has embarked on the preparation of the first MOOC on the management of protected areas in Arica: the MOOC-GAP [Gestion des Aires Protégées (GAP) in French, the original language of the MOOC] [4].

This MOOC has been developed with the Ecole Polytechnique Fédérale de Lausanne (EPFL), one of the leading 'MOOC' factories in Europe (and the 14th university in the Shanghai ranking [5]). Over seven modules, the MOOC-GAP provides an understanding of protected area management issues and their contribution to conservation in Africa. Those who pass all the online exams successfully receive an official certificate of achievement. Those who pass a supervised onsite final exam can then acquire two ECTS credits (in the European Credit Transfer and Accumulation System), which they can then use towards a diploma in the European learning system. The MOOC-GAP is geared primarily to staff working in protected areas and to students and professors interested in this subject, but it also targets a wider audience of people generally interested in the conservation of nature in Africa. It is therefore primarily a teaching tool but also a formidable way to raise awareness on conservation issues.

HOW DOES IT WORK?

Through the MOOC platform, students watch videos online, complete intermediate quizzes to check their understanding of the course and consult the recommended reading for the week. They can take an exam every week in two main forms: a long quiz with automatic correction and immediate result or an examination with open questions, corrected by their peers within a few days after the submission of the assignment. To accompany the course, in addition to the optional quizzes, participants have access to written material specifically developed for the MOOC and which summarizes the course. Downloadable in PDF format from the platform, this is much appreciated by the learners once they have watched the videos. An essential quality of any MOOC is the opportunity to interact with teachers or other students in an online forum. About a quarter of the learners of the MOOC-GAP visit this forum regularly and more participate in the Facebook group for the course. Finally, IUCN-Papaco regularly organizes online chats to allow an instant discussion with the participants, for about an hour. This reinforces the cohesion of the course, creates a sense of team belonging and provides a regular and quick feedback on the course that can then be immediately taken into account.

BOX 2: THE MOOC-GAP IN A FEW LINES

The course is organized in a logical progression allowing the gradual presentation of increasingly detailed subjects. It consists of 56 videos, 16 quizzes, and seven weekly exams.

Module 1 Presentation of Protected Areas: importance, role, history, philosophy, definition, IUCN Management Categories.

Module 2 Protected Area Planning: issues, modalities, planning of systems, impacts, transboundary areas.

Module 3 Protected Areas Governance: definition and different types (government, private, community-based and shared).

Module 4 Protected Area Effectiveness: interest, assessment methods, ecological monitoring, research, Green List.

Module 5 Specific Management of Protected Areas: nature and culture, capacity building, marine areas, species approach, ecotourism.

Module 6 Sustainable Financing: planning, economic value, funding sources, financing mechanisms.

Module 7 Cross-cutting themes for Protected Areas: climate change, connectivity, restoration, equity, corruption, law-enforcement.

Each module is supplemented by a presentation of an important international convention for the management of protected areas (e.g. Convention on Biological Diversity, World Heritage, CMS, RAMSAR, CITES, etc.).

From left to right: Olivier Courbon, Polynice Anagonou, Liliane Poinçon and Junior Ngaba

LEARNERS' TESTIMONIALS

Olivier Courbon – France

"This MOOC was fundamentally different, in form and content, from the other training courses I have followed. It has enlightened me on issues that I had never addressed, such as sustainable funding for protected areas, and opened my eyes to the idea of working in the medium term, I hope, for the conservation of protected areas in Africa. During my internship at the GIZ, I worked in the transboundary biosphere reserve of the Mono delta (Benin) and the knowledge about community management provided by the MOOC enabled me to be more operational on the ground."

Polynice Anagonou – Benin

"I am a teacher in the field of forestry at the agricultural college Medji (Sekou) located 40 km from Cotonou in Benin. My students are in grades 1, 2 and 4. The MOOC-GAP has enabled me to strengthen my skills and abilities in managing protected areas and helped me to identify the key concepts that I need to emphasize to learners for better conservation of natural resources. I take great inspiration from it for my teaching at the College. But also, as an actor in nature conservation, I feel better equipped to participate in the protection of the biodiversity of my country."

Liliane Poinçon – Haiti

"I work at the National Agency for Protected Areas in Haiti (ANAP) as a monitoring and evaluation of activities specialist in Haiti's protected areas. The MOOC-GAP is really useful to me in my work, especially as it has allowed me to better master some essential tools for all protected areas. It creates a common language for all protected area managers, whether African or not. The work I have done in this course has allowed me to better understand the management plan development processes and to be able to make a good evaluation of the activities carried out during the execution of these plans."

Junior Ngaba – Cameroon

"I am currently a student in China, following the PhD programme at the Fujian Agriculture and Forestry University (FAFU). The MOOC on protected area management has helped me better take on the main challenges and stakes Africa is facing today for the conservation of its biodiversity. It has also helped me gaining knowledge on management tools and techniques. Above all, it contributed in helping me get the scholarship for my PhD in China!"

COURSE QUALITY FEEDBACK

Freddy Padonou

"I took this course because of my general interest. But, it very quickly became for me an opportunity for additional training. So I took it seriously and set myself the goal of finishing it in order to get the certificate at the end… A course of this kind deserves to be replicated as many times as possible to reach many other Internet users in Africa."

Hervis Donald Ghomsi

"I decided to take the course on Protected Areas Management with the objective of improving my environmental skills, especially in the tropics… I greatly appreciated the structure of the lessons, each time with a weekly convention (CBD, CITES, RAMSAR…) that help position the learner in the legal framework of conservation. The video montages are impeccable and the courses are well synthesized, idem for the instructors who by their concise and precise interventions, demonstrate a good mastery of the subject."

THE EVALUATION OF MOOC-GAP IN 2016

At the end of each MOOC session, an anonymous questionnaire is automatically sent to all registered students to get their opinion on the MOOC. The results are then published online; directly and transparently. The main conclusions drawn from their responses are as follows:

- 97 per cent of respondents are globally satisfied with the course, its level of difficulty (91 per cent) and its duration (80 per cent).
- 96 per cent think that the content of the course corresponds to their expectations and 95 per cent that the videos are of very good quality.
- 92 per cent believe that what they have learned will be of direct benefit to them in their activities related to the conservation of nature in Africa.
- Finally, most participants (91 per cent) are interested in other MOOCs on more specialized subjects and request the implementation of other educational initiatives of this kind.

These statistics are consistent with the mark given by the students to the MOOC-GAP on the platform directly (4.9 out of 5) and with their numerous testimonials, some of which are reproduced here. The seven modules of the MOOC can be completed over 12 weeks, at a pace chosen by the students. The course, originally developed in French, has also been available in English from the end of 2016.

OUTCOMES IN A FEW FIGURES

In 2016, over 7,000 people from 116 countries registered for the MOOC-GAP and more than 400 learners obtained their final certificate of achievement. We should keep in mind that most MOOC participants do not seek the diploma but rather the knowledge, which explains this relatively low (but typical for MOOCs) rate for the final certificate. The majority of enrolees are professionals, either consultants (17 per cent) or employees of parks, reserves or NGOs (43 per cent). Students (21 per cent) and job seekers (16 per cent) also make up a significant proportion of enrolees.

Nearly 65 per cent of these people are African. African countries with the highest number of participants are Cameroon, Senegal, DRC and Madagascar (Table 1).

An interesting feature of this mode of teaching is that it allows the formation of a strong network during the training itself. Thus, the Facebook group of the MOOC-GAP had more than 2,700 members at the end of 2016 who continue to exchange ideas and information even after finishing the course. It is therefore a formidable platform for continuous learning and not the time-limited experience that is most often the case in face-to-face training. This also provides a means to measure the impact of the training on the ground by continuing to interact with learners once they have returned to work.

Table 1: Country of origin of the participants

Country	Percentage of total number of students
Cameroon	15
France	11
Senegal	6
Democratic Republic of the Congo	6
Madagascar	5
Burkina Faso	5
Côte d'Ivoire	4
Benin	3
Togo	3
Rwanda	2
Gabon	2
Morocco	2

FROM MOOC TO COS

Developing a MOOC is a great experience but certainly not an end in itself. A longer-term perspective is needed, which will ultimately provide learners with an opportunity to make more progress and for their own improvement to be recognized. This is why IUCN-Papaco is collaborating with the EPFL to set up a Certificate of Open Studies (COS) consisting of several MOOCs to be undertaken progressively in order to obtain this official certificate. Within this framework, a MOOC on ecological monitoring was launched in February 2017 and two new MOOCs are currently being prepared: one on conservation law enforcement and the other on the species approach for protected area management. They will be complemented in 2018 by other MOOCs (on Geographical Information Systems, Communities engagement and negotiation, Technology for Protected Area Management, etc.) to complete the COS which is expected to be made up of eight MOOCs in total.

Diplomas are usually reserved for graduates, meaning that only those who already have reached an academic level are allowed to continue in the system. In the case of MOOCs, since there is no compulsory prior screening, it is up to each student to prove his or her capacity. The COS will also be accessible to all by following different MOOCs until they reach the required number of credits. This represents a major revolution, allowing learners,

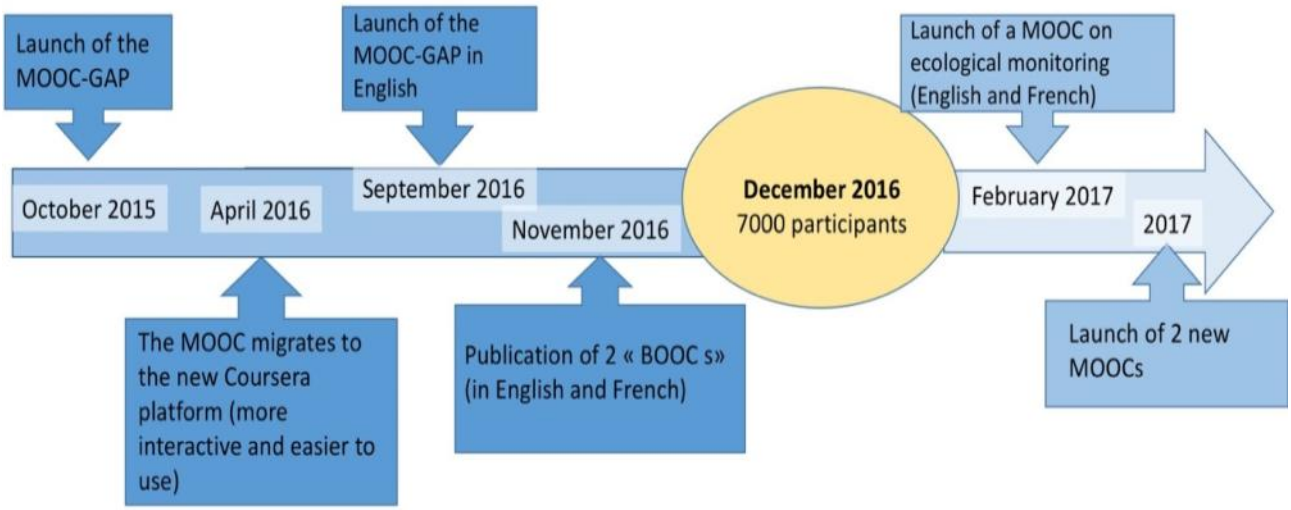

Figure 1: The path to the Certificate of Open Studies

wherever they are, to access a real diploma awarded by a prestigious school. For Africa, it is certainly a solution to the lack of infrastructure and teachers to respond to the current and future explosion in demand. It is also a tremendous opportunity for African universities to enter the open and competitive field of training that is now globalized. Nature conservation has certainly much to gain in this process.

ENDNOTES

[1] www.moodle.org

[2] Blackboards is a Learning Management System that has been developed in the 1990s and allows sharing the training material developed by universities around the planet, such as www.blackboard.american.edu or www.open.ac.uk

[3] OCW is a free training resource based on a course that is put online. Well-known OCWs are www.ocw.mit.edu or www.open.edu/itunes

[4] www.papaco.org/mooc

[5] www.shanghairanking.com

ABOUT THE AUTHOR

Geoffroy Mauvais is a veterinarian specialized in the development and management of protected areas in Africa. He has been coordinating the IUCN-Papaco since 2006. After six years in Ouagadougou and three in Nairobi, he is now based in Johannesburg, South Africa. Papaco's objective is to improve the governance and management of the continent's protected areas, in order to contribute to better conservation of biodiversity. It is therefore aimed both at preserving species and at maintaining ecosystems and all their functions. It also focuses on the sustainable use of this biodiversity, when it strengthens conservation and is possible to achieve in a sustainable manner. To achieve this, Papaco works primarily on site and network assessments, technical support and information for managers, and training of staff and partners in parks and reserves. He joined EPFL in 2015 to develop MOOC programmes and other scientific activities in this area. See www.papaco.org for more details.

JOIN THE MOOCS

MOOC on Protected Area Management:
www.coursera.org/learn/protected-areas

MOOC on Ecological Monitoring:
www.courseware.epfl.ch/courses/course-v1:EPFL+eco-monitoring+2017_T1/about

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PRIVATELY PROTECTED AREAS: ADVANCES AND CHALLENGES IN GUIDANCE, POLICY AND DOCUMENTATION

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ABSTRACT

Privately protected areas (PPAs) are increasingly recognized as important conservation initiatives, as evidenced by recent developments that support recognizing and documenting them alongside protected areas under other governance types. Advances in guidance on PPAs have been accompanied by increasing support within international policy arenas, and more PPAs are being reported to the World Database on Protected Areas (WDPA). Despite this, national approaches to recognizing and supporting PPAs vary, as does the extent to which countries report on PPAs to the WDPA. We present recent advances that support PPAs at the international level, summarize the present state of PPA reporting to the WDPA, and discuss the challenges and opportunities that currently characterize the future of PPAs.

Key words: Privately protected areas; World Database on Protected Areas; WDPA; governance

INTRODUCTION

Protected areas under the governance of private entities, known as privately protected areas (PPAs), have gained attention in recent years (e.g. UNEP/CBD/COP/DEC/XII/19; Borrini-Feyerabend et al., 2013). Their increasing profile in national and global policies reflects a growing understanding of their importance in acting as havens for biodiversity in their own right; as components of coherent landscapes and connectivity; and in complementing protected area networks under other governance types. It further reflects a rising awareness among governments that encouraging, recognizing and reporting on PPAs can facilitate progress towards their international conservation commitments, such as the Convention on Biological Diversity (CBD) Aichi Biodiversity Target 11. Under this Target, governments have agreed on the following global goal: "by 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape" (UNEP/CBD/COP/DEC/X/2).

Despite the positive developments described above, PPAs remain under-reported to global data managers including the World Database on Protected Areas (WDPA) and CBD Secretariat. This paper provides a background on recent developments to strengthen PPA policy, documentation and international guidance. It describes the current state of PPAs as reported in the WDPA, and efforts aimed to encourage comprehensive reporting by governments and other actors.

GUIDANCE AND POLICY

Recent studies show that the world's biodiversity is not adequately conserved by the existing network of protected areas. An update to the UNEP-WCMC and IUCN *Protected Planet Report 2016* (UNEP-WCMC & IUCN, 2016a), published in December 2016, reported terrestrial coverage of 14.8 per cent and marine coverage of 5.1 per cent (this figure rises to 12.7 per cent when only areas within national jurisdiction are considered), falling short of the global coverage ambitions of Aichi Biodiversity Target 11 (UNEP-WCMC & IUCN, 2016b). The *Protected Planet Report* found that fewer than half of terrestrial ecoregions are more than 17 per cent protected. In the marine environment, only one third of ecoregions are more than 10 per cent protected. Butchart et al. (2015) also found that 57 per cent of 25,380 species assessed were inadequately covered by protected areas. As such, if Aichi Biodiversity Target 11 is to be met through a system of protected areas that is representative of ecosystems and species, then protection needs to be extended to areas that have not historically been incorporated in the protected area networks maintained by governments. The existence of private governance actors means that this expansion need not rely solely on newly designated areas, and instead can be achieved in part by recognizing existing initiatives. However, if PPAs are to be counted towards biodiversity targets, it is important that they are appropriately recognized and supported, enabling them to persist into the future, and that they are reported in national and international databases, allowing conservation planning exercises to build on an accurate picture of what is already protected.

Recognition of PPAs by the International Union for Conservation of Nature (IUCN) has grown as part of a broader focus on protected area governance which came to the fore at the fifth World Parks Congress in Durban, South Africa in 2003, where a substantial session on PPAs was held. A themed issue on private reserves was published in *Parks* in 2005 (Mitchell, 2005). As an essential subsequent step in advancing the global recognition of PPAs, IUCN published a report in 2014 entitled *The Futures of Privately Protected Areas* (Stolton et al., 2014). The report sets out a new definition of PPAs, aimed at clarifying and unifying the diverse definitions previously in circulation. This definition, shown in Box 1, is accompanied by further guidance that aligns PPAs with the existing IUCN definition of a protected area (Dudley, 2008)[1], while also elaborating on how the definition should be applied in the face of challenges specific to PPAs.

Box 1. Definition of a privately protected area (Stolton et al., 2014)

A privately protected area is a protected area, as defined by IUCN, under private governance i.e.

- individuals and groups of individuals;
- non-governmental organizations (NGOs);
- corporations – both existing commercial companies and sometimes corporations set up by groups of private owners to manage groups of PPAs;
- for-profit owners;
- research entities (e.g. universities, field stations);
- religious entities.

PPAs around the world exhibit a wide range of objectives and practices, spanning the spectrum of IUCN management categories. They also encompass a wide range of owners and managers, whose governance regimes and objectives vary. It follows, then, that the challenges associated with them are also diverse. Stolton et al. (2014) frame these challenges around the particular issues of control and long-term persistence of sites. Through discussion of these challenges, Stolton et al. (2014) provide guidance on how they should be dealt with when applying the definition of a PPA.

In the first of these challenges, the governance authorities of PPAs may encounter limits to their level of control for a number of reasons. Stolton et al. (2014) recommend that PPA managers be aware of any use-rights that are not within their control. A notable example is rights to sub-soil resources, which remain with the state regardless of land ownership in many countries (e.g. Adams & Moon, 2013; Fitzsimons, 2015; Hardy et al., 2017). There are also often different actors responsible for different land and water use-rights within a single site, potentially resulting in conflicting objectives for the management of the site (Stolton et al., 2014). In cases where use-rights are not all held by the PPA governance authority, the guidance recommends that every effort be made to ensure that there is no negative effect on the site's conservation objectives or adherence with the IUCN definition of a protected area.

While some PPAs are declared under legislation that ensures long-term security, others are not, presenting a potential obstacle to meeting the definition of a protected area. In the second challenge identified by Stolton et al. (2014), relating to the long-term persistence of sites, the report recommends a focus on long-term intent, meaning the intention to manage the site for conservation in perpetuity, or for 25 years as a minimum. Safeguards should also be put in place to ensure that conservation objectives are retained if ownership changes. Such mechanisms may include easements, conservation

Red Kangaroo (*Macropus rufus*) at Neds Corner Station, a 300 km^2 former grazing property in the state of Victoria, Australia, now owned and run as a PPA by the Trust for Nature © James Fitzsimons

covenants and wills. In cases where a permanent agreement is not an option, existing agreements should be renewable and the intention should be to renew in perpetuity. The ending of an agreement should never prohibit the retention of PPA status. The focus on intent is to recognize that PPAs may not have the same legal protection that is experienced by some, although far from all, state-governed protected areas (e.g. Lausche, 2011). In the case of PPAs, dedication to conservation may be demonstrated through formal agreements with government agencies, formal declarations by the governance authority, publicly-available long-term management plans, and recognition by other bodies, such as national associations of PPAs (Stolton et al., 2014).

Although PPAs may face challenges, they also bring opportunities. Stolton et al. (2014) describe ways in which PPAs are particularly well-placed to complement protected areas under state governance. This includes by responding quickly and without bureaucracy to rapid environmental changes, threats or opportunities; by creating spaces for decentralized individual initiatives that involve a more diverse stakeholder base, and diversified funding mechanisms, in the protected area landscape; and by expanding protection to areas where the state is unable to acquire and/or manage land and waters (see also Pasquini et al., 2011).

This final point lends strong support to the need to recognize and report on PPAs. Based on the statistics from the *Protected Planet Report* (UNEP-WCMC & IUCN, 2016a), there is a strong case for supporting the role of PPAs in contributing coverage in places currently unprotected by other governance types. This additional coverage has the potential to add value in terms of connectivity and ecosystem representativeness (see e.g. Gallo et al., 2009; Fitzsimons et al., 2013). Private lands can also offer opportunities for ecological restoration, including through collaborative efforts that aim to achieve landscape-level restoration (Holl, 2017). For example, of 108 ecological restoration projects identified in Colombia, one third took place on privately owned lands and indigenous territories (Murcia et al., 2016). Several studies have suggested a shift in focus towards PPAs, among other non-government designations, in order to facilitate the achievement of global biodiversity targets (e.g. Butchart et al., 2015; Lopoukhine & de Souza Dias, 2012).

PPAS IN RECENT POLICY OUTCOMES

Official policy documents of the CBD have consistently recognized the important role of protected areas, but the CBD Conference of the Parties (CoP) did not formally recognize the contributions of PPAs until 2014. The decisions of the 12th CBD CoP "*Recognizes* the contribution of private protected areas… in the conservation of biodiversity, and *encourages* the private sector to continue its efforts to protect and sustainably manage ecosystems for the conservation of biodiversity" (UNEP/CBD/COP/DEC/XII/19). Subsequent to the most recent CBD CoP (2016, Mexico) the Secretariat has expressed strong interest in "a more systematic collection of information" on PPAs in the "next two years", in preparation for reporting to CoP 14 (Sarat Babu Gidda, pers. comm.).

The 2016 IUCN World Conservation Congress (WCC) approved a resolution on supporting PPAs (WCC-2016-Res-036). This resolution acknowledged the "valuable work and the report of the Futures of Privately Protected Areas project and its proposed concept of privately protected area". Through the resolution, IUCN members recognize the complementarity of PPAs to other governance types, and their ability to contribute to connectivity within the broader conservation estate. The resolution, summarized in Table 1, makes clear that action on PPAs is needed from a range of different actors.

PPAS IN NATIONAL POLICIES

Although PPAs are gaining support through international policy developments, legislation and policy on PPAs remain highly variable at the national level. The following examples are adapted in part from Stolton et al. (2014).

- **Australia (Fitzsimons, 2014; Fitzsimons, 2015)**

PPAs have been an important policy objective for Australia for several decades, with conservation covenants and land acquisition being the primary mechanisms employed (Fitzsimons & Wescott, 2001; Cowell & Williams, 2006; Fitzsimons, 2006; Pasquini et al., 2011). The Australian Government has supported PPAs through the National Reserve System Program by providing up to two-thirds of the purchase price to private land trusts for strategic land acquisitions. As at late 2013, approximately 140 properties were owned by private land trusts covering approximately 45,941 km² (Fitzsimons, 2015). This programme, combined with increased philanthropic support (Taylor, 2012), was critical in enabling land trusts to acquire larger and more remote properties. Tax concessions are also available to landowners who establish covenants in areas of high conservation value, although these are not widely used (Smith et al., 2016). Conservation covenants are perpetual legal agreements between a landholder and a government department or statutory body nominated under the respective covenant legislation to sign covenants. Covenants run with the title of the land, binding all future owners of that land and can typically only be removed by the agreement of both the landholder and relevant government minister. Conservation covenants are increasingly employed to meet national and state governments' objectives of comprehensiveness, adequacy and representativeness, and to fill gaps in the conservation estate where the government is unable to do so. As at September 2013, there were approximately 5,000 terrestrial properties that could be considered PPAs in Australia, covering some 89,130 km² (Fitzsimons, 2015).

The support provided to PPAs varies by jurisdiction, and legislation on conservation covenants differs between states and territories. It is also more difficult to establish covenants on leasehold land compared to freehold land. The relatively high proportion of leasehold land in central Australia has led the distribution of covenants to be skewed towards eastern and southern Australia and Tasmania. Not all jurisdictions provide data on conservation covenants when reporting to Australia's central protected area database, which is used to report against international agreements and to the WDPA. Table 3 shows the high number of PPAs in Australia relative to other countries, while Figure 1 demonstrates the clustering of PPAs in particular Australian jurisdictions.

- **South Africa (Cumming & Daniels, 2014)**

South Africa allows for a range of governance types within protected area legislation, and permits protected areas to be designated on private land with the consent of the landowner. Although it lacks a formal national-level definition, the term "private protected area" is used to refer to protected areas that are owned by private entities, or to communal land.

Around thirty per cent of the terrestrial area of the protected area estate in South Africa is made up of PPAs, according to national records (Department of Environmental Affairs, 2016). PPAs are created with the same legislation as state-owned protected areas, and are subject to the same legal requirements. Over the last ten years, many PPAs have been created through provincial biodiversity stewardship programmes, creating partnerships between provincial conservation authorities, landowners, and, in many cases, NGOs. These programmes prioritize areas of high biodiversity importance, provide management assistance, and require annual audits. A range of incentives is also sometimes offered, including management assistance, preferential game sales, and tax deductions. The legal designation of the protected area status is binding on the property irrespective of changes in land ownership. In addition, a legally-binding contract is established with the landowner, committing the landowner to management objectives. These contracts can be as long as 99 years, or in perpetuity, and are seldom less than 30 years.

National Parks in South Africa may also be privately owned. These protected areas, known as Contract National Parks, are mostly established adjacent to state-governed National Parks, and landowners are usually bound by a contract for 50 – 100 years. In many cases, landowners of Contract National Parks delegate management authority to the state, in order for the

Table 1. Summary of the recommendations of the resolution on supporting privately protected areas, including intended actors.

Intended actor	Support national governments:	Support PPA governance authorities:	Support PPAs generally:
Director General and Commissions of IUCN	• Promote the development of policy and legislation that are supportive of PPAs; • Provide guidance on incentives and other forms of support; • Provide support regarding the contributions of PPAs to the implementation of global and regional conventions		• Further develop best-practice guidelines on their establishment and management; • Further study their extent, configuration and contributions
World Commission on Protected Areas		Consider providing advice on gaining protected area status	Build on the work of the Futures of Privately Protected Areas project to develop frameworks and guidance on the voluntary conservation of private lands
IUCN members			In collaboration with owners, report on PPAs, including to the WDPA and CBD
IUCN state members		Create or promote legal or financial incentives	• Adopt policies that recognize, encourage and monitor PPAs, and integrate them into broader PA systems; • Work alongside civil society organizations to establish the importance of PPAs in the public agenda
UNEP-WCMC	Support reporting by governments to the WDPA		Support reporting by other data providers to the WDPA

Contract National Park and the adjacent state-owned National Park to be managed as a single unit.

The South African government has recently focused on documenting PPAs in order to better assess progress against national and international targets. This focus has enabled South Africa to develop a more strategic and effective National Protected Area Expansion Strategy, and has the potential to help the country allocate resources more efficiently for protected area expansion. The Department of Environmental Affairs maintains records of all protected areas, including PPAs, and reports these to the WDPA. The combination of legal support for PPAs and a central reporting process means that South African PPAs are well-represented in the WDPA relative to other countries (Figure 2).

- **Chile (Núñez-Ávila & Corcuera, 2014)**

There is no specific PPA legislation in Chile, but private lands can be recognized as Nature Sanctuaries through Law 17.288. Designation as a Nature Sanctuary has associated requirements for good conservation practices, but incentives are not currently offered to landowners. As represented in Figure 3, the WDPA lists 15 Nature Sanctuaries under private governance in Chile, with a further 29 under other governance types (IUCN & UNEP -WCMC, 2016). A 2013 study, however, suggests that the true number of private conservation initiatives in the country may exceed 300 (Núñez-Ávila et al., 2013). This implies that the current framework is not capturing the majority of privately governed areas that contribute to conservation in Chile.

- **Mexico (Bezaury-Creel, 2014)**

The Mexican government has certified PPAs since 2002 and through this mechanism these properties become legally protected areas at the federal level. The duration of legal protection is specified within the certification document, which also defines the management regime. Although the incentives offered to landowners are quite basic, the use of the Voluntary Conservation Use Area (ADVC - *Áreas Destinadas Voluntariamente a la Conservación*) protected area management category (which also includes indigenous peoples' and community conserved territories and areas) has been successful, reaching a total coverage of over 4,040 km² by early 2016 (Oceguera-Salazar et al., 2016). Nevertheless, by 2012, there were at least 285 uncertified PPAs, potentially encompassing a further 3,589 km², indicating that many landowners prefer to pursue their individual conservation initiatives outside a governmental framework. PPAs that have been reported to the WDPA are shown in Figure 3.

Monhegan Island in Maine is one of the first Land Trusts on the east coast of the USA; a large portion of the small island is owned and managed by local residents, the Monhegan Associates © Kent Redford

DOCUMENTATION: PPAS IN THE WORLD DATABASE ON PROTECTED AREAS

The WDPA is the most comprehensive global database of protected areas, containing records on over 230,000 sites. Parties to the CBD are requested to report to the WDPA on their national protected area systems. The database is used as an indicator for Aichi Biodiversity Target 11, the Sustainable Development Goals, and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). International goals and targets are reported on through the publication of the biennial *Protected Planet Report* series (UNEP-WCMC & IUCN, 2016a; Juffe-Bignoli et al., 2014).

Table 2. Number of privately protected areas (PPAs) in the World Database on Protected Areas, and per cent of total PPA area, by governance sub-type.

Governance sub-type	Number of records	Per cent of total PPA area
For-profit organisations	33	0.1
Non-profit organisations	7,362	26.8
Individual landowners	5,339	68.9
Unknown (Australia only)	1,562	4.2
Total	**14,296**	**100**

Although the database uses the inclusive IUCN governance types (Dudley, 2008), at present 80 per cent of records are for protected areas under the governance of government agencies (IUCN & UNEP-WCMC, 2016). Since the WDPA's primary data providers are governments, the database has historically relied on state recognition and reporting of non-government governance types. This has meant that the WDPA has not received information on PPAs from countries without legal or policy frameworks for recognizing PPAs, or which lack the capacity to report on them. The variation in national policies described in the previous section has resulted in very good reporting on the part of some countries, and limited or no reporting on the part of the majority. This is compounded by a reluctance on the part of some PPA governance authorities to be counted as part of a national or global protected area system. This reluctance may stem from a concern that governments could report on PPAs rather than investing in new protected areas elsewhere, which is seen by some as a way for states to avoid making difficult decisions in order to meet their international obligations (Fitzsimons & Wescott, 2007). Lastly, PPAs in the WDPA may not always be readily identifiable because their governance type has not been reported, or has been misreported.

Table 3. Number and area of PPAs in countries and territories for which data are available in the WDPA.

Country/territory	Number of PPAs	Area of PPAs (km^2)	PPA area as percentage of country/ territory's total PA area (marine & terrestrial)
USA	8,731	21,821.3	0.46
Australia	2,751	47,756.1	1.10
South Africa	959	26,044.6	9.30
UK	601	1,396.4	0.65
Canada	379	231.8	0.02
Mexico	330	4,036.3	1.14
Colombia	292	803.0	0.45
Guatemala	93	7,028.3	19.60
Peru	71	28,795.0	10.28
Puerto Rico	18	401.6	0.24
Cayman Islands	16	13.4	10.81
Chile	15	3,725.4	0.62
Kenya	11	1,914.6	2.61
Virgin Islands	5	1.4	0.38
Bonaire, St. Eustatius and Saba	3	77.3	48.95
Nepal	3	11,656.9	33.40
Fiji	3	17.5	0.13
Madagascar	2	2,113.2	5.95
Falkland Islands (Malvinas)	2	6.3	5.58
Marshall Islands	2	98.1	1.81
Mauritius	2	2.5	1.67
Namibia	2	2,898.7	0.90
Belize	2	42.2	0.35
Philippines	2	0.4	0.00
Botswana	1	752.3	0.44

As a result of the above factors, the proportion of designated PPAs in the WDPA currently stands at just 6.25 per cent of the total number of protected areas, with representation in only 25 countries and territories[2]. The distribution of these sites is heavily skewed towards a few countries, with just nine countries hosting 99.38 per cent of the sites. A breakdown of PPAs in the WDPA by governance sub-type is given in Table 2, reflecting an abundance of sites governed by individual landowners and non-profit organizations relative to for-profit organizations. Table 3 shows the number and area of PPAs for all countries and territories that have designated PPA data reported in the WDPA. The USA has the highest number of PPAs, and Australia has the greatest area. Bonaire, St. Eustatius and Saba have the highest proportion of their protected area coverage contributed by PPAs.

Those PPAs currently listed in the database occupy 161,634 km^2, contributing 0.42 per cent [3] of the total global coverage of protected areas. 5.7 per cent of the area occupied by PPAs overlaps with protected areas of other governance types (for further information on overlapping protected areas, consult UNEP-WCMC, 2016). Figures 1 to 6 show PPAs (identified using the governance type (GOV_TYPE) field) alongside other protected areas (all other governance types) by region [4,5]. PPAs are shown with a border for increased visibility. While not represented in the statistics presented, proposed PPAs are shown in Figures 1 to 6. Polar Regions, Russia, the Arabian Peninsula, Central Europe, Central Asia and Eastern Europe are not shown, due to the absence of PPAs in the WDPA for these regions. The figures demonstrate the low coverage and spatial clustering of PPAs in the WDPA in comparison with some other governance types. For example, in North East Asia, South Asia, South East Asia, and Mashriq collectively, PPAs reported to the WDPA are limited to Nepal and the Philippines, with the addition of one proposed PPA in Jordan, totalling six sites (Figure 4). In the case of Nepal, these sites nevertheless constitute a large proportion of the country's protected area coverage (Table 3). By contrast, North America reports large numbers of designated PPAs to the WDPA, with the USA reporting 8,731 and Canada reporting 379 (Figure 5). In both countries, PPAs contribute a relatively small proportion of total protected area coverage (Table 3).

Larger versions of all the maps below can be downloaded as supplementary online material

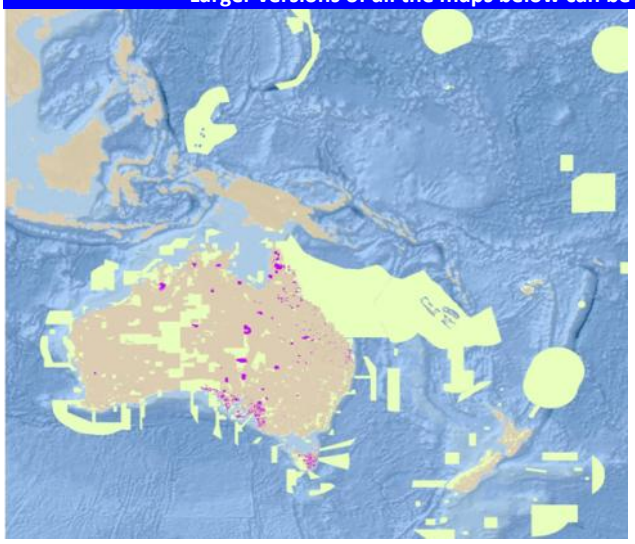

Figure 1. Australia, New Zealand and South Pacific: protected areas in the WDPA, December 2016, with the addition of South Australian Heritage Agreements as PPAs

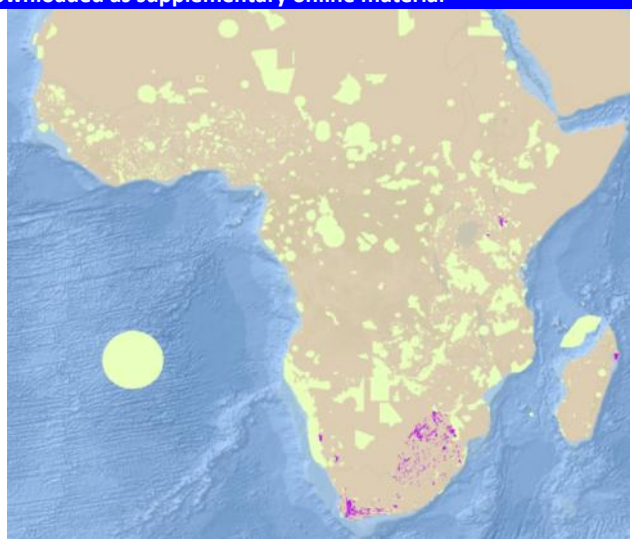

Figure 2. Africa: protected areas in the WDPA, December 2016, with South African Biosphere Reserve buffer zones removed

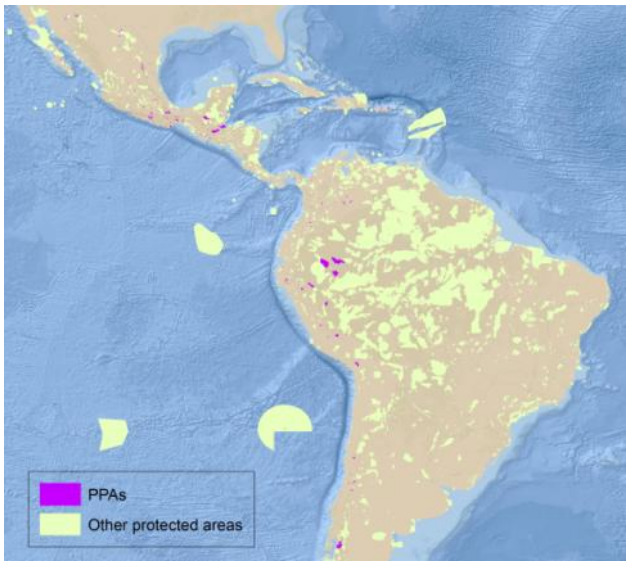

Figure 3. Latin America and the Caribbean: protected areas in the WDPA, December 2016

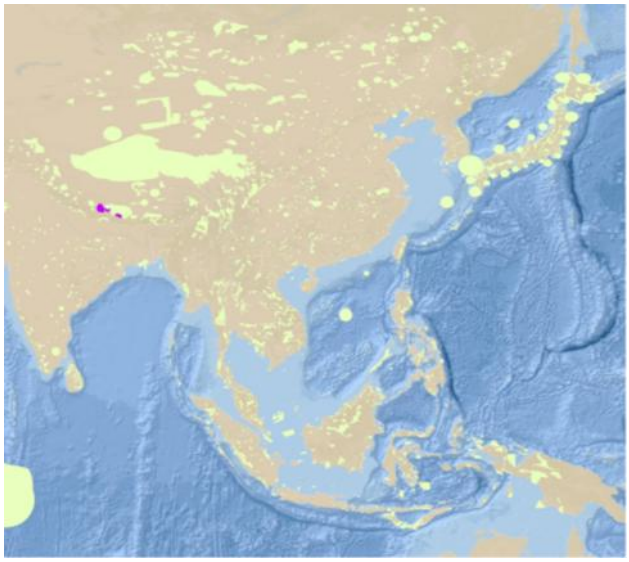

Figure 4. North East Asia, South Asia and South East Asia: protected areas in the WDPA, December 2016

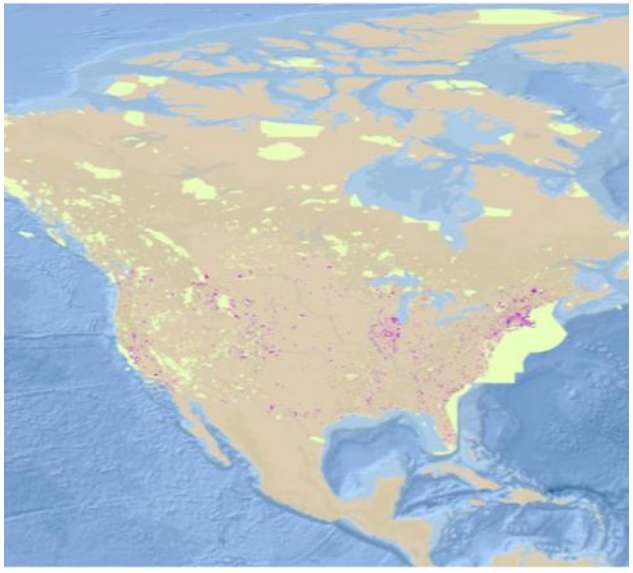

Figure 5. North America: protected areas in the WDPA, December 2016

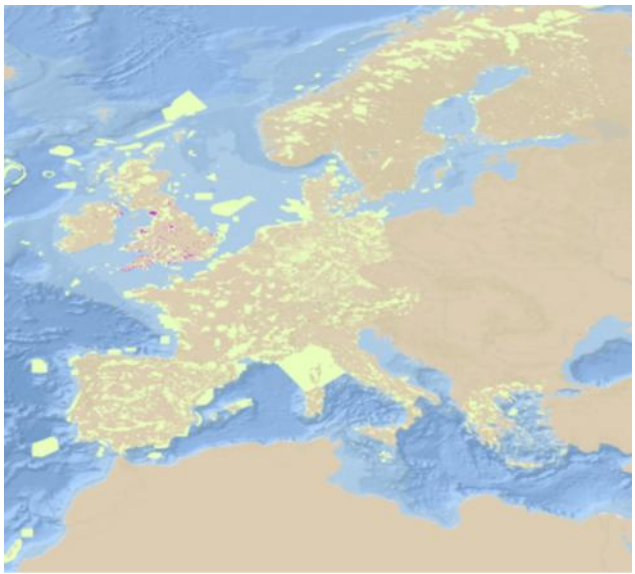

Figure 6. Western Europe: protected areas in the WDPA, December 2016

Work done by country experts and included in Stolton et al. (2014) suggests strongly that this reporting in the WDPA is a major underestimate of the number and area of PPAs. For example, the report estimates that Australia could have 5,000 terrestrial PPAs, in contrast to the 2,751 designated PPAs currently reported across Australia's terrestrial and marine area.

A second example is the United Kingdom, where significant work has been undertaken in recent years to map PPAs. The Putting Nature on the Map project run by the IUCN National Committee UK (Crofts et al., 2014) aims to identify all areas in the UK that meet the IUCN definition of a protected area, and to assign IUCN management categories. The collaborative project has received input from multiple NGOs and from the UK government, and has resulted in the addition of almost 800 PPAs and sites under joint and community governance to the WDPA [6]. The impact of this project on the UK's data in comparison with other Western European countries can be clearly seen in Figure 6.

A further example is Spain, which has an estimated 3,097 km² of conservation initiatives under private governance (Rafa, 2014), but no reported PPAs in the WDPA. It is unclear whether all of these initiatives would meet the IUCN definition of a protected area, though Rafa (2014) suggests that many of them could. It is likely that this could be the case for many countries where PPA data are not fully recognized or reported, underscoring the value of national-level projects such as Putting Nature on the Map. Stolton et al. (in Dudley, 2008, p.14) provide guidance on best practices for projects of this nature.

Technical issues and data management capacity also contribute to under-reporting. Since 1990, the Brazilian Environment Agency (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis) has recognized the designation of Private Natural Heritage Reserves (Reservas Particular do Patrimônio Natural – RPPNs), establishing regulations as well as restrictions on land use and benefits to landowners (Rambaldi et al., 2005). A national confederation of RPPN maintains a database of 1,371 reserves covering over 7,660 km² nationally. However, only 372 are currently included in the WDPA, and they are reported as under the governance of government.

The example of Brazil highlights the issue that PPAs may not always be identifiable in the WDPA by their governance type. A second example is New Zealand, which has over 4,500 conservation covenants protecting more than 1,800 km² (Queen Elizabeth II National Trust, 2016). Around 800 of these conservation covenants have been reported to the WDPA, but the governance type provided in all cases is 'Collaborative governance'. Although this may be an accurate reflection of the governance arrangement, it highlights the fact that expert or local knowledge may sometimes be needed in order to identify PPAs in the database. In other cases, the governance type of PPAs may be misreported or not reported at all.

These examples demonstrate that the absence of PPAs from many countries or jurisdictions in the WDPA does not necessarily reflect an absence on the ground.

EFFORTS TO ENCOURAGE REPORTING

The WCC resolution discussed above requested that UNEP-WCMC support government and non-government data providers in supplying data on PPAs. IUCN's Director General and Commissions are asked to further study the extent, configurations and contributions of PPAs, and IUCN members are requested to report on PPAs to the WDPA. The success of these actions in improving reporting on PPAs will depend on strong data-collation protocols and guidance, and on alignment of efforts.

To address under-reporting of non-state governance types, including PPAs, the WDPA now has revised protocols for accepting data from non-government sources, including directly from individuals, NGOs, businesses, and academics who are involved in PPA governance. These data are verified by members of the World Commission on Protected Areas (WCPA), and are tagged as 'expert verified' in the WDPA. This tag means that users can easily differentiate data from government and non-government sources, and that statistics can be produced that demonstrate the contributions of these areas. With the agreement of the data-provider, reporting to the WDPA can also act as a first step in gaining government recognition. Data that are provided by non-government sources and later verified by the national government are listed as 'state verified'. This is the pathway being taken by the UK's Putting Nature on the Map project. This optional stage is represented by the dotted arrow in Figure 7, which summarizes the WDPA reporting process.

Governments remain the WDPA's primary data providers. The WDPA provides guidance to governments through the WDPA User Manual, provided in English, French and Spanish (UNEP-WCMC, 2016). The manual provides information on the IUCN governance types, discusses the protocols described above and their relationship to PPAs, and encourages governments to report on governance.

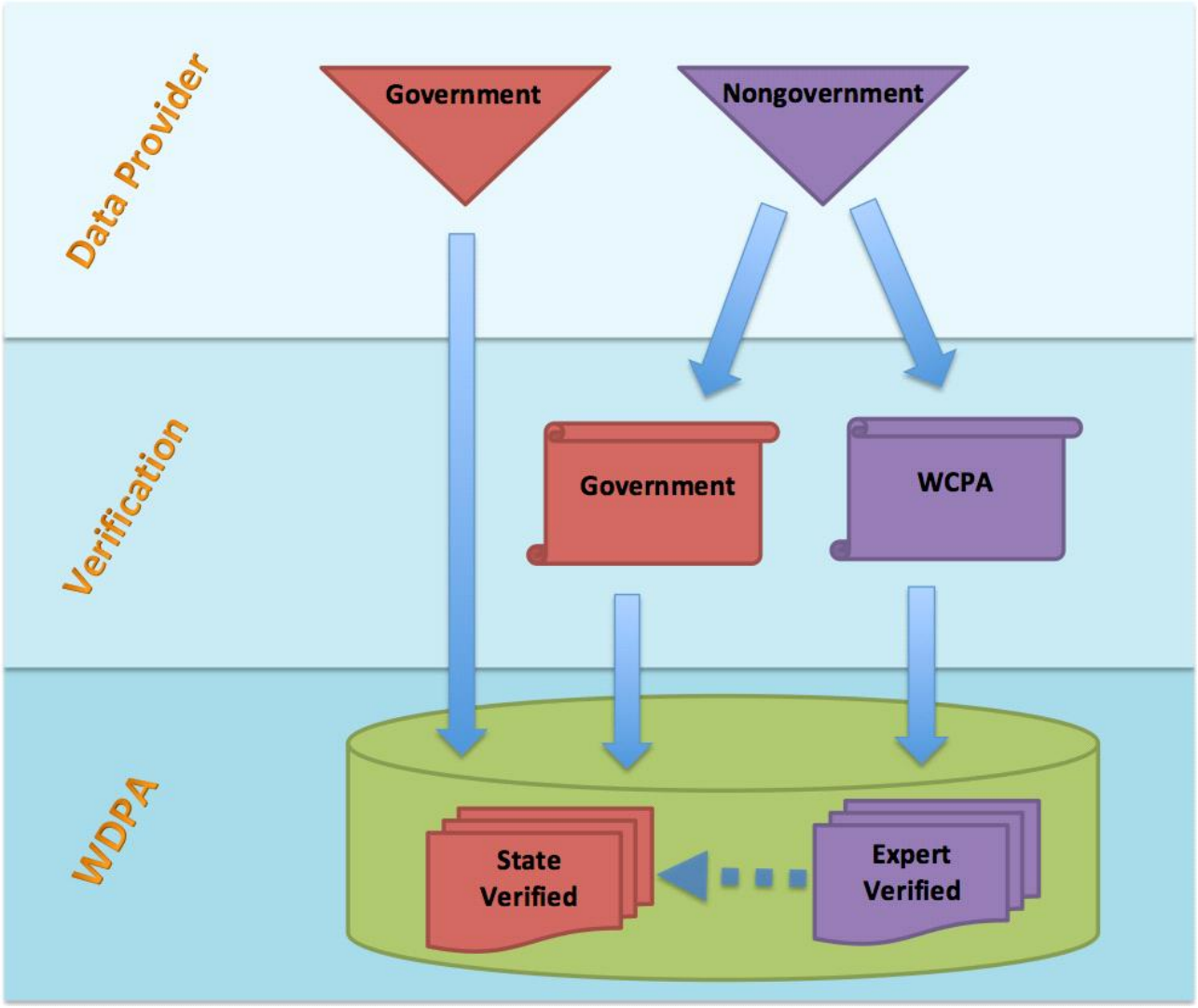

Figure 7. Schematic diagram of revised protocols for accepting data from non-government sources to the WDPA

A further improvement to the WDPA has been the addition of a field recording ownership type. As the field becomes more populated, it may assist in efforts to tease out complex relationships between governance, management and ownership. For example, South Africa has state-owned land held in trust for communities, and considered to be PPAs, as well as land managed by the state on behalf of private landowners. The new field may also help in identifying potential PPAs where the governance type has been misreported or not reported.

Lastly, the WDPA accepts data with restrictions on use and dissemination. In cases where data on PPAs are considered sensitive by the data provider, this means that the data can be used by WDPA managers for analyses, but not shared further. This is especially important in countries where rural governance structures are weak or have deteriorated due to illegal activities. For example, during the compilation of a PPA database for Mexico (Bezaury-Creel et al., 2012), concerns were raised by some private landowners that the misuse of information by others could lead to instances of blackmail. In other cases, landowners questioned whether PPAs might be perceived by local communities as disused or unproductive land, that could be better used to provide short-term benefits to local populations, without due regard to the broader range of environmental services potentially provided by PPAs in the long term.

A recommendation of the *Futures of Privately Protected Areas* report (Stolton et al., 2014) is for "structures and incentives to report on PPAs both nationally and to the WDPA". The report goes on to provide a background on the WDPA and the challenges around PPA data. This integration of advice on the WDPA into more general guidance on PPAs is essential to improving reporting, and should remain a key consideration as further guidance is developed. Related to this is the need to build and enhance relationships between the holders of PPA data and the WDPA, so that the best existing data can be incorporated.

DISCUSSION

Governments may not include PPAs in their national inventories and global reporting for a number of reasons. In some countries, PPAs may not exist at all where legislation or policy does not provide for management of protected areas by non-state entities (e.g. India (Stolton et al. 2014)). In others, there may be a lack of capacity to document PPAs, a lack of understanding that private initiatives can be considered protected areas at the international level, or privacy restrictions (Fitzsimons, 2015). In still others, private conservation initiatives may be valued for their contributions to conservation, while not being considered protected areas. The formulation of the CBD text on 'other effective area-based conservation measures', and subsequent interest from parties in the development of a definition of this category of land conservation (Jonas et al., 2014), suggests that countries are keen to explore the possibility of reporting conservation areas that they do not count among their protected areas. For some countries (e.g., Brazil) PPAs are included in the WDPA but not tagged as under private governance. Lastly, PPA managers themselves may not wish to be counted among their country's protected areas for a range of reasons. For example, Fitzsimons and Wescott (2007) found some managers of properties identified as PPAs in south-eastern Australia did not want their properties reported as part of a national reserve system, with one citing "concern that figures contributing to (the National Reserve System) may justify land clearing to continue elsewhere in the region". Other owners of PPAs have expressed concern that counting their properties towards national and international targets relieves governments of their CBD commitments.

The challenges described above have resulted in under-reporting on PPAs to the WDPA. Their absence from the WDPA and from national databases means that their contributions to conserving biodiversity at a global scale, and to connecting state protected areas, are largely unknown. This has potential implications for national and regional conservation planning as well as potentially for the owners and managers of these lands. Without an accurate picture of the areas already conserved by PPAs, planning exercises will not achieve the best possible outcomes for biodiversity or for people. A further impact of neglecting to document PPAs is that they themselves may become vulnerable to conversion to other, biodiversity-incompatible, land-use types. By appropriately recognizing PPAs (and indeed other private land conservation mechanisms that might not qualify as PPAs, e.g. Fitzsimons & Wescott, 2001), governments are in a better position to support them and ensure that their positive outcomes persist into the future. Furthermore, governments will be better able to meet their international commitments and targets if they provide support to PPAs, and document them with the consent of PPA owners and managers. Integral to supporting this process will be the implementation on Stolton et al.'s (2014) recommendation for structures and incentives to encourage reporting. For the governance authorities of PPAs, these incentives could include support from the state or NGOs, increased security, or recognition-based incentives including increased ecotourism or the sale of 'green' products. For governments, incentives could include improved spatial planning for conservation and other land-use decision-making, and the ability to count PPAs towards their international commitments.

Achieving these commitments and targets, and understanding where to go next, depends on the availability of accurate data. Some studies suggest that progress towards Aichi Target 11 could be significantly boosted simply by recognizing protected areas that are already there (e.g. Butchart et al., 2015), and several positive steps have been taken recently to support this. Firstly, Stolton et al.'s definition of PPAs (2014) provides an international standard, helping to clarify issues around what should and should not be counted. Secondly, the revised procedures for integrating non-government data into the WDPA mean that a more complete picture of PPA extent globally can be built.

In addition to recognizing existing sites, the contributions of PPAs to conservation can be enhanced by promoting PPAs so that new sites are designated, and by providing guidance on good governance and management. It is clear from the policy changes and country case studies presented here that this will require a collaborative approach, involving governments, NGOs, and private governance actors.

Finally, there are on-going developments at the international level that have the potential to support PPAs. There are possibilities for increased recognition of PPAs through the development of IUCN's Green List of Protected and Conserved Areas. The Green List recognizes success in protected areas of all governance types, based on the principles of good governance, sound design and planning, effective management, and successful conservation outcomes. Guidance is available on committing to the Green List standard and implementing its rules and procedures (IUCN, 2016). The IUCN WCPA Specialist Group on Privately Protected Areas and Nature Stewardship presents further opportunities for collaboration on PPAs. The group is expanding its membership, and reaching more private

Children visiting Attenborough Nature Centre, England, UK, a site managed by the Nottingham Wildlife Trust © Equilibrium Research

governance actors through an online discussion group. In response to a request from the IUCN World Conservation Congress, it is also developing best practice guidance on the governance and management of PPAs. These developments have the potential to draw attention to the significant benefits offered by PPAs, to encourage states to recognize and support them, and to facilitate the implementation of best practices by PPA governance authorities.

CONCLUSIONS

Although there have been major developments in policy and guidance on PPAs, including an international definition, national-level approaches to PPAs remain diverse. PPAs are reported to the WDPA by a small proportion of countries, and those countries that do provide data may do so for only a subset of existing PPAs. Ongoing work to support recognition, documentation and best-practice in PPAs will bring further positive contributions, but additional collaborative work, involving governments, NGOs, and PPA governance authorities, continues to be needed.

Concerted efforts to map PPAs at the national level, both by governments and NGOs, have been instrumental in improving datasets for some countries. Examples include the Putting Nature on the Map project in the UK, and the decision taken by the South African government to focus on documenting PPAs in order to better measure progress towards national and international targets. The revision of WDPA protocols to support documentation of PPAs has been an important step in the implementation of the WCC resolution on PPAs (WCC-2016-Res-036), and one that has the potential to encourage further countries to implement the resolution by adopting strategies on mapping PPAs.

Next steps could include national-level assessments of different mechanisms that support PPAs to establish which are most effective in incentivizing and supporting conservation by private entities. Such assessments could potentially inform the development of mechanisms in countries that currently lack effective PPA-support frameworks. Secondly, the relatively low reporting of protected areas governed by for-profit organizations to the WDPA suggests that increased efforts are needed to identify and document such initiatives.

SUPPLEMENTARY ONLINE MATERIAL

Appendix S1. Map (see figure 1) Australia, New Zealand and South Pacific: protected areas in the WDPA, December 2016, with the addition of South Australian Heritage Agreements as PPAs

Appendix S2. Map (see figure 2) Africa: protected areas in the WDPA, December 2016, with South African Biosphere Reserve buffer zones removed

Appendix S3. Map (see figure 3) Latin America and the Caribbean: protected areas in the WDPA, December 2016

Appendix S4. Map (see figure 4) North East Asia, South Asia and South East Asia: protected areas in the WDPA, December 2016

Appendix S5. Map (see figure 5) North America: protected areas in the WDPA, December 2016

Appendix S6. Map (see figure 6) Western Europe: protected areas in the WDPA, December 2016

ENDNOTES

[1] A protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

[2] The figures and maps presented here have been generated using the December 2016 release of the WDPA. However, the data for South Africa and Australia have been edited to reflect changes requested by their governments that have not yet been made in the WDPA. For Australia, the change is the reclassification of 1,562 South Australian Heritage Agreements, previously listed as joint governance, as private governance. As shown in Table 2, their governance sub-type is not yet known. For South Africa, the change is the removal of the buffer zones of eight Biosphere Reserves.

[3] This figure was generated using the methodology outlined in the Protected Planet Report 2016 (UNEP-WCMC & IUCN, 2016a). This methodology involves removing sites where the Status field is 'Proposed' or 'Not Reported'. The methodology removes 57 PPAs, which cover an additional 32,895 km^2 globally. Swaziland and Jordan have only proposed PPAs, and are not represented in Table 3 for this reason.

[4] The designations employed and the presentation of material on these maps do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

[5] Regions/sub-regions are derived from a dataset combining Exclusive Economic Zones (EEZ: VLIZ, 2014) and terrestrial country boundaries (World Vector Shoreline, 3rd edition, National Geospatial-Intelligence Agency). A simplified version of this layer has been published in the Nature *Scientific Data* journal (Brooks et al., 2016a; Brooks et al., 2016b).

[6] Further data on PPAs in the UK have been collected by the Putting Nature on the Map project and are currently being formatted to comply with the WDPA data standards.

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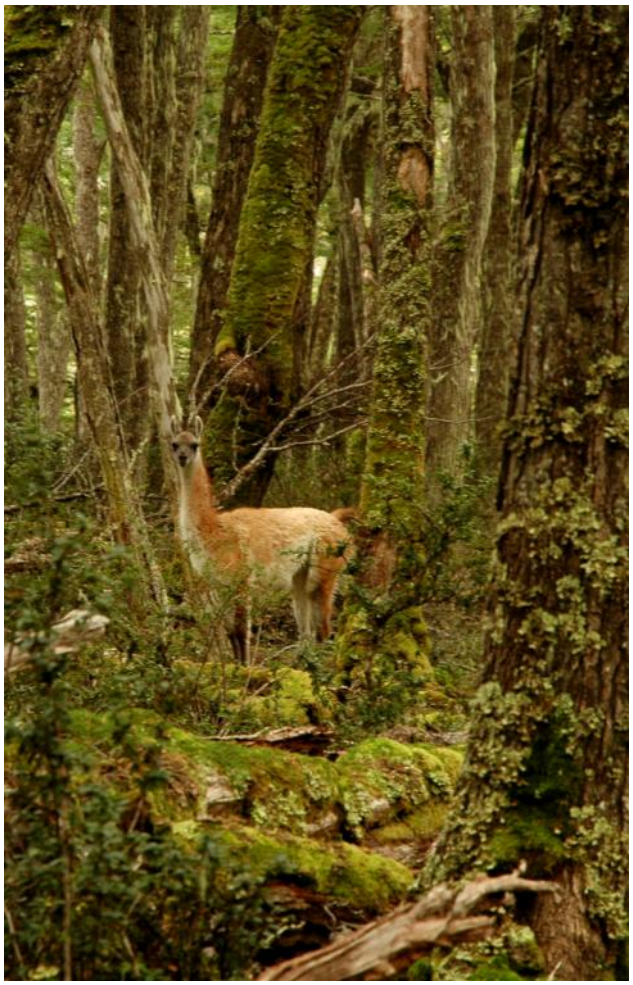

A guanaco (*Lama guanicoe*) in Karukinka on the island of Tierra del Fuego; this 2,980 km^2 area is the largest donation of private land for conservation in Chile © Kent Redford

Mexican organization, Amigos de Sian Ka'an, as well as for World Wildlife Fund. His professional experience includes protected areas and other area-based environmental policy instruments designed for biodiversity conservation and sustainable management. He currently collaborates with the Mexican government agencies dealing with marine and terrestrial conservation and natural resource use, on policy, legislative and planning initiatives.

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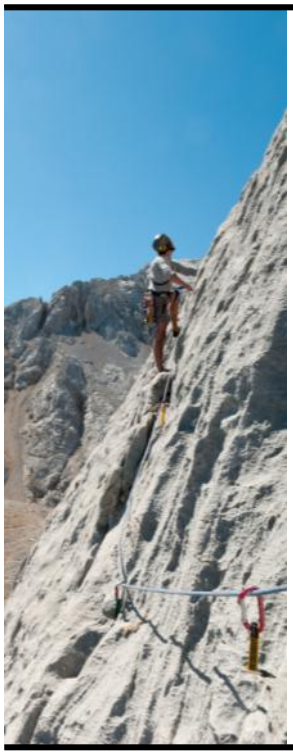
RESUMEN

Las áreas bajo protección privada (APP) son consideradas cada vez más como instrumentos de gran importancia para la conservación, tal y como se demuestra en los esfuerzos recientes que apoyan su reconocimiento y documentación a nivel nacional e internacional, a la par de áreas naturales protegidas bajo otros esquemas de gobernanza. Los avances en la definición de los lineamientos para caracterizar las APP, han ido acompañados de un apoyo cada vez mayor en el ámbito de las políticas internacionales, situación que se ha reflejado en un incremento del número de APP que han sido integradas en Base de Datos Mundial sobre Áreas Protegidas (WDPA). A pesar de ello, los esfuerzos nacionales para reconocer y apoyar las APP aún son muy dispares, al igual que el empeño de los países para reportar sus APP a la WDPA. En este artículo: se presentan los avances recientes que respaldan las APP a nivel internacional; se resume el estado actual de los informes sobre APP a la WDPA; y, se discuten los retos y oportunidades que caracterizan actualmente el futuro de las APP.

RÉSUMÉ

On reconnaît de plus en plus l'importance des initiatives de conservation menées par les aires protégées privées (APPs), comme en témoignent de récents développements qui préconisent leur identification et leur enregistrement au même titre que les aires protégées sous d'autres types de gouvernance. Les avancées des directives pour les APPs ont été accompagnées et soutenues par les instances politiques internationales. Ainsi, de plus en plus d'APPs sont inscrites à la Base de Données Mondiale sur les Aires Protégées (WDPA). Cependant, au niveau national, le niveau de soutien aux APPs est variable, tout comme les inscriptions des APP à la WDPA. Nous faisons état des récents progrès au niveau international en faveur des APPs, puis décrivons l'état actuel des inscriptions des APPs à la WDPA, et enfin nous exposons les défis et opportunités qui caractérisent actuellement l'avenir des APPs.



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

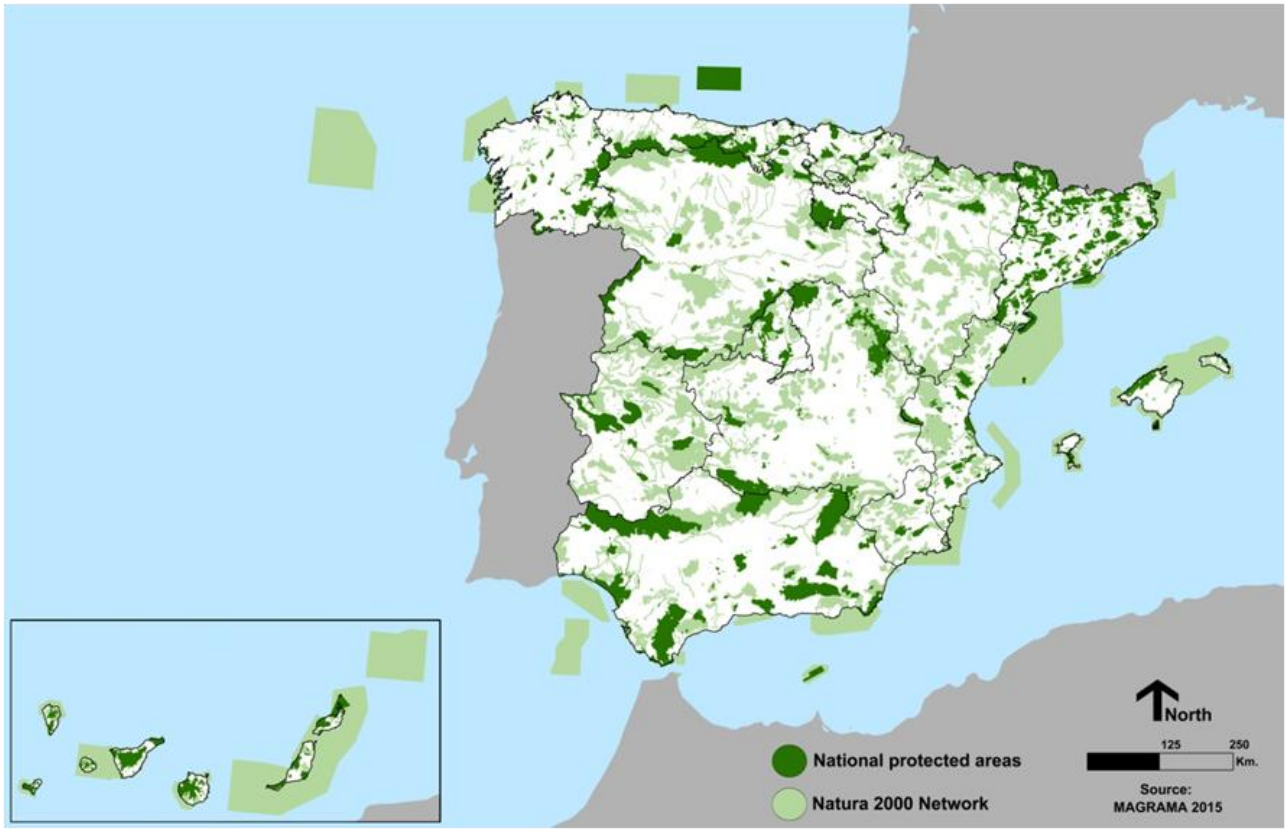

Figure 1. Distribution of nationally designated and Natura 2000 Network figures of protected areas in Spain.

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

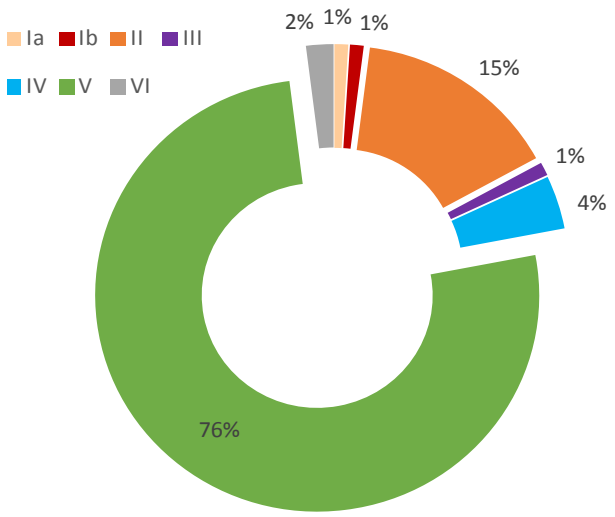

Figure 2. Percentage of area protected in Spain belonging to the different IUCN protected area categories. Data includes the 43% of nationally designated protected areas. Natura 2000 sites are not included in this analysis. The relevance of Category IV will increase when considering Natura 2000. Source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

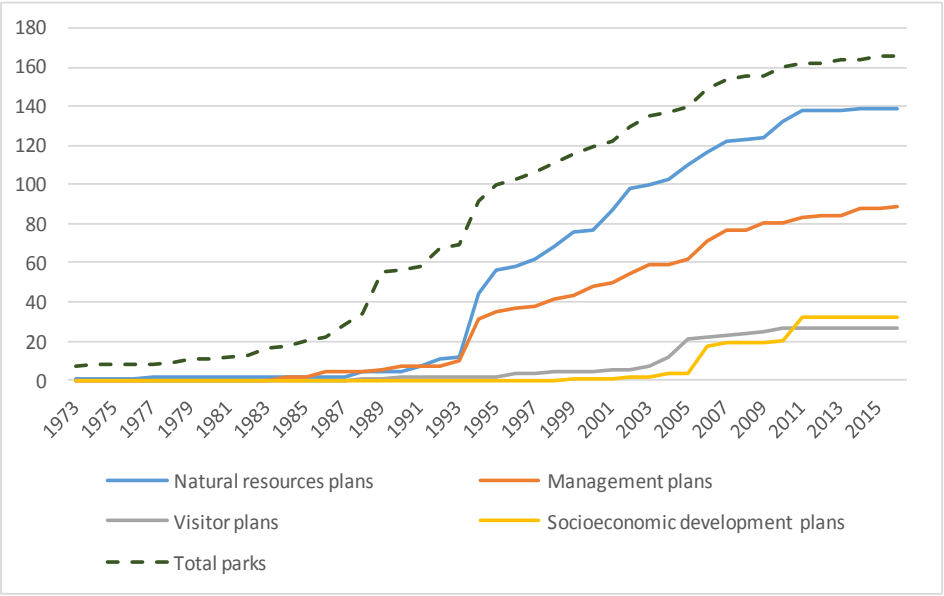

Figure 3. Total number of protected areas (considering National and Natural Parks) in Spain and of different management plans (natural resource plans, management plans, visitor plans and socioeconomic development plans). Several protected areas still do not have management plans.

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

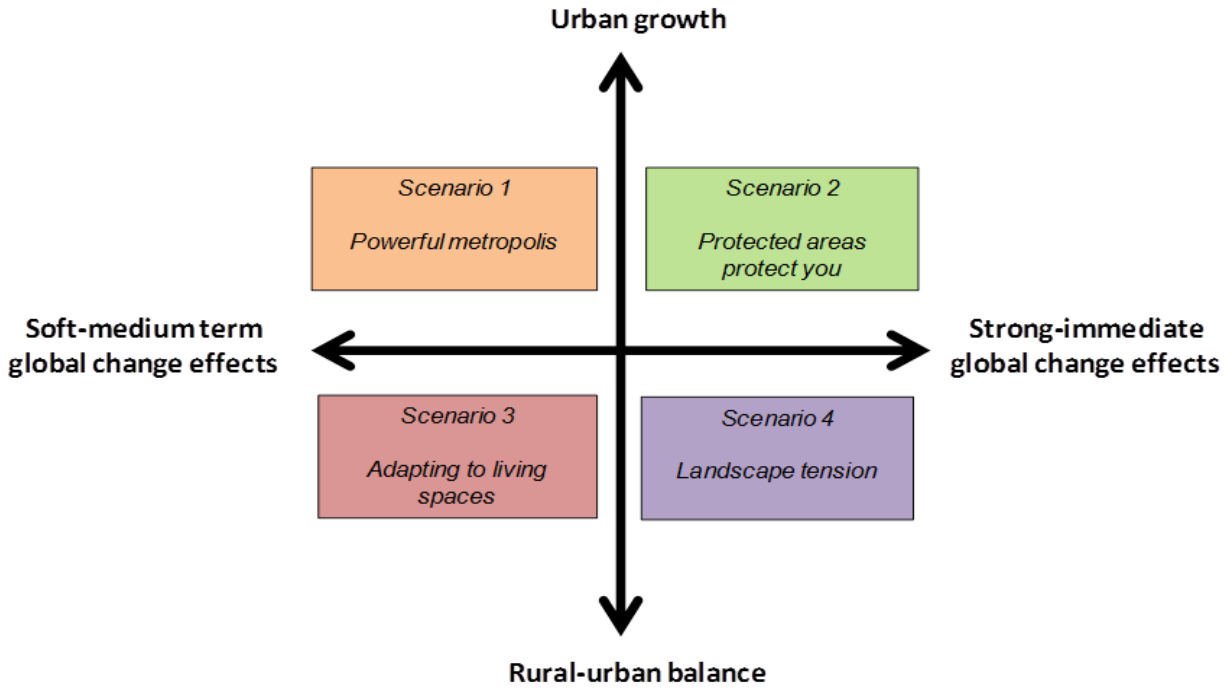

Figure 4. Axes of drivers of change (strong–immediate global change effects vs. soft–medium term global change effects and greater urban growth and rural depopulation vs. greater urban–rural population balance) and the names of the four scenarios developed by participants.

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

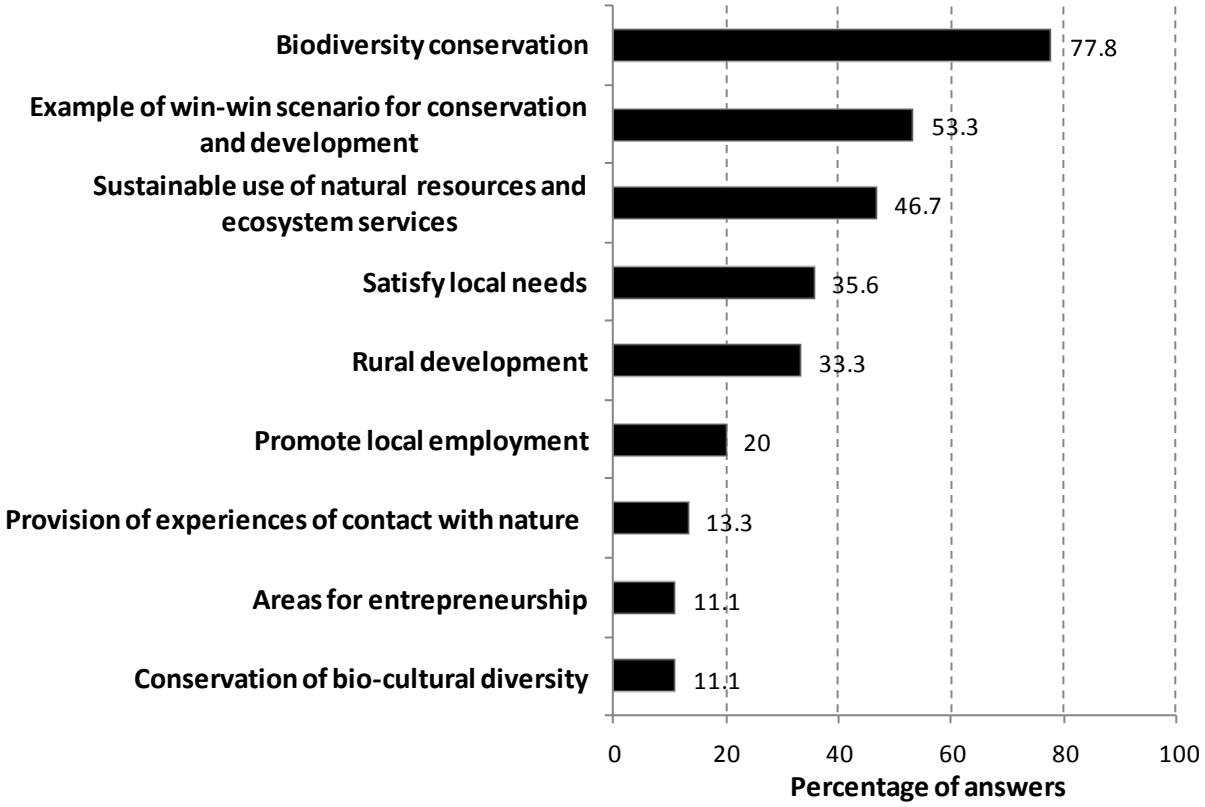

Figure 5. Answers to the question "what should be the role of protected areas in the near future (2020-2025)?" which included a list of possible answers. The numbers indicate the percentage of respondents supporting the indicated role.

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.

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

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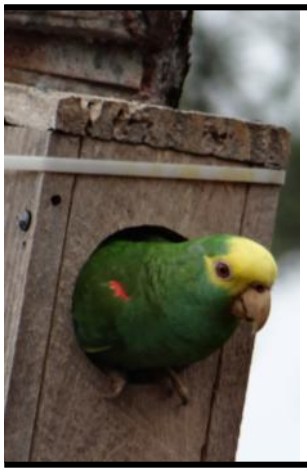
RESUMEN

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.



A GOVERNANCE SPECTRUM: PROTECTED AREAS IN BELIZE

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ABSTRACT

The size, scale and diversity of protected areas in Belize provide an informative case study of system management and governance that can offer a model for countries with expanding systems. The Belize National Protected Areas System is proportionately large for the size of the country, with terrestrial protected areas covering 36.6 per cent of the national territory and 19.8 per cent of the marine environment. The 108 sites in the National Protected Areas System exhibit the full spectrum of management categories and governance types recognized by IUCN. Though 85 per cent of terrestrial protected areas are national lands, only 43 per cent are managed directly by government agencies. The system overall is characterized by a heavy reliance on co-management, privately protected areas and ICCAs, in that order. Central government provides less than 18 per cent of the funding for management of the system. The diversity of actors in protected area management creates a dynamic, multivariate governance system, with different parties contributing to the debate to constantly refine management practices.

Key words: Belize, protected areas, system, governance, co-management, shared governance, privately protected areas, connectivity

Most countries are expanding their national protected area systems to meet biodiversity, nature conservation and other needs, whilst attempting to balance this with national development priorities. According to a 2013 IUCN global review of protected areas, "governance is the variable with greatest potential to affect coverage" and "governance is a main factor in determining the effectiveness and efficiency of management" (Borrini-Feyerabend et al., 2013, xii). The governance of protected areas in countries with proportionately large national protected areas systems can inform other countries yet to expand.

Belize is one of only a dozen countries that have met Aichi Biodiversity Target 11 of the Convention of Biological Diversity (CBD) of the conservation of 17 per cent terrestrial and 10 per cent marine areas, respectively. Belize manages 36.6 per cent of its terrestrial area in protected areas and 19.8 per cent of its marine area (GoB, 2014). This paper describes the many governance structures Belize currently employs for these sites, outlines the history of the system and its governance, and highlights some of the current issues facing the national protected area system.

GOVERNANCE AND MANAGEMENT

Governance refers to all processes of governing, whether undertaken by a government, market or network, whether over a family, tribe, formal or informal organization or territory and whether through laws, norms, power or language (Bevir, 2013). It refers to the principles, policies and rules for decision-making, and these apply to protected areas as a dedicated land use of 'territory' for conservation. Most considerations of protected areas once centred on questions of management and management effectiveness. Since the World Parks Congress in 2003, however, there has been an increasing recognition of the importance of governance. Whilst governance and management are closely linked, they can be distinguished (Borrini-Feyerabend et al., 2013). Governance sets the goals, objectives and policies for protected areas, the decisions that will influence the outcomes, and takes on accountability for those decisions, whilst management encompasses the methods and mechanisms to implement decisions taken through governance. Therefore, the governance structures that are in place and accepted at any given protected area can influence management. Governance is not new, of course, but the

Table 1. Key facts about Belize and its protected areas. Based on an update of the Rationalization Report (Walker et al., 2013)

Fact	Data	Notes
Area (land/incl. sea in km^2)	22,966	
Population (#)	368,000	
Economic (GDP)	US$1.807 billion	
National Protected Areas (#)	108	Including Privately Protected Areas, Spawning Aggregation Sites and Crown Bird Colonies
Managed under the Forest Department	51	
Managed under the Fisheries Department	20	Including 11 Spawning Aggregation Sites
Managed under the Institute of Archaeology	16	
Privately Protected Areas	6	Including one community managed area of private community lands
Direct management by Government	38	
Co-management	28	Not including Privately Protected Areas
• NGO co-management	16	
• Community co-management	12	
• Long term Forest Licences	10	Based on 2010 agreements
Spawning Aggregation Sites	11	Protected areas where large densities of fish regularly converge to reproduce
Ramsar Sites	2	
World Heritage Sites	1 serial site (7 sites)	

increased focus on and understanding of governance is important to the effectiveness and efficiency of management. However, though IUCN first produced guidelines on protected area management categories in 1994, types of governance were not recognized until a revision published in 2008 (Dudley, 2008). IUCN recognizes four governance types:

- Government
- Shared governance
- Privately protected areas
- Indigenous and community conserved areas

The Belize protected area system demonstrates all of these types. As a small, democratic country with a diversity of protected area managers and authorities, limited financial resources and evolving governance structures, it presents a case study in these types, and gradations between them, that can provide a model for other national protected area system managers, policy-makers and experts.

EVOLUTION OF BELIZE PROTECTED AREAS

Belize is a small, subtropical country approximately 280 km from north to south and 110 km wide, bordered by Mexico, Guatemala and the Caribbean Sea. It was originally occupied solely by the Maya people, until the arrival of Europeans in the 16th - 17th centuries, and was a British colony from 1798 until 1981, when it gained independence. The country has three distinct physiographic regions: the flat northern lowlands, with a complex mosaic of lowland, semi-deciduous forests, savannahs, freshwater rivers and wetlands, with saltwater lagoons and mangroves along the coast; the southern coastal plain supporting tropical pine and broadleaf forest; and the Maya Mountains of granite, quarzites and shales. Seventy ecosystems have been identified within these broad categories (Salas & Shal, 2015) The marine environment supports the second largest barrier reef in the world with a coastal lagoon of productive seagrass beds and patch reefs.

The environmental services of the protected area system are key to Belize's socio-economic health. The forested mountains provide clean water for the majority of communities in Belize, and the natural resources support the tourism industry, the primary foreign exchange earner in 2015 (Central Bank / BTB, 2016), and accounting for 34.8 per cent of employment (WTTC, 2016). Tourism in Belize is primarily natural- and cultural-resource based, with visitors focusing on the cayes, coastal communities and coral reef (particularly for its scenic beauty, snorkelling, diving and sport fishing), inland protected areas and Maya sites.

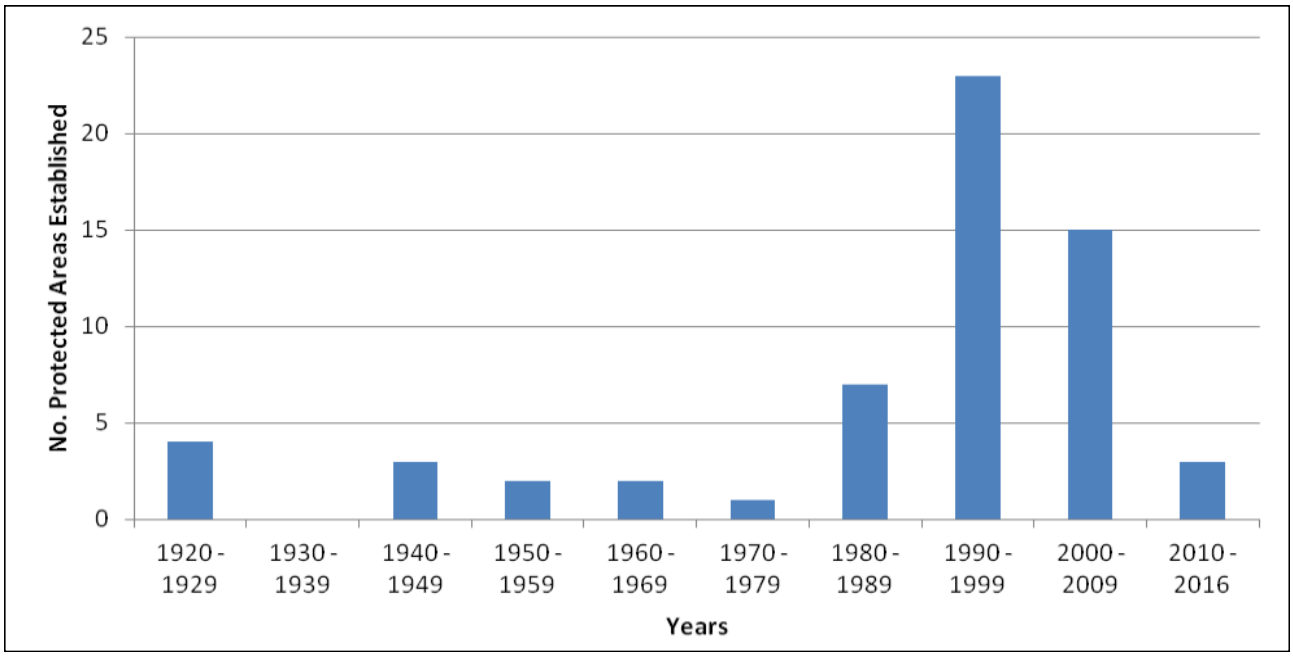


Figure 1: Trend of Protected Areas Establishment between 1920 and 2016

Changing threats have led to a shift in the reasons for the designation of protected areas, from the need to control unsustainable harvesting during the early days of the logging industry, to the need to balance the increased human footprint and associated habitat and species loss (Young, 2008). Reduced forest connectivity is impacting the viability of large-ranging species such as white-lipped peccary (*Tayassu pecari*), tourism infrastructure is rapidly removing littoral forest and coastline vegetation, and the increasing number of fishers and level of transboundary incursions are resulting in unsustainable levels of fishing.

The National Protected Areas System in Belize is the result of a long history of best-land-use surveys and natural resource protection that started with the Crown Land Ordinance in 1817, the first legal framework for control over land and natural resources (Young & Horwich, 2007). This provided a mechanism for government-controlled lands to be set aside as forest reserves for improved management of forest resources - primarily timber. Starting with the Silk Grass Forest Reserve in 1922, these were established for timber extraction (Zisman, 1996), and subsequently designated and managed under the Forest Ordinance of 1927.

The establishment of Half Moon Caye in 1928 as a Crown Reserve for the protection of its bird colony set Belize on the path as a conservation leader in the region, with the first reserve created specifically for the protection of wildlife. Generally, however, protected areas were for the management of the extraction of forest products until 1964, when attention turned to the need to protect areas for wildlife and for their intrinsic values. With the decline in the importance of logging to the national economy, recommendations were focused on a shift from forestry management to biodiversity protection. This led to the formation of the National Parks Commission in 1966, with the role of identifying and setting aside areas for the conservation of biodiversity. The establishment of Belize Audubon Society (BAS) in 1969, Belize's first non-governmental organization, led to a strong private sector lobbying power focused on wildlife and wilderness protection and linked to international conservation partners.

In 1978, an FAO consultancy provided the first recommendations for the development of Belize's National Parks System: the 'Proposals for wildlife protection and national parks system legislation and the establishment of national parks and reserves' (Deshler, 1978). The National Parks System Act (1981) evolved from the FAO recommendations and provided the first enabling legislative framework for the development of the National Parks System, the pre-cursor to the National Protected Areas System that Belize has today. The mid to late 1980s was a time of firsts. In 1984, the Community Baboon Sanctuary was established, the first community managed area of its type. In 1987 the first multi-use Marine Reserve, Hol Chan, was designated under the Fisheries (Amendment) Act of 1983 in recognition of its important role in supporting local fishers, and in Belize's fledgling tourism industry. In 1988-1989, the first two nationally recognized privately protected areas, Rio Bravo and Shipstern, were added to the protected areas system (though this was an informal recognition, and not supported by legislation until the revision of the National Protected Areas System Act in 2015).

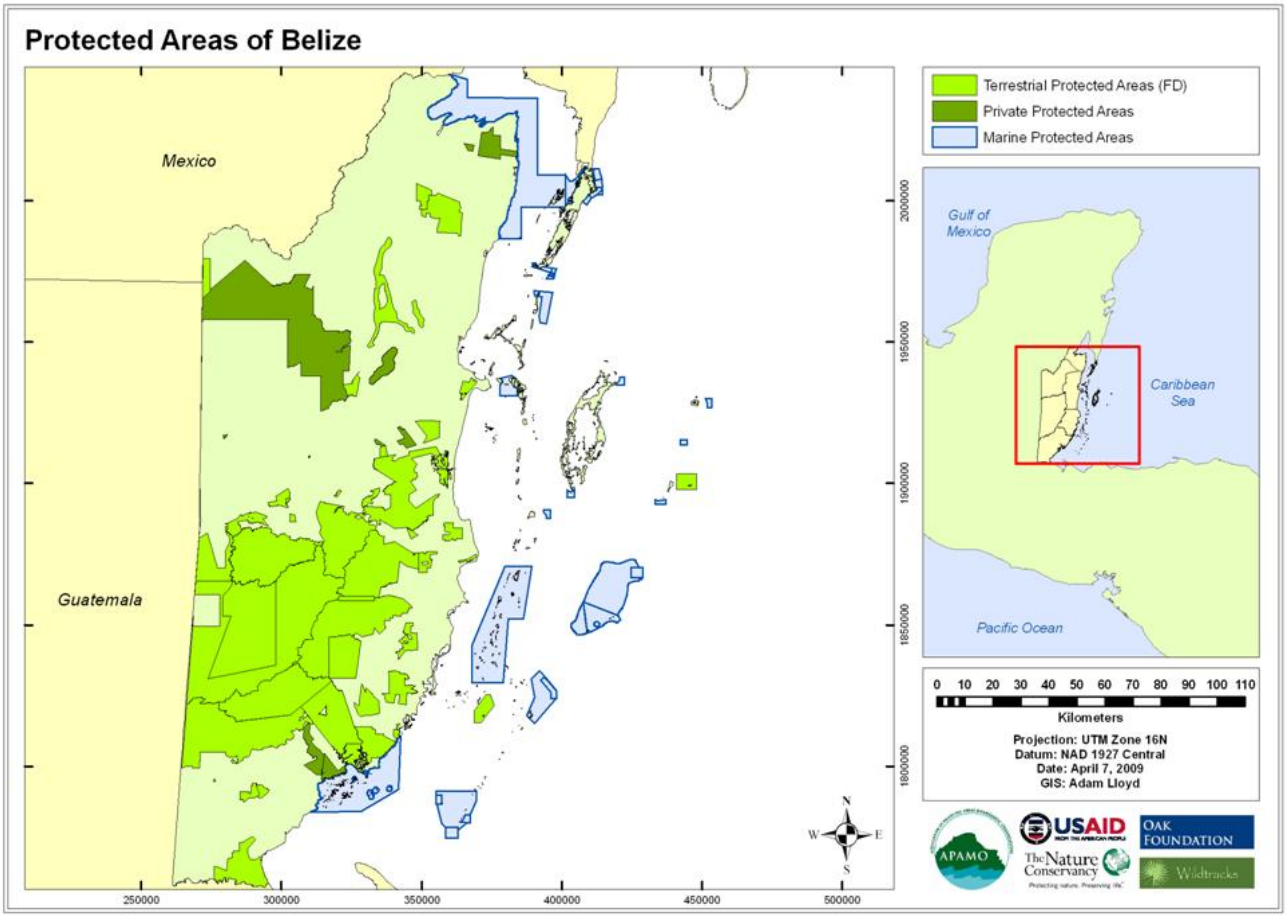


Figure 2: Protected Areas of Belize (Walker & Walker, 2009)

In 1993, Belize took on international commitments with the ratification of the Convention on Biological Diversity for ecosystem coverage and species conservation. This was then followed in 1994-1995 by a comprehensive evaluation of the protected areas system, focused on identifying and addressing gaps to ensure that Belize met its national requirements for maintenance of biodiversity.

In the 1990s Belize's national protected areas system was strengthened by a number of important national planning initiatives — the Natural Resource Management and Protection (NARMAP) project and Forest Planning and Management Project (FPMP). Another significant step was the establishment of two quasi-government agencies – the Coastal Zone Management Authority (CZMA) in 1998 for guiding activities in the coastal zone and the Protected Areas Conservation Trust (PACT) in 1996 as a funding mechanism for management of protected areas.

The Belize reef is the largest barrier reef complex in the Atlantic-Caribbean region, and the second largest in the world. In 1996 Belize signed the World Heritage Convention, inscribing the Belize Barrier Reef System World Heritage Site as a serial site of seven protected areas that provide representative examples of the outstanding reef system, reef types, reef connectivity, evolutionary processes and protection for threatened species. This resulted in the declaration of five additional protected areas, to ensure representative coverage of the unique aspects of the reefs of Belize.

In 1998, the Belize Manatee Recovery Plan was finalized under the CZMA, leading to the designation of three Wildlife Sanctuaries (Corozal Bay, Swallow Caye and Gales Point [Southern Lagoon]) over the next five years. They were designated specifically for their role in maintaining viable populations of manatee in Belize, as the stronghold for this species in the region.

As part of its commitments to the CBD, Belize developed its first National Biodiversity Strategy and Action Plan in 1998. Whilst this Plan was never officially endorsed, it was important in bringing government, non-government and community stakeholders together for the first time to discuss biodiversity management in Belize. In combination with the Northern Biological Corridor Project, it focused not only on the protected areas, but also on ecosystem connectivity, and encouraged communities to seek co-management of their natural resources towards maintenance of these critical links.

A baby Hicatee — Central American River Turtle (*Dermatemys mawii*) — hatched in captivity at TIDE's Private Protected Lands base station in May 2014 © Elmar Requena

These two initiatives created an environment of increased collaboration among community-based and non-governmental organizations. By 2005, an assessment of the National Protected Areas System (NPAS) demonstrated that it was considered to fulfil the majority of its functions, with little need for further additions to the system other than to improve forest connectivity (primarily through the integration of private lands in identified forest corridors into the system), and to provide coverage for a small number of under-represented ecosystems — including the deep sea, mangroves and rivers.

CURRENT STATUS

A revision of the NPAS Plan in 2015, based on a national rationalization exercise, re-visited the NPAS categories. It was agreed to split the Wildlife category into two— one as non-extractive (Wildlife Sanctuary (1)), the other with potential for traditional use if supported by an approved sustainable use plan (Wildlife Sanctuary (2))— in recognition of the importance of traditional natural resource use rights for local community-based users. The NPAS was considered to fulfil its roles in water catchment, watershed protection, storm protection and provision of other environment services. It was recognized, however, that with the increasing risks of hurricane impacts, increasing human footprint, pressures on the marine resources and changing weather patterns, the level of redundancy within the system is minimal, with the need to ensure retention of large areas and replication of ecosystems to guard against potentially non-reversible impacts, particularly with Belize being highlighted as at highest risk from climate change.

Belize currently has 36.6 per cent of its terrestrial area protected and 19.8 per cent of territorial waters under marine protective management (GoB, 2014), meeting and exceeding the CBD target (figure 2). However, for the marine environment, only 6.7 per cent is legislated replenishment zones with full protection against fishing activities. Belize is still working towards achieving the national target of ensuring that 10 per cent of all marine and coastal habitats within Belize's territorial waters are legally protected as non-extractive replenishment zones.

Over 90 per cent of Belize's 70 recognized ecosystems have greater than 10 per cent representation within the NPAS. 60 per cent have greater than 30 per cent representation within the NPAS, as per regional targets. As a result, the creation of new national terrestrial protected areas to strengthen ecosystem coverage is not considered critical, though realignments to improve the representation of rivers and riparian vegetation are recommended. The greatest gaps are in the coastal areas.

Current strengthening of the NPAS is focused on improving management effectiveness, ensuring the maintenance of ecosystem connectivity between protected forest nodes in the three identified key national corridors, and the realignment of marine protected area boundaries and zones to provide increased percentage of replenishment zone areas and the increased inclusion of deep water ecosystems.

Table 2. Protected area governance types recognized in Belize (from National Protected Areas System Plan, 2015)

Belize protected area governance types	Description
Government authority Responsibility and accountability is founded on legislation and rests with a government agency. Although management may be exercised directly or be delegated, and consultation or communication with concerned parties may be required, government retains full ownership and control	This is the mode of governance implicit under present legislation but that has in many cases proved largely ineffective due to chronic deficiencies in financial, human and material resources.
Joint governance (co-management) Authority, responsibility and accountability are shared among a variety of concerned parties, which include government agencies, and local communities, private landowners or other stakeholders. The parties recognize the legitimacy of their respective entitlements and choose or are required to collaborate.	This approach has been encouraged over the past two decades, has proved effective, and has been the preferred option for the development of the NPAS. By 2012, 32 co-management agreements existed between government agencies and some 21 civil society groups (Walker & Walker, 2013). A number of Forest Reserves are also managed by logging concession holders under long term (20 to 40 year) logging licenses that have strict agreements that include protection of environmental services and biodiversity
Private governance Authority and responsibility rest with the landowners, who may exercise it for profit (e.g., tourism businesses, resource extraction) or not for profit (e.g., foundations, universities, conservation NGOs). Usually, the landowners are fully responsible for decision-making and their accountability to the society at large is quite limited.	Private governance does have its role where landowners elect to use their holdings under a conservation management regime, as an individual decision made in their own interests. Unless the land is committed in trust or under a covenant, however, there is the risk that the land owners can decide to remove the land from the National Protected Areas System
Community governance Authority and responsibility for managing the natural resources rest with the indigenous peoples and/or local communities with customary and/or legal claims over the land and natural resources. It is therefore analogous to private governance and accountability to society at large usually remains limited, although it is at times achieved in exchange for recognized rights or economic incentives.	This form of governance is usually associated with areas (including those under partial private ownership) that are collectively controlled or managed under traditional or locally agreed rules, such as the Community Baboon Sanctuary (considered a privately protected area) and the Sarstoon Temash National Park.

GOVERNANCE AND MANAGEMENT DIVERSITY

Belize's National Protected Areas System is characterized by a heavy reliance on co-management partnerships, privately protected areas and ICCAs, in that order. Thus the System exhibits the full spectrum of management categories and governance types recognized by IUCN (Stolton et al., 2013).

The 2015 National Protected Areas Act replaces the National Park Act of 1981, presenting an updated framework for the System, articulating 13 categories of protected area and consolidating authorities under the Protected Areas Conservation Trust. The Act also establishes the National Protected Areas Advisory Council. Unlike the Protected Areas Conservation Trust, the Council is, with one exception, constituted of government officials.

Though criticized for a lack of consultation, the Act significantly strengthens the System by:

- integrating the legal requirement for stakeholder and community consultation and participation in the designation or revoking of protected areas, and the use of a standardised management planning process;
- providing a legal framework for integrating privately protected areas into the NPAS;
- facilitating the provision of "special management areas" for sites outside of the NPAS where critical management actions need to be put in place (for example, in the formation of corridors, or in managing the increasing watercraft activity on the Belize River delta, linked to increasing manatee mortality in this key manatee site);

Birding at Rio Bravo Conservation and Management Area. At c. 105,000 ha. (nearly 5 per cent of Belize's land area) it is by far the largest privately protected area in the country © Programme for Belize

- recognizing traditional use rights in areas where conflict exists between traditional use and the non-extractive designation of the protected area—if managed under an approved sustainable use management plan.

Individual protected area governance types recognized in Belize closely mirror those identified by the IUCN (Salas & Shal , 2015).

- **Government Protected Areas**

Ninety-four per cent of protected areas in Belize are national lands administered by the Forest and Fisheries Department under the Ministry of Agriculture, Forestry, Fisheries and Sustainable Development, or by the Institute of Archaeology under the National Institute of Culture and History. However, only 22 per cent are managed directly by government agencies.

The Fisheries Department manages a number of marine reserves directly, including four of the seven units that constitute the Belize Barrier Reef System World Heritage Site. Whilst the Marine Reserves were legislated to include site level staff for basic management functions, those protected areas managed directly by the Forest Department do not have this provision, and therefore have limited financial resources and personnel available for direct management on the ground. The importance of the co-management partnerships with non-governmental organizations (NGOs), Community-Based Organization (CBOs) or long term logging concession holders therefore increases in this situation.

The NPAS also includes 16 Archaeological Reserves, the majority of which are Maya sites of antiquity. All are managed by the National Institute of Culture and History, which does not generally enter into co-management agreements.

- **Co-management, or Shared Governance**

In Belize, the tradition of co-management is well established following the first co-management agreements with an NGO, the Belize Audubon Society (BAS), founded in 1969. By 1982 the Government of Belize and the BAS had developed agreements for joint management of six of the protected areas, in recognition of the limitations of the government's capacity for direct management of terrestrial protected areas. Today, 38 per cent of protected area units, including some of the largest protected areas in Belize, are managed by co-management partners such as Belize Audubon Society under agreement with the government.

The Belize system, now codified in the National Protected Areas System Act, draws a sharp distinction between NGOs (non-governmental organizations) and

CBOs (community based organizations). However, the distinction is somewhat arbitrary and based largely on scale. The distinction may be important in terms of the capacity to manage grants, develop management plans, and satisfy reporting requirements. But most NGOs are connected to their communities and many are derived from the growth and expansion of CBOs. The governing boards of the NGOs are nearly all Belizeans, as are the staff, and often include both technical experts and local community representation. Community and traditional user participation in governance of the protected area is generally through an Advisory Committee or similar structure. Governing boards of CBO co-management partners tend to be local community members.

Thirteen protected areas are managed by CBOs, twelve of these through formal or informal co-management agreements with the government. The thirteenth, the Community Baboon Sanctuary (CBS), differs in that the protected area is based on private lands. The CBS was founded in 1985 as a community conservation initiative to ensure the long-term survival of Yucatan black howler monkeys (*Alouatta pigra*) – known locally as 'baboons'. The monkeys are also a tourism attraction, and thus an important resource for local communities. The Sanctuary is comprised of a series of land-use agreements under which private landowners agree to leave corridors of tree connectivity across their lands to allow howler monkeys to feed and travel.

In terms of the IUCN governance typology, the CBS inhabits a blurred boundary between a privately protected area and indigenous peoples' and community conserved territories and areas (ICCAs). Private landowners agree to participate but do so as part of a community effort, thus the Sanctuary might be considered a hybrid of the two. This is an excellent example of gradation among the protected area governance types. In practice the types are not always as distinct as they appear in theory; some protected areas exhibit characteristics of more than one governance type.

- **Indigenous and Community Conserved Areas**

Of the four governance types, ICCAs are the least well represented in Belize. As noted above, twelve community groups manage protected areas (some of them indigenous communities), under formal or informal agreement with government, and based on nationally held lands within the NPAS, defined under statutory instrument. The recent revision of the NPAS Act opens the way for establishment of community protected lands through Special Management Areas, when these lands are able to contribute towards the NPAS, such as formation of key corridors or protection of key species.

- **Privately Protected Areas**

Reflecting global trends, privately protected areas (PPAs) play an important and growing role in the NPAS (Stolton et al., 2014). Currently six PPAs are recognized by government (though a further two are reported to the WDPA – these two are no longer considered part of the system). In 2013, 17 other private areas were identified for future recognition as PPAs (Walker & Walker, 2013). National recognition of PPAs is based on an evaluation of their role within the NPAS, improving key connectivity in recognised priority national corridor routes, protecting important environmental services, or protection of critical habitat / species. Two of the larger protected areas in Belize are PPAs, the c. 105,000 ha Rio Bravo Conservation and Management Area and 8,226 ha Shipstern Conservation and Management Area.

Despite the important current and potential role of PPAs in the national system private conservation faces many challenges in Belize. IUCN guidance on privately protected areas calls for "…long-term *intent* to conservation. Long-term here should be at least 25 years, though the intent should be conservation 'in perpetuity', and safeguards put in place to ensure conservation objectives persist even if ownership changes." (Stolton et al., 2014, p x). Only three PPAs have secure long-term protection (Shipstern, Rio Bravo and TIDE Block 147). The other existing PPAs satisfy IUCN definitions by having long-term intent for conservation but there have been limited legal or institutional mechanisms in place to secure that intent. A perennial concern with unsecured PPAs is that land use may change when the private land ownership changes. For some PPAs, intent was insufficient, with two of the 17 candidate PPAs already largely lost to land conversion.

Currently there are no clear, tangible incentives for private landowners to manage their land for conservation. PPAs (like conservation on the larger landscape) face a challenge in a perverse tax incentive to develop land. In an attempt to discourage speculation, Belize levies an "undeveloped land tax" whereby undeveloped land is taxed at a higher rate than land converted to agriculture or otherwise developed. In at least one instance the owner of 95,000 acres of forested land (Corozal Timber) within a critical national corridor area (the Balam Jungle Estate) sold off 25 per cent of the area after annual taxes increased four-fold, resulting in the immediate clearance of 25,000 acres for agriculture.

These losses to conservation, and particularly to connectivity, vividly underscore the need to secure in the long term private conservation where it occurs, and their recent occurrences indicate a need for urgent action by

Staff of the Toledo Institute for Development and Environment inspect a Hicatee turtle found on the Rio Grande River in TIDE's Private Protected Lands in June 2014 © Karena Mahung

the government to establish a system to recognize, monitor and incentivize PPAs. For Rio Bravo Conservation and Management Area and Shipstern Conservation and Management Area, this has been resolved by placing the land in trust to the people of Belize. More recently, the revised NPAS Act provides a legislative framework for the recognition of PPAs in the NPAS (GoB, 2015b).

In the face of these challenges and issues, the Belize Association of PPAs, representing land owners wishing to commit lands to conservation, is working to further realize the potential for PPAs in the country, particularly under the revised NPAS legislation.

- **Complexity: Resilient or Inefficient?**

In the absence of checks and balances in central government, the diversity of actors (government agencies, NGOs, community groups and logging concession holders) in protected areas management helps to create opportunities for course corrections, with different parties participating directly in national initiatives to refine management practice. The involvement of civil society acts as a balance in a system vulnerable to political whim. The greatest weakness in the NPAS has, in the past, been *ministerial discretion*. Legally, the Minister responsible for protected areas has the power to de-gazette a protected area with the stroke of a pen. This sweeping authority has, to some extent, been mitigated as any de-gazettement must now go through a consultation process.

The Government of Belize is limited financially, and does not prioritize investment in the NPAS, despite this being the foundation for its tourism industry. It therefore relies heavily on its co-management partners (and increasingly PPAs and ICCAs) for locating the financial resources required for effective management. However, such assistance from civil society can lead to an abdication by government of its role in managing protected areas, and lead to an under-appreciation of the value of the National Protected Areas System — not only by government, but also by the Belizean people.

MANAGEMENT EFFECTIVENESS OF THE NPAS

An assessment in 2009 looked at management effectiveness across the different management regimes (Walker et al., 2009). Seven management regimes were recognized under the assessment, including management by long term logging concession holders through forest licences (see figure 3), defined by the structure of the different governance partnerships, from direct

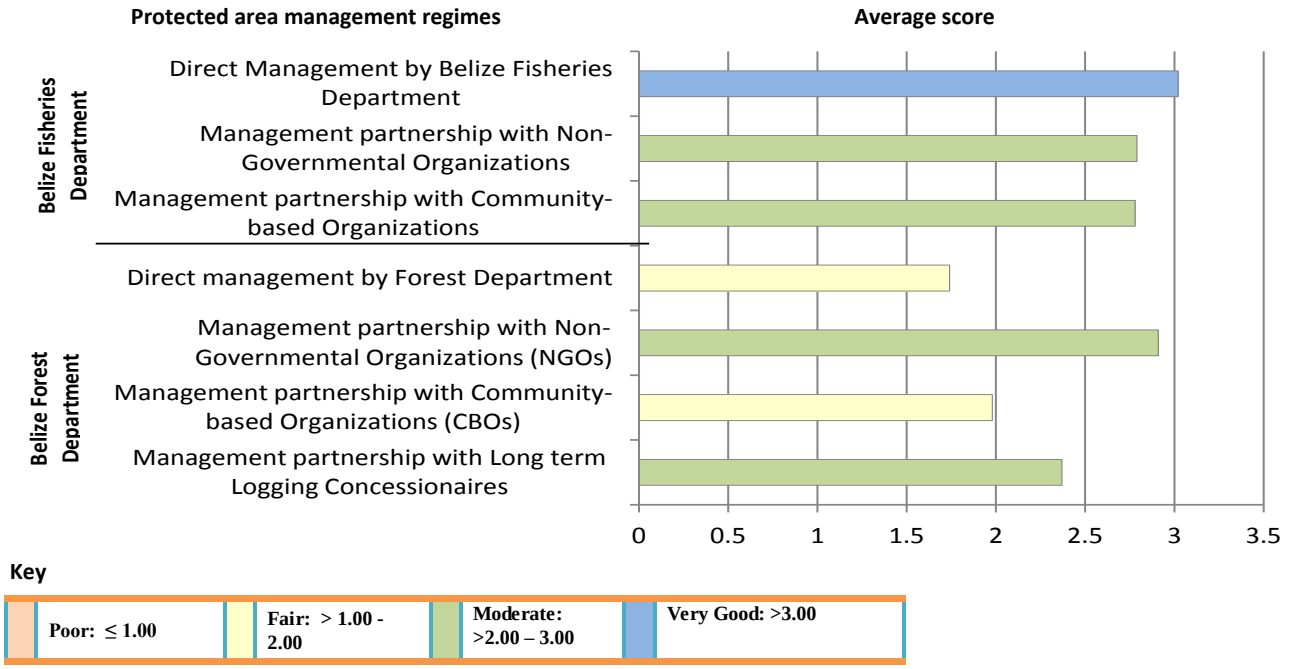


Figure 3: Management effectiveness based on governance and management regimes (Walker & Walker, 2009)

governance and management by government entities to co-management partnerships with NGOs and CBOs and logging concession agreements. The outputs demonstrated that:

- Protected areas governed by and managed directly under the Fisheries Department had the highest average management effectiveness score; 3.02 out of a possible score of 4.00 (75.4 per cent), rating as **VERY GOOD,** reflecting the government investment in staff, equipment and operational costs.
- Protected areas governed by and managed directly under the Forest Department had the lowest management effectiveness score; 1.74 out of 4.00 (43.4 per cent), rating as **FAIR,** reflecting the limited investment from central government.
- Protected areas under co-management agreements between NGOs/CBOs and the Forest Department differ greatly. Management effectiveness of protected areas under NGO governance and co-management average at the higher end of **MODERATE,** with a score of 2.91 out of 4.00 (71.8 per cent). Co-management with CBOs rates as **FAIR**, with an average score of 1.98 (49.4 per cent).
- Protected areas managed through co-management agreements between NGOs/CBOs and the Fisheries Department rated as **MODERATE** in their level of management effectiveness, averaging a score of approximately 2.79 out of 4.00 (69.7 per cent). There was little difference between NGO co-management partnerships (which scored 2.79) and that with a CBO (2.78), reflecting the level of support co-management partners receive from the Fisheries Department.

It should be noted that, based on site specific assessments, there has been a significant improvement in the effectiveness of co-management agencies across the NPAS since the 2010 assessment, but there has not yet been an updated national assessment.

DISCUSSION

- **System level management and connectivity**

Despite being a small country with limited human and financial resources for investment in protected areas, Belize has a NPAS of over 100 individual sites, managed under three different departments across two different ministries. Managing individual conservation areas of this number is challenging and can be inefficient, leading to repetition and overlap, with no maximizing through efficiencies of scale. The National Protected Areas Policy and System Plan (2005) recommended the simplification of the existing protected areas system through consolidating adjacent protected areas with similar landscape or seascape features, socio-economic contexts, and conservation threats into larger, system-level management units, with increased coordination and collaboration between site-level management agencies. This creates a smaller number of system level units that are more firmly integrated into the landscape/seascape context, incorporating biological corridors and facilitating a more coordinated management regime towards unified goals and visions.

These system-level units are comprised of geographically grouped protected areas within the same landscape or seascape that share similar stakeholders and impacts. To

Yellow-headed parrot (*Amazona oratrix*) in an artificial nest box taken at Payne's Creek National Park March 2013 © Andrew Williams

date, four have been established, using conservation action planning (CAP) as a framework to improve communication and collaboration within the units. Three of these are in the southern half of Belize: the Maya Mountains Massif, Maya Mountains Marine Corridor and Southern Belize Reef Complex. The fourth, and most recent, the Northern Belize Coastal Complex, is in the north. These system level units have varying degrees of success, based on the level of buy-in by the management agencies (as they require an effort to overcome turf-protectionism) but provide an opportunity for increased management support and cost-effectiveness within a landscape/seascape.

The Northern Belize Coastal Complex (NBCC) demonstrates the river-to-reef seascape role of the system-level management units. The six protected areas that lie within the NBCC are managed under different legislative designations and different governance and management regimes. Corozal Bay Wildlife Sanctuary (CBWS) protects the Belize waters of the largest transboundary estuarine system flowing into the Mesoamerican reef. CBWS was originally established for its role in protection of the endangered Antillean manatee (*Trichechus manatus*), as well as for its service as a fish nursery area. CBWS is managed by a CBO, the Sarteneja Alliance for Conservation and Development, with site-specific conservation targets focused on improving the viability of manatees, mangroves and estuarine species. Bacalar Chico, Hol Chan and Caye Caulker Marine Reserves are managed directly by the Belize Fisheries Department, with conservation targets focused on reef health and reef species. Conservation planning at system level, however, brings the management of the river to reef seascape into sharper focus, with system-level management strategies for increased reef health being integrated into management of the estuarine system, and vice versa.

The planning process for these system-level management units brings site-level management personnel together, providing space and a framework for protected area managers to meet to discuss threats, impacts and conservation strategies beyond their respective site-level protected area boundaries. This leads to improved coordination and collaboration between protected areas towards system-level goals, improving effectiveness, reducing overlap and increasing cost effectiveness. Strategies such as joint patrols, sharing of capacity building opportunities, standardization of biodiversity monitoring over the system and sharing implementation of education and awareness strategies in stakeholder communities all increase effectiveness of the system, as does the recognition of the value of non-protected sea within the seascape, its role in maintaining marine connectivity and ecosystem services.

- **Viability in the long term**

With the exception of the forest and marine reserves which are managed primarily for extracted resources, protected areas have developed in Belize largely in a reactionary way, in response to the threats of the day. And although great progress has been made, the system is not yet sufficiently respected by government and the Belize people to maintain integrity against many looming threats that are proximate and inevitable. Among these are:

- Population growth and concomitant demands on land use. Though population density is relatively low in Belize it is not heavily urbanized; the total population of Belize has doubled in 30 years and is projected to treble again by 2050.
- High poverty levels.
- Climate change – including sea level rise.

The country is not yet making strategic investments for the long term (50-100 years) to minimize erosion of the conservation value of its protected areas, and these and other threats will increase pressure to allow greater use and conversion of protected areas.

The NPAS Plan (Salas & Shal, 2015) identifies three main barriers to successful implementation:

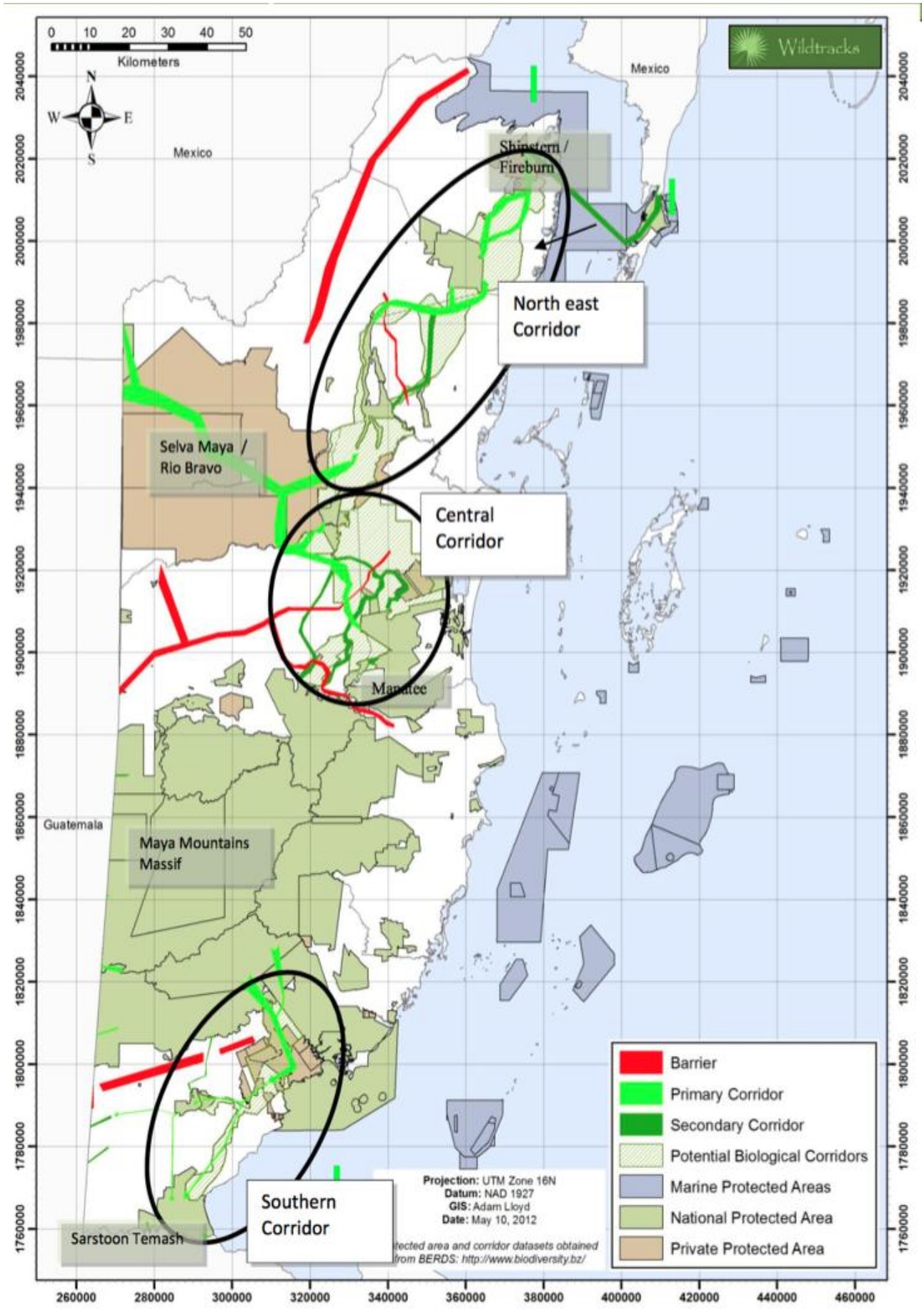


Figure 4: Identified Nodes and Primary Biological Corridor Routes (Walker & Walker, 2013)

The NPAS is currently fragmented, not cost-effective and not financially sustainable;

- Biodiversity within protected areas is increasingly isolated as historically connecting landscapes are transformed while surrounding communities remain indifferent, or even opposed, to protected areas and their conservation goals; and
- PPAs are isolated from the broader NPAS, with few incentives or mechanisms for their establishment or effective management for conservation.

Conservation depends not only on protection but also on connection (Lovejoy & Wilson, 2015). Plants and flightless animals require connectivity of habitats in order to move, both for their natural life cycles and in response to climate change. According to the IUCN, a connectivity conservation area is "actively, effectively and equitably governed and managed to ensure that viable populations of species are able to survive, evolve, move and interconnect within and between systems of protected areas and other effective area based conservation areas" (Worboys et al., 2016, p17). However, in recognition of this issue, there are currently two initiatives underway to secure key corridor connectivity (figure 4).

FINANCE AS MEANS AND TOOL

The NPAS is supported through a variety of funding mechanisms including national allocations towards the ministries responsible for natural resource management, grants from the Protected Areas Conservation Trust (PACT), Debt-for-Nature agreements, revenue generated directly by the protected areas themselves, and funds leveraged by protected area co-management agencies. There is a strong reliance on bilateral and multi-lateral international funding.

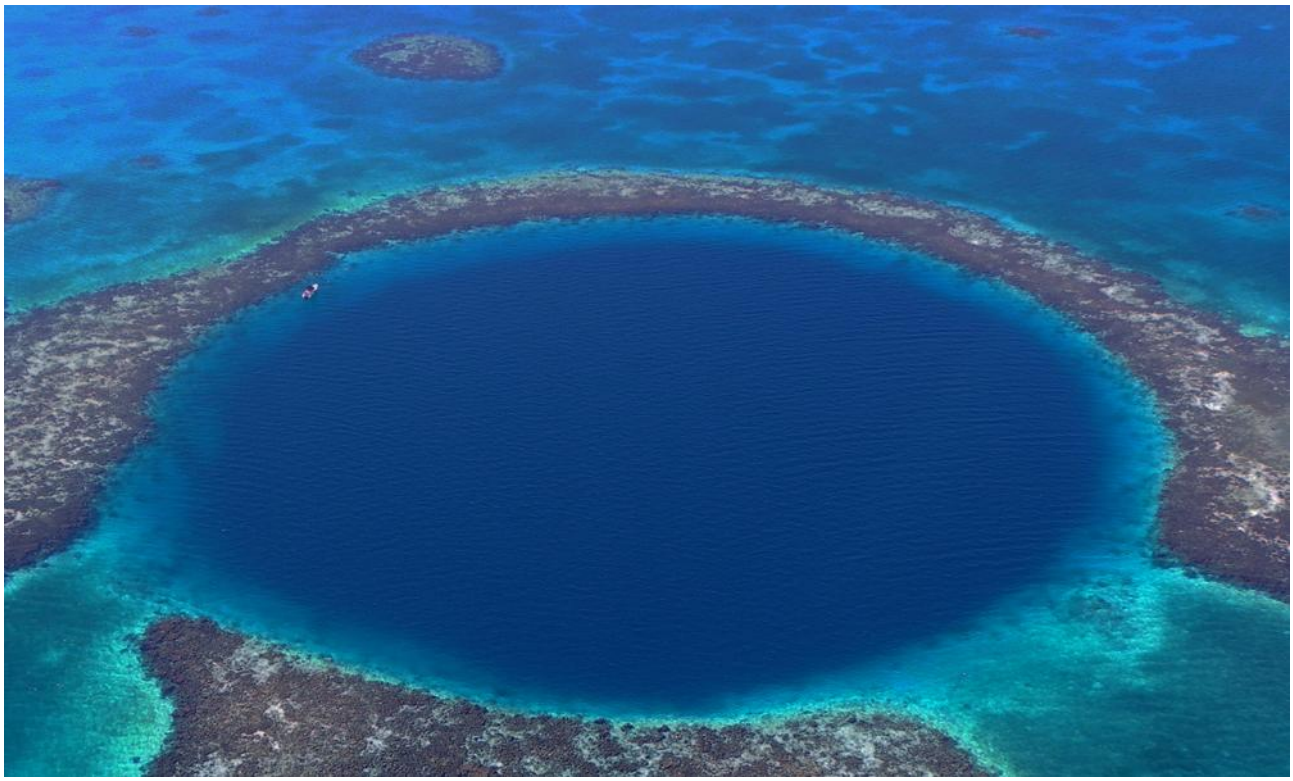
External funding for protected areas in Belize, sourced by the co-management partners, has two sides. On the one hand, it is very positive in facilitating management of protected areas that might not happen otherwise. On the negative side, it reduces the necessity for the Government of Belize to recognize and begin to account for the benefits protected areas provide, including 1) disaster risk reduction (reduced flooding, landslides, erosion, etc); 2) basis for tourism, central to the economy; 3) water security; etc.

PACT is a quasi-government entity (by law non-government representatives serve as board members in a slight minority to government officials) and as such also receives grants from external sources (GoB, 2015a). It is the primary national financial sustainability mechanism for support of the NPAS. One of the NPAS financial sustainability mechanisms focuses on fees associated with tourism. Thereby, 45 per cent of PACT's income was received from a Conservation Fee, levied on departing visitors to Belize and 49 per cent from the commission levied on cruise ship passengers. The remaining 6 per cent is through interest and other income sources (including investments and donations from agencies, corporations and interested individuals). These funds are then distributed to protected area managers of all governance regimes, currently on a competitive basis. The role of PACT is being greatly expanded following the revision of the NPAS in 2015 to include strategic planning for the system, monitoring and evaluation, and review of individual management plans for each protected area, duties previously performed by the Forest and Fisheries departments.

Belize is highly dependent on its natural and cultural resources. Tourism is the main earner of foreign currency and is based largely on nature and culture. Agriculture is dependent on water supplied by protected watersheds, and fisheries on both no-take zones and limited run-off from rivers. As the climate changes, disaster risk reduction becomes increasingly important. (For example, in 2008, Hurricane Arthur raised awareness when flooding destroyed the Kendal Bridge, requiring a US$5.45 million replacement, a large sum in the tiny Belizean economy). The revenue system, however, does not recognize the value of conservation for its current use in providing ecological services nor the cost to government of providing services to developed areas. This is not helped by the fact that a calculation of the value of Belize protected areas has not yet been made or accepted. However, the Biodiversity Finance Initiative (BIOFIN) is starting this work. The programme has identified that current sources of protected area finance include central government allocations (US$1.9 million), extra budgetary funding (US$2.4 million), local fees and concessions (US$3.8 million) and grants and other sources (US$2.6 million). BIOFIN however, estimate that the funding needs of the NPAS in Belize are expected to double over the coming decade (UNEP-WCMC & IUCN, 2016). Understanding the full value of the NPAS should provide a strong argument for increased funding.

CONCLUSION

Belize can boast a large and representative protected area system with reasonably good legislation and improving enforcement. The size, scale and diversity in Belize combine for an instructive case study of protected area system management and governance. Belize is a small country in both land area and human population. It is



Blue Hole Natural Monument is managed by the Belize Audubon Society under a co-management agreement with the Belize Forest Department. The iconic tourist attraction is one of seven sites in the Belize Barrier Reef Reserve System World Heritage Site © Belize Audubon Society

quite different from its neighbours Guatemala and Mexico in political structure, economic system and colonial history. In many ways it is an island in its region. Though a small country its NPAS is impressive and proportionally very large; in area it is second only to Nicaragua in *de jure* protected area in Mesoamerica. As the national system nears completion any expansion is likely to include novel forms of management and governance. The growing diversity of protected area governance types and finance systems may provide lessons for the development of more complex protected area systems in larger countries. But old and new threats encroach on the integrity of the system, and several large, important and intact privately-held natural areas have been lost to land conversion in the past two years.

The NPAS exemplifies all types of governance regime as recognized by IUCN, with heavy reliance on co-management, or shared governance, and increasing dependence on PPAs and community managed areas to fill in the gaps. The many different actors with direct management responsibility for protected areas bring diversity to decision-making and greatly increase the capacity for practical, on-the-ground management. This diversity of governance also helps to counteract the issues confronting system management, including: lack of human capital and financial resources; dependence on external funding; and flaws in the taxation system creating perverse incentives to clear land.

Protected area management is a huge challenge in Belize, but technical capacity within government is increasing. The full range of governance types, government agencies, and civil society managers operating in Belize, and their connection to a national PA system — all through the six system-level areas, once fully established — will create a web of interdependence. This web should help individual sites in the system grow to the next level of integration with each other and other land use interests at the larger landscape and seascape scale.

ABOUT THE AUTHORS

Brent Mitchell is Senior Vice President of the Quebec Labrador Foundation / Atlantic Center for the Environment, advancing conservation through international exchange, facilitation and technical assistance in over 50 countries. Brent is a founding partner in the National Park Service Stewardship Institute; chairs a specialist group on privately protected areas within IUCN's World Commission on Protected Areas; and is a past president of the George Wright Society. QLF has conducted training, exchange and assistance projects with partners in Belize for more than two decades.

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Paul Walker graduated from the University of Leeds in the UK with a degree in Zoology. He is co-director of Wildtracks, and works with conservation organizations in Belize to improve ecosystem and species conservation. He directs the wildlife rehabilitation activities and subsequent releases. Previous wildlife experience includes wildlife rehabilitation from an early age, care of sanctuary primates in the UK, involvement in the initial rehabilitation of chimpanzees in Spain and planning for their release in the Ivory Coast, and postgraduate research on tropical amphibian ecology. Research publications spread from amphibian ecology, species assessments, to forest structure and carbon storage, biodiversity and protected area planning.

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RESUMEN

El tamaño, la escala y la diversidad de las áreas protegidas en Belice proporcionan un estudio de caso informativo sobre la gestión y gobernanza del sistema que puede ofrecer un modelo para los países con sistemas en expansión. El Sistema Nacional de Áreas Protegidas de Belice es proporcionalmente extenso para el tamaño del país, con áreas protegidas terrestres que cubren el 36,6% del territorio nacional y el 19,8 por ciento del medio marino. Los 108 sitios comprendidos en el Sistema exhiben el espectro completo de categorías de gestión y tipos de gobernanza reconocidos por la UICN. Aunque el 85 por ciento de las áreas protegidas terrestres son tierras nacionales, solo el 43 por ciento de ellas son administradas directamente por dependencias gubernamentales. El sistema en general se caracteriza por una fuerte dependencia de la cogestión, de las áreas protegidas privadas y de los Territorios y Áreas Conservadas por Pueblo Indígenas y Comunidades Locales (ICCA), en ese orden. El gobierno central provee menos del 18 por ciento de la

financiación para la gestión del sistema. La diversidad de actores en la gestión de áreas protegidas crea un sistema de gobernanza dinámico y multivariado, en el que los diferentes grupos interesados mantienen una presencia destacada en el debate para perfeccionar constantemente las prácticas de gestión.

RÉSUMÉ

L'ampleur, l'échelle et la diversité des aires protégées au Belize proposent un riche cas d'école sur la gestion et la gouvernance, qui peut servir de modèle pour des pays dont les aires protégées sont en expansion. Le système national des aires protégées du Belize occupe un territoire proportionnellement grand pour la taille du pays, couvrant 36,6% du territoire terrestre et 19,8% du milieu marin. Les 108 aires protégées présentent l'éventail complet des catégories de gestion et des types de gouvernance reconnus par l'UICN. Bien que 85% des aires protégées terrestres soient des terres nationales, seulement 43% sont gérées directement par des organismes gouvernementaux. Le système dans son ensemble se caractérise par une forte dépendance envers la cogestion, les aires protégées privées et les APACs, dans cet ordre. L'administration centrale fournit moins de 18% du financement de la gestion du système. La diversité des acteurs de la gestion des aires protégées crée un système de gouvernance dynamique et varié, les différents intervenants contribuant chacun au débat pour affiner constamment les pratiques de gestion.

USING A PARTICIPATORY ASSESSMENT OF ECOSYSTEM SERVICES IN THE DINARIC ARC OF EUROPE TO SUPPORT PROTECTED AREA MANAGEMENT

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ABSTRACT

Economic and non-economic benefits of protected areas were assessed in 58 national parks in the Dinaric Arc of Europe, involving over a thousand local people and identifying major economic benefits from tourism, rural development and water. The study used the Protected Area Benefits Assessment Tool in stakeholder workshops in all the parks studied. The results are being applied to improve protected area management and enhance collaboration with local stakeholders. The Dinaric Arc includes parts of eight countries in south-eastern Europe. While being one of the continent's most important areas for biodiversity conservation, it is under intense pressures from development and many of the region's protected areas are underfunded and undervalued. Understanding the full range of values and benefits of protected areas to stakeholders provides a good basis for developing management and policy responses and has proved popular with both governments and donor organizations. The results suggest that protected areas already provide significant economic benefits to local people in the region, often in places with few other options, and that further utilization of many ecosystem services is possible without undermining protected area objectives and effectiveness.

Key words: protected areas benefit assessment tool (PA-BAT), Dinaric Arc, socio-economic benefits, ecosystem services, tourism, policy, water

INTRODUCTION

The environment provides many resources that can be used to provide ecosystem services, subsistence resources, economic benefits and less tangible benefits such as spiritual peace or mental well-being. To help understand the interactions between humans and their environment, the United Nations Millennium Ecosystem Assessment (MEA) classified four categories, or services, relating to ecosystems that are of direct or indirect benefit to humans:

- Provisioning services which enable people to make a living (e.g., fisheries and forestry, both subsistence and commercial).
- Services which support human life (e.g., potable water and clean air).
- Services which regulate other important ecosystems (e.g., mangroves that act as a nursery for juvenile fish).
- Services of cultural significance or which provide opportunities for recreation (e.g., sacred sites and walking trails) (MEA, 2003).

The primary goal of any protected area is to maintain its natural values (Dudley, 2008). If carefully planned and well managed these same values can provide a range of ecosystem services capable of benefitting diverse stakeholders. Knowledge of values and benefits can lead to a better overall understanding of how protected areas contribute to local and national well-being and economies and enhance relationships between local people and protected area managers (Stolton & Dudley, 2010). Protected area assets can also, if properly managed and sustainably utilized, provide economic returns far above the level of investment needed to maintain them (Balmford et al., 2002). But to do this the benefits need to be understood and their contribution assessed.

Figure 1: Dinaric Arc region

Ecosystem valuation is the process of expressing a value for ecosystem goods or services (Farber et al., 2002). These values can be articulated in a variety of ways, from economic to intrinsic values and can be conducted at different spatial scales, from local (e.g., individual sites) to larger scale assessments (e.g., regions or biomes) (Kettunen & ten Brink, 2013). The Protected Areas Benefits Assessment Tool (PA-BAT) has been developed to help collate information on the full range of values from protected areas and the current and potential benefits (both economic and intrinsic) of individual protected areas from ecosystem services (Dudley & Stolton, 2009) using a participatory approach.

This paper discusses the implementation and results from using the PA-BAT in 58 protected areas across the Dinaric Arc region of south-eastern Europe; the largest use of this tool to date.

THE STUDY AREA

The Dinaric Arc includes parts of eight European countries: Albania, Bosnia and Herzegovina, Croatia, Kosovo[1], Former Yugoslav Republic Macedonia, Montenegro, Serbia and Slovenia (figure 1) in south-eastern Europe. Covering approximately 320,000 km², and with more than 6,000 km of coastline, the region includes the Dinaric Alps (after which the region is named) and the Adriatic Sea (the northernmost arm of the Mediterranean Sea).

The Dinaric Arc is particularly important for biodiversity conservation with high floristic diversity and endemism in landscapes which persist in few other areas of Europe. The region includes large areas of natural forest, preserved flood plains and free-flowing rivers, unique large-scale karst limestone landscapes with associated high diversity of cave fauna and large areas of traditional land uses and agricultural systems, with associated agro-biodiversity (Republic of Albania, 2014; Republic of Bosnia and Herzegovina, 2014; Republic of Croatia, 2014; Republic of Kosovo, 2011; Republic of Macedonia, 2014; Republic of Montenegro, 2014; Republic of Serbia, 2014; Republic of Slovenia, 2015). The region includes the most extended network of subterranean rivers and lakes in Europe, as well as wetlands of international importance. Important stopover and wintering sites for migrating birds include the Neretva delta (Bosnia and Herzegovina/Croatia) and Skadar/Shkodra Lake (Montenegro/Albania), which also has important nesting populations of endangered bird species, such as Dalmatian pelican (*Pelecanus crispus*). Inland, large carnivores (including wolf (*Canis lupus lupus*), lynx (*Lynx lynx)* and brown bear (*Ursus arctos arctos*)) use the Dinaric mountains as an ecological corridor between the Alps and the mountains of south-eastern Europe. The Eastern Adriatic coast has hundreds of islands and diverse coastal/marine ecosystems, which are feeding and breeding grounds for cetaceans, sea birds and marine turtles, and include unspoilt tracts with limited

BOX 1: THE PA-BAT STRUCTURE

The PA-BAT assesses the importance and values of all forms of **legal** resource use in a protected area (illegal resource use is usually identified in threat analyses and management actions are developed accordingly) and the benefits (both economic and non-economic) which accrue, or could potentially accrue, from these values. The assessment has two parts: an information sheet records basic details about the protected area and 24 datasheets record types of benefit; recipients of benefits; and qualitative information about their importance. The datasheets record the full range of protected area ecosystem services (de Groot et al., 2002) organized around nine main groups: nature conservation; protected area management; food; water; culture and spirit; health and recreation; knowledge; environmental benefits; and materials. Additional values can be added if they emerge from the discussion.

mass tourism development. Low-intensity farming practices have created semi-natural habitats which integrate forest, pasture and croplands and support a unique set of species (Glasnović et al., 2009).

Many of the most important natural areas in the Dinaric Arc are protected in national parks and nature parks. These cover nearly 20,000 km² of land and 750 km² of sea. Most also contain resident or nearby human populations, who derive direct benefits from the areas, and the ecosystem services also benefit more distant communities. However, an understanding of these values and associated benefits is low, even among protected area staff. Most protected areas are underfunded and their management approaches sometimes lag behind the professional standards in other countries (e.g., Glasnović et al., 2009), in particular concerning the role of local communities in site management.

The aim of the study was to provide locally sourced, credible information on the economic and non-economic importance of in-situ conservation in the region and the potential for increasing these benefits whilst ensuring effective biodiversity conservation. The objective was to use the results of this assessment to improve protected areas management and enhance collaboration with local stakeholders. Although, some site/country specific economic valuations have been published (e.g., WWF, 2011; Spurgeon et al., 2009; UNDP, 2011; Flores & Selimi, 2013; Flores & Ivicic, 2011; Emerton, 2009; UNEP, 2016; UNDP-GEF, 2015), no previous regional stakeholder analysis had been attempted and the results of existing assessment have had little practical impact in the protected areas studied. Given that the Dinaric Arc is under intense pressures from development (e.g., Glasnović et al., 2009), the values and benefits of the region's protected areas urgently need to be understood and secured.

The Protected Area Benefit Assessment Tool (PA-BAT) was chosen as it is the only tool currently available which assesses stakeholder opinions of benefits. Its dialogue-driven approach was developed specifically to counteract the challenges many protected area managers face when data-driven approaches to assessment provide detailed cost and benefits analysis but little practical guidance on how to use this data. Once such a locally-driven process has been completed the need for more precise data can also be assessed and prioritized, thus ensuring any future assessments, such as detailed economic assessments (e.g., Kettunen & ten Brink, 2013), are precisely focused on the needs of the protected area.

METHODS

The PA-BAT methodology was implemented in 58 protected areas across the eight countries in the Dinaric Arc region between 2011 and 2014. The methodology was implemented in all the national parks in the region and in total implementation covered over 70 per cent of all the national and nature parks. Of the protected areas included in the study, 45 were in remote mountainous forest areas, six were marine protected areas (reflecting the terrestrial bias of protected areas in the region) with other sites in areas dominated by freshwater (floodplains, lakes and waterfalls).

Before implementation, the PA-BAT was adapted for use in the Dinaric Arc. Each question and stakeholder group was reviewed and adaptations were made to ensure that the tool was relevant to the region, e.g. indigenous peoples were removed as there are no indigenous peoples in this region, and two new groups, scientist/experts and civil society organizations (e.g. hunters, fishers and sports associations), were added according to the value assessed. (see figure 2). Information on ecosystem services was collected through facilitated, participatory workshops. The workshops were held locally to the protected area and notice of the meeting and/or invitations were distributed widely to ensure relevant participants were invited. During the workshop, participants were asked to assess the economic and non-economic value for a range of ecosystem services (see box 1) against a range of stakeholder groups (see figure 2). Assessments were selected from six possible values: 1) no importance; 2) minor or 3) major non-economic benefit (e.g. subsistence value, aesthetical value, cultural or

Local people living inside the protected area	Local people living near the protected area	National population	Science/ experts	Civil society organisations (user groups)	Business sector	Government /managers of protected areas	International community
	+	+	+	++	+	+P	+
	€€P		€	€€P	€P	€€P	

Key: + minor benefit, ++ major benefit, € minor economic benefit, €€ major economic benefit, P potential benefit, blank boxes relate to stakeholders not being relevant or the benefit being of no importance or potential.

Figure 2. An English translation of the PA-BAT assessment datasheet filled in during the workshop in Telašćica Nature Park for the assessment of recreation and tourism (question 13 in the PA-BAT). A detailed explanation of these results is provided in Box 2. The first row represents non-economic benefits (+ signs) while the second row represents economic values (€ signs).

BOX 2: CASE STUDY TELAŠĆICA NATURE PARK, CROATIA (INTERPRETATION OF FIGURE 2)

Telašćica Nature Park is situated in the central part of the eastern Adriatic coast on the southern side of the island of Dugi Otok. There are no inhabitants inside the protected area, thus there are no results for the first stakeholder group in figure 2. The local community living on the rest of the island represents locals living around the protected area. Locals have minor benefit from the recreational opportunities in the protected area while they have major economic benefit from the tourism activities (e.g. renting houses, working in the tourism sector, etc.) and they also see potential for further economic benefits from tourism.

The national population recognize Telašćica Nature Park as a touristic destination but it is not as important as some other Croatian national parks and it is not a major revenue earner in terms of GDP. Scientists and experts have conducted a few studies mainly regarding tourism in the protected area; and this has resulted in some income for them. Civil society organizations, in this case sports clubs (divers) and local cultural associations, receive major non-economic benefits from the protected areas as their work and cultural heritage can be presented to a wider audience. They also have major economic benefit from tourism related activities (e.g. renting sports equipment and services, selling local products) and they also see potential in gaining more income from marketing local products.

The business sector (e.g. local tourism agencies) sees some non-economic benefits from tourism and recreation on the island but their main focus is an economic one. At present, the local business sector has only a minor economic income because agencies from outside of the island run most enterprises and gain the majority of the tourism income.

Government (e.g. the tourist board/managers of the protected area, etc.) recognized tourism as a non-economic benefit although the main focus of protected area management is nature conservation; nonetheless, they see potential in improving current tourism practices. Managers of the protected areas receive major economic value from tourism related activities because they charge entrance fees mainly to nautical tourists, and this funding provides a major part of their budget. They also see potential in improving the tourism offer. The international community, mainly tourists from other European countries, recognize Telašćica Nature Park for its tourism and natural values, as Telašćica is on the majority of national touristic brochures and is represented at international tourism fairs, etc.

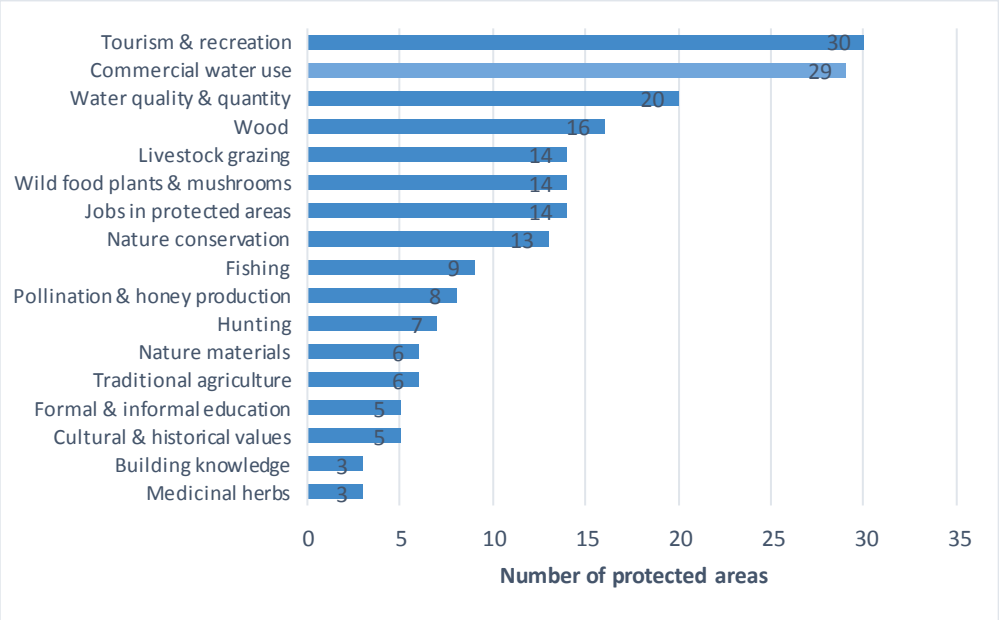


Figure 3. The assessment of major economic benefits in 58 protected areas in the Dinaric Arc.

religious value, etc.); 4) minor or 5) major economic benefit; and, if appropriate, 6) potential benefit (see figure 2). Symbols were used to record the group's final assessment decision, achieved through discussion and consensus. These decisions were then projected onto a screen to ensure the results are transparent and to encourage further participant involvement and debate (see figure 2). Detailed minutes of the discussion captured any additional information. Each participant was also given a short workshop assessment form to fill in at the end of the workshop, which asked what they thought of the workshop and how they could use the knowledge gained.

The PA-BAT was developed in part as a response to top-down, science-led transfer of knowledge. However, as Reed (2008) notes, local knowledge should not be accepted unquestioningly and a combination of local and scientific knowledge generally results in the most accurate result. The results from the workshop assessments were thus checked with expert input through a validation process. Any changes in the results were, however, kept to a minimum and recorded along with the justification for any revisions to ensure transparency.

As this was a regional implementation, volunteer national PA-BAT coordinators were recruited and trained to set up and implement the assessment in each country, and in each protected area a PA-BAT focal point was designated. In total the PA-BAT workshops involved 1,245 local people across the region. Following the workshops and data verification process, the results were entered into an Excel database. For each benefit and each beneficiary, indicators were entered using a three-point scale: 0 = no importance, 1 = minor importance and 2 = major importance. Potential benefits were recorded separately. Over 22,000 items of data were inputted into the database. An online platform (using the Excel Dashboard programme) was developed so PA-BAT focal points and protected area staff could enter additional information and search, check and use the results. The estimated cost of implementation was €65,000 (approximately US$83,000) over three years plus staff time (usually two people per workshop; one to facilitate the discussion and one to record the discussion). Over 30,000 km were travelled to implement the workshops.

RESULTS

This paper focuses on the results of the economic assessment of benefits only. Overall, the results showed a wide range of legal use of resources from protected areas which provide current (figure 3) and potential economic benefits (figure 4) to a wide range of stakeholders. Three findings are highlighted in more detail below. Firstly, although 95 per cent of stakeholders stated they already received some economic gain (i.e. both minor and major benefit) from tourism in protected areas, it was clear from the workshop discussions that there was potential to increase these benefits. Secondly, research highlighted the role of protected areas in a group of benefits, including local food production (agriculture, livestock, non-timber forest products, fishing, honey and in some cases hunting), employment, etc., which are broadly termed as local development, and were all seen as having major potential for increasing economic returns from the protected areas. Thirdly, commercial water use has a major economic value in 50 per cent of protected areas, linked to the widespread occurrence of karst landscapes in the region which have highly productive groundwater supplies (Veni et al., 2001), but there has been a very uneven distribution of the resulting benefits (figure 5).

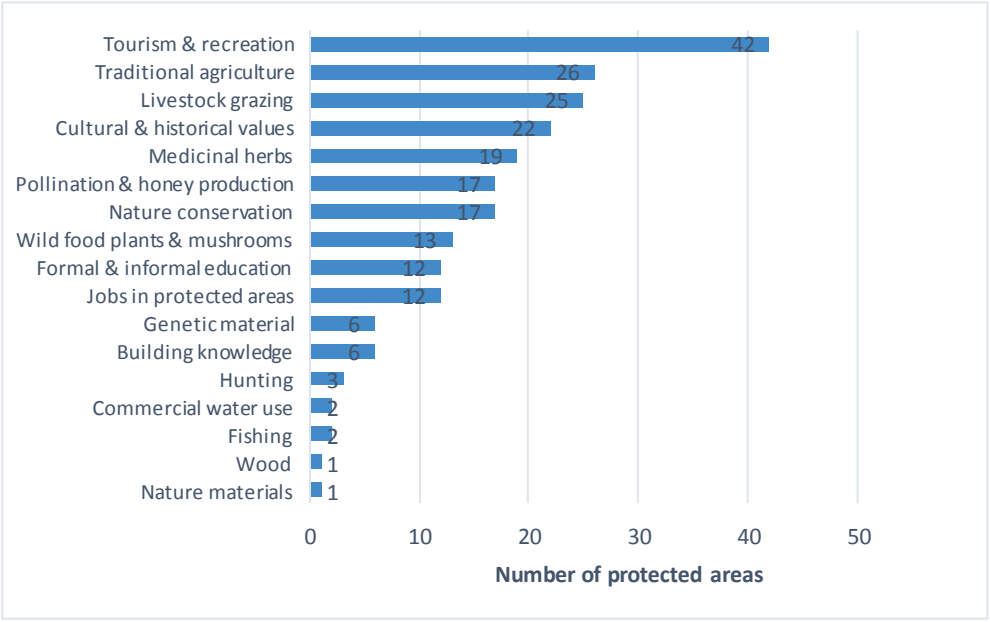


Figure 4. The assessment of economic benefits with potential recognized by the local community (locals in and around protected area) and civil associations in 58 protected areas in the Dinaric Arc.

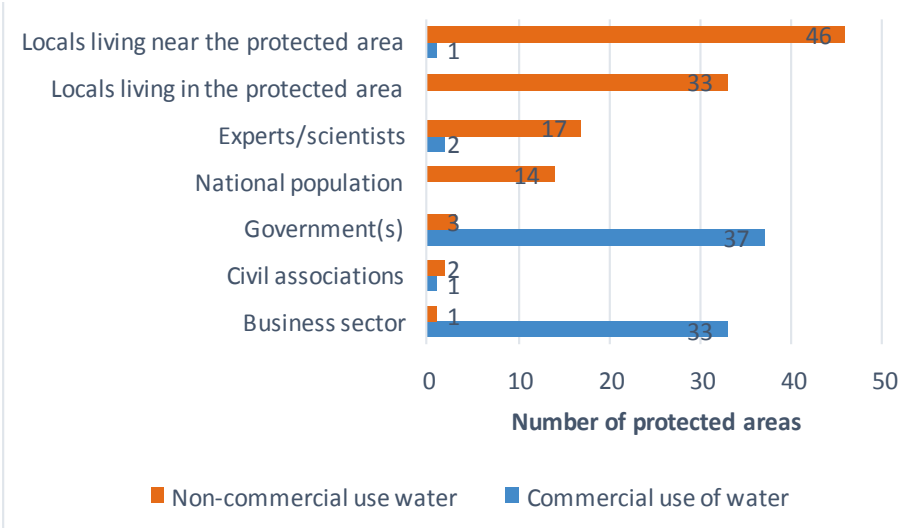


Figure 5. Comparison of flow of economic benefit from the non-commercial and commercial use of water to different stakeholder groups in 58 protected areas in the Dinaric Arc.

TOURISM

Tourism is both an important and potentially important benefit from protected areas in the region (figures 3 and 4). In 2014, the World Tourism Organization reported that south-eastern Europe (Albania, Bosnia-Herzegovina, Croatia, FYR Macedonia, Greece, Montenegro and Serbia) was the most buoyant area for growth in tourism in Europe (WTO, 2014). Although several protected areas in the Dinaric Arc receive high volumes of visitation, most tourist activity is focused on seasonal coastal and cultural tourism rather than year round nature-based tourism. In Croatia, for example, although the Plitvice Lakes World Heritage site has over one million visitors per year (IUCN, 2014), the vast majority of tourist bed nights (95 per cent) are in coastal areas (Demunter & Dimitrakopoulou, 2014) whereas most protected areas are inland. There is, therefore, considerable potential to develop higher value, locally beneficial, sustainable, nature-based tourism. Being comparatively labour intensive, tourism provides multiple local employment benefits including: opportunities for women; relatively low barriers to entry (e.g. low educational requirements); and varied job opportunities, particularly important in areas with low agricultural activity (ODI, 2008). Projections for nature-based tourism suggest rapid growth for this sector. At the start of the 21st century ecotourism / nature-based tourism was growing three times faster globally than tourism as a whole (Coria & Calfucura, 2012). The PA-BAT assessment identified 42 protected areas (over 76 per cent of those assessed) which have some income from tourism and have the potential to bring in more economic gain to local people and business (figure 4). Assuming this tourism is developed in a way that supports protected area management, it could provide a major boost to protected area finances and involvement of local people in management without undermining conservation values (Spenceley et al., 2015).

Mljet National Park, Croatia © Equilibrium Research

LOCAL DEVELOPMENT

The Dinaric Arc region of Europe retains cultural traditions which encompass both landscape and livelihoods. However, as in many parts of the world, changes in global production networks and increasing urbanization are changing the character of rural areas. Nearly three-quarters of Europeans live in cities (European Environment Agency, 2014), leaving many rural areas with depleted populations and depressed economies; the cycle of declining jobs, migration, lack of demand for local services leads to many rural areas being virtually abandoned, local cultures disappearing and traditional land-use systems collapsing. It is accepted that in many areas the survival of local cultural will depend on tourism, niche manufacture and recreation as a replacement for resource extraction and agriculture as the dominant economic drivers (Moseley, 2003). All these values can, if carefully managed, be complimentary to protected area management.

In the Dinaric Arc study, the reinvigoration of traditional agriculture, including local production of medicinal herbs and honey, cultural and historical benefits and benefits specifically linked to protected area management (including nature conservation, education, knowledge building and jobs in protected areas) were all assessed as being more likely to provide increased economic gain in the future than the more 'traditional'

BOX 3: LOCAL PEOPLE'S RESPONSES TO THE PA-BAT EXERCISE

Miloje Blagojević, Beekeepers association, Đerdap National Park, Serbia:
"*We have learned that in the same area honey is collected by a few other young honey makers who I can join so that together we can put our honey on the market*."

Dragan Kovačević of the Republic Institute for Protection of Cultural-Historical and Nature Heritage, Bosnia and Herzegovina:
"*For the first time, we have received data from the bottom-up, that is, from people who live in the protected areas. It is a simple tool for the assessment of resources and values of existing and proposed protected areas*."

Miodrag Šikić, "Kurnatari" Association for the protection of the ownership rights and conservation of original Kornati archipelago values, Kornati National Park, Croatia:
"*Kurnatari are owners of their land in the national park. After 30 years we have got the chance to say what we expect of the park and which values are important to us...*"

Lonjsko Polje Nature Park, Croatia © Andrea Štefan

economic activities such as water and wood (e.g. timber harvesting and processing) which are currently providing benefits (figures 3 and 4). If achieved, such 'new' rural development could be an important tool for reversing the trend of depopulation and land abandonment (Terres et al., 2013).

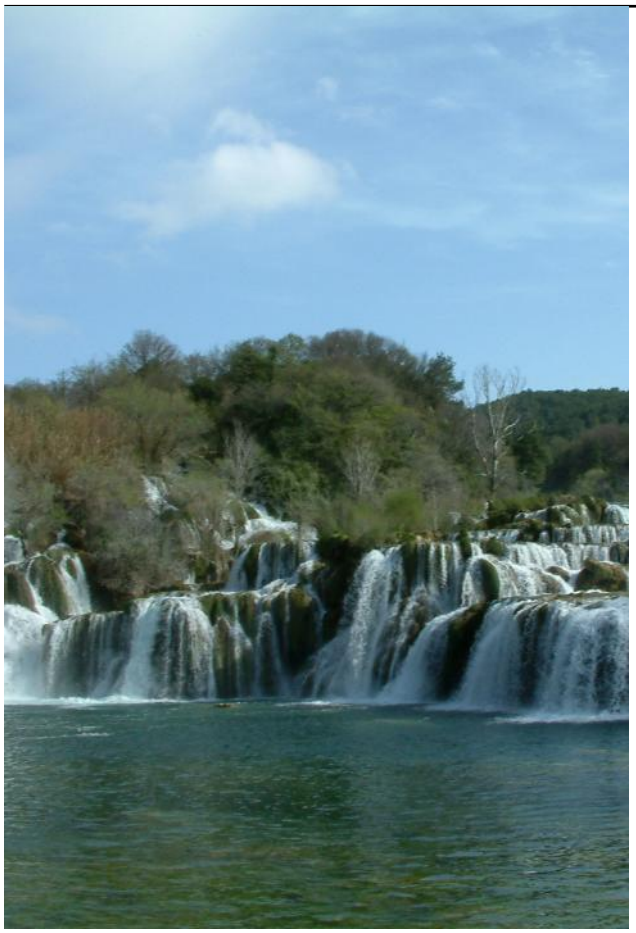
A wide variety of local products come from protected areas in the region. However, there is no regional or international marketing of these products that highlights their links to conservation and local development, and there is often little coordination between producers even when they are working in the same area. During the PA-BAT workshop different producers met each other and stated that they will try to collaborate in the future.

A few examples of regional products from protected areas include the protection of rare and endangered birds in the salt-pans of Sečovlje Nature Park in Slovenia is coupled with producing top quality and traditionally gathered salt. The Croatian Lastovo Island Nature Park in Croatia has 9,000 trees of a species known locally as 'Piculja', an olive cultivar native to the country; almost all the 800 inhabitants of the island produce olive oil for their personal use and sale which, together with fishing, is the main source of income. Beekeepers from all over Serbia bring their hives to Đerdap National Park because of the clean air and linden trees, producing one-sixth of all linden honey produced in Serbia. Njeguši village in Lovćen National Park, Montenegro, produces a dry-cured ham recognized for its particular flavour and aroma resulting from the mixture of sea and mountain air and wood burned during the drying process. Over 100 drying facilities, supported by government incentives for the production of traditional products, employ many local people in and around the park. Ensuring that protected areas management plans include sustainable resource use for these important products will help build relationships with local people whilst protecting biodiversity. National or even regional marketing can enhance both the market for local products and raise awareness about protected areas (Kremer, 2007).

Protected areas can also provide direct employment opportunities ranging from reserve management to resource-specific management (e.g. forestry operations), species protection, survey and monitoring, tourism/ visitor services, retailing and cleaning operations. The PA -BAT assessments revealed that in 25 per cent of the protected areas jobs linked to conservation management were the only source of income and thus vital for the survival of local economies. The majority of these areas are in mountainous regions where no alternative employment exists; so without the opportunities presented by protected areas people would leave. Research in the UK supported the importance of conservation jobs in rural areas. In these areas one or two secure jobs can have a major impact on families and the local community; e.g. young families do not leave the area, thus supporting schools, business, local shops, etc. (Molloy et al., 2011).

COMMERCIAL WATER USE

The link between karst landscapes, water quality and economic benefit is clearly reflected in the assessment results (figure 3). There is a variety of commercial water use from protected areas in the region. Water sourced from protected areas is important for the national water supply. Two capital cities and their surrounding area, each with a population of more than a million, get their water from protected areas: Sarajevo in Bosnia and Herzegovina from Vrelo Bosne protected area and Tirana in Albania from Dajti National Park. In Croatia, Krka National Park and Papuk Nature Park supply two counties (Šibenik-Knin and Požega-Slavonia) with water, while Velebit Nature Park provides water locally and to three nearby offshore islands (Rab, Pag and Pašman).



The waterfalls at Krka National Park, Croatia which powered the first commercial HP plant in Europe (left) © Irina Zupan; bottled water from Durmitor National Park, Montenegro displaying the world heritage emblem (right) © Equilibrium Research

Hydroelectric Power (HP) is an important, well-established and often controversial source of power, often built in or close to protected areas. Krka National Park is home to the first commercial HP plant in Europe and second in the world (it began operation three days after the first plant in Canada in 1895). Although clearly an economic benefit to some sectors of society, plans to build major HP facilities in or very near protected areas throughout much of the region are likely to have serious detrimental impacts on the environment (see for example IUCN, 2012; Freyhof et al., 2015), perhaps a reason why water was not seen as having potential for further economic gain in the region by local stakeholders (figure 4). The fact that so many protected areas in the Dinaric Arc are in upland areas which include important water sources means that conflict around these issues is likely to remain for many years.

Another economic link between business and protected areas in terms of water is through the bottling of mineral water. The European bottled water market was worth over €39 billion in 2012 and market reports predict future growth of 6 per cent per year (Technavio, 2014). In some parts of Europe the benefits that ecosystems provide have for many years been recognized by companies that depend on high-quality water; for example, the mineral water company Perrier-Vittel pays to restore forests in the catchment where it collects water in France (Johnson et al., 2002). In Croatia, more than 85 per cent of the population has access to high-quality water from the mains water supply system. Nevertheless, Croatia is ranked 12th in the world for per capita bottled water consumption partly due to high numbers of tourists during summer. Bottled water is a thousand times more expensive than tap water; and the largest producer of bottled water is one of the most profitable companies in Croatia(Zelena akcija, 2014).

Across the Dinaric Arc, however, there is little evidence that commercial enterprises consider the protection of their primary asset by supporting the management of the protected areas they rely on, despite using the perception of quality water from protected environments as part of their marketing strategy. Durmitor water, for example, sources its water from the 'Gusarevci' spring within the Durmitor National Park, Montenegro, as it notes on its website (Diva, 2017). Similarly, there are two bottling companies using water from Velebit National Park in Croatia; the natural spring water SANTA links the location with ensuring continued water quality (Santa,

Traditional woven products made by women (inset) in Una National Park, Bosnia-Herzegovina © Equilibrium Research

2017). Jazak spring water from Fruška Gora National Park, Serbia also links the quality of the water with its location in the national park (NIS, 2017) as does Qafshtama bottled water located close to two protected areas, Dajti and Qaf Shtama National Park, in Albania (Qafshtama, 2017).

Water use from protected areas in the Dinaric Arc provides a clear example of unequal distribution of benefits from the ecosystem services provided by parks and the benefits that accrue to local people. Although protected areas provide important non-economic water benefits (many water users living in protected areas do not pay for drinking water provision), the PA-BAT workshop participants identified the inequality of benefits distribution (figure 5). Only stakeholders in Shabenik Jabllanica National Park in Albania assessed economic gain from water ecosystems through locally organized irrigation associations. In contrast, Qafshtama, which has captured about 18-20 per cent of the national market for bottled water in Albania, provides limited local benefits (employment for around 20 local people and help with local road maintenance) and the local government does not receive any tax from the company as the water concession was given by central government.

Commercial uses of water from the protected areas of the Dinaric Arc Region present an important opportunity for protected areas and protected area authorities to build better relationships with the companies involved. Links could be as simple as providing better information about the protected area, its importance and management on marketing material about bottled water from the site, to cooperative agreements to share capacity and even funding to secure the water source such as Payment for Ecosystem Service (PES) schemes. Making such linkages provides a basis for building knowledge and developing projects that promote equitable and sustainable use of protected area resources.

There is an urgent need to establish these activities. At present the water bottling operations in the region are generally locally (or at least nationally) based businesses, however the global trend is for multinational food and beverage companies to acquire bottled water brands, reducing competition and local control over resources and profits, which may make cooperation between protected areas and bottled water companies harder to establish (Technavio, 2014).

DISCUSSION

One of the persistent challenges in securing protected area assets is that many of the services maintained by sustainable management or protection of ecosystems are diffuse, providing many people with benefits that are hard to measure, which although collectively are very important, are relatively small for each individual. On the other hand, unsustainable use often provides a few people with a lot of benefits, at the expense of the majority (Stolton et al., 2015). By collecting data from the majority of the protected areas in the Dinaric Arc, the results provide a region-wide picture of protected area benefits from which local, national and regional strategies can be developed. The data are being used for a wide range of applications including management planning, business planning, communication strategies, system-level policies, sector dialogues, detailed ecosystem services assessments, interpretation and education, rural development projects and to mobilize and generate funding. For each of the above-mentioned applications a guidance document has been developed to help protected areas use the results of the PA-BAT[2].

As noted above, the main objective of the assessment was to use the results to improve protected area management and enhance collaboration with local stakeholders. These objectives will be primarily accomplished by applying the PA-BAT results when protected area management plans and annual operational plans are developed or revised. To help facilitate this, each PA-BAT assessment is being made available on the evidence base web page (from March 2017) allowing all protected area staff easy access to the assessment results [3]. At the site level, the results have helped identify entrepreneurs to work with protected area staff and local/regional communities to create new sustainable initiatives which support conservation and rural development.

One of the main issues raised during the process of undertaking the PA-BAT assessment in the region is the lack of communication between the local community and protected area management. This highlighted challenges in protected area governance and has led WWF to develop recommendations for the improvement of governance, which are being presented to governments in national reports developed using the PA-BAT results (e.g. WWF, 2016). Strategic documents on sustainable use of resources (e.g. tourism, rural development) are also being developed for focused dialogue with different ministers, corporate entities (hydropower), EU delegations and the European Parliament.

Implementing the results of the PA-BAT has been aided by the assessment attracting donor agencies interested in funding projects on biodiversity and well-being, using the PA-BAT results as a baseline to develop a range of site-based projects. The analysis served as a basis for a new project, Protected Areas for Nature and People (PA4NP), to support the improvement of protected area systems in the region. Based on the PA-BAT findings, field projects in nine protected areas in Bosnia and Herzegovina, Serbia, Kosovo and Montenegro have been developed in order to present good practices and resolve conflicts. Regionally the results are informing two processes: the Dinaric Arc Big Win, a joint statement to coordinate efforts to deliver on the commitments made by countries in the region under the Convention on Biological Diversity and the establishment of the Dinaric Arc Parks Association.

CONCLUSIONS

The implementation of the PA-BAT in the Dinaric Arc resulted in a large amount of credible data sourced directly from hundreds of local people across the region. The site-based workshops proved an efficient and inexpensive process for gathering information from protected area stakeholders, often for the first time since the area was established. An expert review process ensured the data were checked for accuracy and that clean data were inputted into the database for analysis.

The results indicate that the Dinaric Arc is well placed to re-orientate rural planning and livelihoods in a way which brings rural development and biodiversity conservation together as partners working towards similar goals, rather than driving opposing strategies of intensification versus conservation.

ENDNOTES

[1] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/99 and the IJC opinion on the Kosovo declaration of independence.

[2] See: croatia.panda.org/projekti/zatiena_podruja_za_prirodu_i_ljude/pa_bat_metodologija/

[3] natureforpeople.org/protected_areas/

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Kasandra-Zorica Ivanić worked on the implementation and the analysis of the PA-BAT in eight countries of the Western Balkans. Now, as part of the WWF Adria team, she is working on gathering socio-economic benefits of protected areas and best practices in their management in the region.

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Sue Stolton has worked for the last 25 years on a range of issues including the assessment of management effectiveness and issues related to understanding the wider values and benefits that protected areas can provide. Sue established Equilibrium Research in partnership with Nigel Dudley in 1991. Sue is a member of two IUCN Commissions: WCPA and CEESP.

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RESUMEN

Los beneficios económicos y no económicos de las áreas protegidas fueron evaluados en 58 parques nacionales del arco dinárico de Europa, con la participación de más de mil personas locales, y se identificaron importantes beneficios económicos derivados del turismo, el desarrollo rural y el agua. El estudio utilizó la "Herramienta de evaluación de beneficios en áreas protegidas" en talleres para los interesados directos de todos los parques estudiados. Los resultados se están aplicando para mejorar la gestión en las áreas protegidas y aumentar la colaboración con los actores locales. El arco dinárico incluye partes de ocho países del sudeste de Europa. Si bien es una de las áreas más importantes del continente para la conservación de la biodiversidad, se encuentra sometida a las intensas presiones del desarrollo y muchas de las áreas protegidas de la región están subfinanciadas e infravaloradas. La comprensión acerca de la amplia gama de valores y beneficios de las áreas protegidas para las partes interesadas ofrece una buena base para desarrollar respuestas a nivel de gestión y políticas y ha tenido buena acogida entre los gobiernos y las organizaciones donantes. Los resultados sugieren que las áreas protegidas ya proveen beneficios económicos significativos a la población local de la región, a menudo en lugares con pocas opciones, y que es posible un mayor aprovechamiento de muchos servicios ecosistémicos sin socavar los objetivos y la eficacia de las áreas protegidas.

RÉSUMÉ

Une évaluation des avantages économiques et non-économiques des aires protégées a été effectuée dans 58 parcs nationaux de l'Arc Dinarique d'Europe, en coopération avec plus de mille représentants des communautés locales, et a permis d'identifier les principaux avantages économiques du tourisme, du développement rural et de l'eau. Des groupes de travail ont été rassemblés dans chacun des parcs étudiés, et se sont servis de l'Outil d'évaluation des Prestations dans les aires protégées (PA-BAT) dans le but d'améliorer la gestion et d'encourager la collaboration. L'Arc Dinarique s'étend sur huit pays en Europe du sud-est. Bien que ce soit l'un des plus importants domaines de conservation de la biodiversité du continent, la région est soumise à de fortes pressions liées aux développements économiques et de nombreuses aires protégées sont sous-financées et sous-évaluées. La sensibilisation des parties-prenantes locales aux multiples avantages des aires protégées constitue une base solide pour élaborer des solutions d'administration concrètes, ce qui s'avère être une stratégie populaire auprès des gouvernements et des mécènes. Les résultats suggèrent que les aires protégées fournissent déjà d'importantes retombées économiques à la population locale, souvent dans des endroits où il n'existe que peu d'autres options, et qu'il est possible d'utiliser davantage de services écosystémiques sans compromettre les objectifs et l'efficacité des aires protégées.

CONTRACTUAL ARRANGEMENTS FOR FINANCING AND MANAGING AFRICAN PROTECTED AREAS: INSIGHTS FROM THREE CASE STUDIES

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ABSTRACT

Protected areas and conservation are inadequately funded throughout the world, especially in Africa. In response to this challenge, 'innovative financial mechanisms' are meant to make use of markets and contractual arrangements to provide for additional and secured funding. The use of these instruments within nature conservation has increased in recent years. Proponents of these instruments argue that they may soon fill the funding gap. Critics warn that such instruments may favour market priorities, which could undervalue the overall conservation goals. This paper analyses the practical functioning of three cases of innovative financial mechanisms for African protected areas. It draws insights about their potential replication, with respect to their contractual design, their associated impacts and success factors, as well as the challenges encountered. The paper argues that these contractual approaches critically depend on enforcing conditionalities, maintaining long-term relations through intermediary organizations, as well as finding champions and building capacities. Challenges to be assessed in the future include the variability of markets and the significance of transaction costs.

Key words: Protected area management, contractual approaches, funding gap, innovative financial mechanisms, Africa

INTRODUCTION

Aichi Biodiversity Target 11 has set an ambitious goal: "By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes." Although this target appears as one of the very few for which some achievement is observed, progress remains insufficient (Secretariat of the Convention on Biological Diversity, 2014; Juffe-Bignoli et al., 2014). Protected area coverage of terrestrial area including inland waters has increased from 10 per cent in 1994 to 14.7 per cent in 2016 (UNEP-WCMC & IUCN, 2016). To reach 17 per cent of terrestrial coverage an additional 3.1 million km² of land needs to be protected. Additionally, most protected areas currently seem to be inadequately managed. Recent assessments show that most protected areas (62 per cent) only display a basic level of management (Leverington et al., 2010).

Africa is no exception. It represents only 3.3 per cent of the total number of sites protected globally (both terrestrial and marine). Protected area downgrading, downsizing, and degazettement (PADDD) is also a worrying trend on the continent (Mascia et al., 2014).

New and additional funding as well as better governance systems are needed to expand the protected area network, effectively and adequately. The challenge is daunting, but not impossible. The Convention on Biological Diversity (CBD) estimated that achieving target 11 would require spending between US$ 9.2 and 85 billion annually over the eight-year period from 2013 to 2020 (CBD, 2012). In Africa, more precise estimates of funding requirements for protected areas range from US$ 460 to US$ 2,048 per km² (Lindsey et al., 2016). Against these needs, available resources on the continent are really scarce.

To fill both these funding and management gaps, a broad range of instruments have been proposed to finance and manage biodiversity conservation within and outside protected areas, including economic and market instruments (McNeely, 1988; Emerton et al., 2006). In 2008, Parties to the CBD adopted the Strategy for Resource Mobilization and called to "explore new and innovative financial mechanisms at all levels with a view to increasing funding to support the three objectives of the Convention". Later in 2012, IUCN members further approved resolution 122 at the Vth World Conservation Congress in Jeju to promote such innovative financial mechanisms as complementary fundraising tools.

The leading group on Innovative Financing for Development[1] defines innovative financing as mechanisms for raising funds that are complementary to official development assistance, predictable and stable (Sandor et al., 2009). The characterization, advantages, limits and applicability of innovative financial mechanisms have been largely discussed (Vatn et al., 2014; Galaz et al., 2016). Potential advantages include economic incentives being efficient signals, optimal allocation of resources, and filling of the funding gap (Lapeyre & Pirard, 2013). Drawbacks of these mechanisms include the volatility and uncertainty of such instruments, and the possible commodification of nature (Melathopoulos & Stoner, 2015).

From both perspectives, the central contractual nature of these instruments, be it an opportunity or a risk, is emphasized. Yet, to move beyond wishful thinking, CBD Parties, donor agencies and practitioners now need to better analyse how these so-called innovative mechanisms are actually linked to renewed governance and what difference they make *on the ground*, especially in Africa. By bringing actual practice to theory and concepts, this article thus aims to investigate these contractual instruments and uncover their decisive characteristics, conditions for success, and challenges.

Based on a review of experiences (Lapeyre & Laurans, 2016) this article presents three case studies from protected areas in Côte d'Ivoire, Sierra Leone and South Africa. Selected in close co-operation with IUCN, the sample is intended to encompass a variety of contractual approaches to explore the potential role of contracts in funding and managing protected areas in Africa. This article describes the contractual design of these protected area management models and presents the results with respect to biodiversity conservation efforts. It aims to highlight some of the key principles that should be considered before replicating such instruments. Finally, it addresses the challenges of such approaches.

Funding the Gola Rainforest National Park through a non-profit company limited by guarantee (CLG) contributes to both conservation and development ©Renaud Lapeyre

UNCOVERING CONTRACTUAL APPROACHES FOR PROTECTED AREA FINANCE IN AFRICA: THREE MECHANISMS AND THEIR IMPACTS

Investigating in depth three case studies, and their differences in terms of rationale, institutional set-up, actors involved, and scale, allows us to uncover the role of various contractual arrangements in funding protected areas in Africa and improving their management.

- **A long-term innovative contractual approach in Sierra Leone**

The Gola rainforest occupies 70,000 hectares along the Liberian border. Situated within seven chiefdoms with a total of 140,000 inhabitants, its biodiversity is threatened by local slash-and-burn agricultural practices and mining.

Until the mid-1990s, logging concessions were granted over the forest. Yet, in 2004 a Conservation Concession was declared by the Government of Sierra Leone (GoSL) whereby two NGOs, the Royal Society for the Protection of Birds (RSPB) and the Conservation Society of Sierra Leone (CSSL), agreed to conserve the forest and compensate local actors for the loss of logging rights (Belvaux, 2012). A Benefit Sharing Agreement (BSA) was

In South Africa, landowners sign management plans and are provided with incentives to conserve biodiversity on their private lands © Yann Laurans

signed in 2007, which was funded by both the European Union and the French Global Environment Facility (FFEM). Through the BSA, the seven chiefdoms have so far received US$ 122,500 annually, conditional to their strict compliance with the forest management plan. In 2012, the Gola rainforest was eventually gazetted as a National Park (GRNP).

Since 2012, this contractual innovation was further developed into a REDD project in an attempt to sustainably fund GRNP over the longer term (Hipkiss & Tubbs, 2012). To sell credits for avoided deforestation on the voluntary carbon market, the project followed two leading international standards, the Verified Carbon Standard (VCS) and the Climate, Community and Biodiversity Alliance standard (CCBA). This created two important institutional changes. First, a Conservation and Cooperation Agreement was further signed with directly adjacent communities (within a leakage belt) to incentivize them and ensure enforcement of regulations. Second, a not-for-profit company limited by guarantee (CLG) was registered in 2015 to act as a legal entity to receive proceeds from the sale of verified carbon credits. Strategically, the government and both NGOs are the CLG's members. Operationally, the CLG is an autonomous, private body responsible for managing the GRNP area as a REDD project, meaning that it lawfully sells credits and pays for the management costs of GRNP and its leakage belt.

- **Signing biodiversity stewardship agreements with private landowners in South Africa**

Since the turn of the century, enrolling private properties in land-use management and conservation has been identified by South African authorities as a key condition to reaching the country's biodiversity objectives (Marnewick et al., 2015). Biodiversity legislation was redrafted in 2004 allowing private land to be officially and perennially registered as protected areas. This policy organization in turn gave rise to a "biodiversity stewardship" (BDS) approach, whereby everyone in the country is potentially called to steward natural assets that sit on their properties, in view of collectively forming a network of conservation through varied individual contributions (Cumming et al., 2015).

This brought the South African environmental NGOs, including BirdLife South Africa, and the Federal environmental authorities to think about sustaining landowners' motivation and incentivizing voluntary conservation. As a result, attention was given to building into legislation the ability to pay lower taxes, so as to induce a fiscal reward for landowners who committed their land to the conservation and management standards (Selinske et al., 2015). After an initial stage, during which the tax incentives were inadequately drafted, the fiscal provisions were re-worded and better adapted to the logic of business and taxes, and were adopted in March 2015.

Kob antelope (*Kobus kob*) in Comoé National Park, Cote d'Ivoire. FPRCI conditionally funds OIPR to manage the protected area network in Côte d'Ivoire © Wikimedia Commons

Based on national priorities, NGOs and provincial conservation agencies reach out to landowners whose land is considered important for conservation. After a technical site assessment, a protection status is proposed for the site by the provincial conservation authorities and a specific management plan is drafted. The selected site must then be officially declared as a protected area as defined in the legislation by the official representative of the Province. A preliminary agreement between the Provincial authority and the landowner is submitted for official public consultation after which the agreement is gazetted and the management plan is officially approved by the Province. The surface area covered in the agreement is officially delineated, and the resulting maps, declaration and management agreement are sent to the governmental deeds office to be attached to the land parcels through a notarial contract. On this basis, landowners are then allowed to apply for a tax reduction in their annual tax declaration. The relevant provincial conservation authority is responsible for annual monitoring of the management plan implementation.

- **Sustaining the protected area network in Côte d'Ivoire: debt swaps and funding agreements**

Forest area has been massively lost in Côte d'Ivoire, decreasing by 75 per cent in 50 years since 1960, in part due to rapid agricultural growth. Biodiversity in the country is highly threatened. To prevent further erosion Côte d'Ivoire has secured a network of eight protected areas and six natural reserves. One of these, the Tai National Park (TNP) consists of 536,017 ha of land in the west of the country. With one million people inhabiting its surroundings, main pressures for the park include commercial agricultural activities, especially cocoa production (Varlet et al., 2013).

Three types of innovation have been at work in Ivorian protected areas. First, the Foundation for Parks and Reserves of Côte d'Ivoire (FPRCI-CI) was created in 2003 as a private not-for-profit institution, the first Ivorian trust fund dedicated to funding the country's protected areas. FPRCI-CI is comprised of a General Assembly of ten founding members, a Board of nine directors and two observing members. FPRCI-CI's goal is to mobilize funds to generate returns on the international financial market. For this purpose, a sister foundation was registered in the UK in 2009 (FPRCI-UK) to legally host the endowment fund. Financial interests from the latter are then used to fund protected areas through FPRCI-CI.

Second, to capitalize this endowment fund, debt-for-nature swaps were undertaken. In this regard, both German and French governments signed debt swap agreements with the Government of Côte d'Ivoire, respectively in 2012 and 2014. Through these, the management of protected areas, including TNP, could be funded. In the latter case for instance, 9.5 million Euros were capitalized in FPRCI-UK's endowment fund to generate interests. To date, this has allowed FPRCI-CI to partially finance TNP's operational costs with 610,000 Euros every year [2].

Third, such FPRCI funding is contractually granted to an ad hoc management body. Created in 2002, the Côte d'Ivoire Parks and Reserves Office (OIPR) is an autonomous parastatal entity governed by a management committee, although supervised by the administration. Under the FPRCI's new financing role, OIPR's management responsibilities and results are closely checked by FPRCI as well as its donors. A Framework Agreement is signed with the foundation to define modalities and eligible expenses for each protected area. A yearly funding agreement is further discussed and monitored to determine FPRCI's regular disbursements to OIPR.

- **Contractual approaches' contribution to Aichi target 11: safeguarding biodiversity while ensuring equity**

When assessed against Aichi target 11, results suggest that innovative instruments potentially contribute to achieving three objectives simultaneously: increasing the geographical extent of protected areas, improving their management, and ensuring equity.

Table 1. Contribution of BDS to provincial protected area targets Source: Cumming et al., 2015.

Province	(a) Additional area still required in 2008 to meet the 2028 provincial protected area target (ha)	(b) Contract protected areas declared and in negotiation through biodiversity stewardship (ha)	(c) Percentage contribution of (b) to (a)	(d) Land acquired in the same time by the Provincial authority (other than with biodiversity stewardship) (ha)
Eastern Cape	1,570,000	234,074	15	0
Kwa-zulu Natal	842,000	268,668	32	1,165
Mpumalanga	632,000	129,325	20	0
Western Cape	1,004,000	87,447	9	100,026

First, cases in South Africa, Côte d'Ivoire and Sierra Leone suggest that innovative financial mechanisms are able to operate well beyond a pilot project's scale to encompass significant tracts of biodiversity-rich lands. In South Africa, based on the BDS approach, 70 different protected areas were declared and integrated in the national protected area register in 2014. This amounts to over 400,000 ha, i.e. 1 per cent of the total terrestrial protected areas. In March 2015, 153 sites totalling over 560,000 ha were in negotiation for protected area declaration (Cumming et al., 2015), potentially doubling these proportions. Overall, protected areas under BDS contribute to Provincial protection objectives in various proportions, from 9 to 32 per cent of surface area under protection (table 1).

In Côte d'Ivoire, the Taï national park (536,017 hectares) together with its peripheral zone (408,277 hectares) represents an area close to 3 per cent of Côte d'Ivoire inland territory where OIPR, with FPRCI's funding, manages and monitors biodiversity and human economic activities. Similarly in Sierra Leone, when counting the Gola Rainforest national park and its leakage belt, more than 132,000 ha of land fall under some sort of protected area management, approximately 2 per cent of the country's total territory.

Second, conservation activities in all these cases have proved successful in protecting biodiversity inside the concerned protected areas. In Sierra Leone, GRNP's budget is approximately US$ 1.6 million. The management unit permanently employs 170 local staff members, including 49 park rangers working full-time for the park's integrity. In 2015 and 2016, park rangers were provided with a patrol plan defined by the supervisor and assisted by a GIS specialist. They patrolled a total of 6,363 km and arrested several poachers and illegal miners [3]. Patrols have served as a strong deterrent: illegal activities (poaching, slash-and-burn farming) have decreased and deforestation is kept to a minimal level, if not zero. In Côte d'Ivoire, the Taï national park's budget also amounted to around US$ 1.68 million, out of which US$ 610,000 of operational costs were allocated by FPRCI. The latter thus provided critical support for the Taï national park's 140 staff, including 120 field officers in the park. In 2015, 203 patrols have been carried out inside (and just outside) Taï national park with 9,933 working days involved, mainly concentrated in vulnerable areas where encroachment and small-scale gold mining are occurring. This eventually led to the arrest of 174 offenders during 2015 (including three-quarters of illegal miners and 15 per cent of poachers). In total, despite the south-west region being the biggest cocoa producing area and as a result a place of migration, Taï national park is probably the most intact and best protected park within the Ivorian protected area network. Deforestation is kept to a minimum and wildlife numbers have stabilized or increased since 2012.

Third, these positive environmental results were to a certain degree equitably obtained with the participation of local communities. In Sierra Leone, results look impressive in reducing resentment and gaining local support for the GRNP and conservation in general (Tubbs et al., 2015). Since 2007, due to the benefit sharing agreement, US$ 122,500 has been spent annually for community development in the larger area and around 30 staff have been funded to provide critical support to communities around the park. The 122 forest edge communities (FECs), approximately 24,000 people living in the immediate surroundings of the park, have been supported with additional cocoa and agricultural assistance, 244 scholarships, as well as village savings and loan schemes. In South Africa, while sometimes criticized, the BDS approach actually also applies to land owned by communities, and the approach is cautiously kept neutral to all political criteria. The benefit acquired is limited in terms of fiscal resources, and the whole country benefits from the nature reserves.

Table 2. Principles to achieve success and their operationalization across the three cases

Case study Condition for success	Sierra Leone	South Africa	Côte d'Ivoire
Contractual agreements	1) Conservation Concession agreement between GoSL and both NGOs; 2) BSA between both NGOs and paramount chiefs, local authorities and FECs; 3) The same BSA between CLG and other actors; 4) Joint-venture agreement between GoSL and CLG.	1) BDS Agreement between Provincial Authority and private landowners. 2) Fiscal benefits agreement between Treasury, Province and landowners.	1) Debt swap agreements between the Ivorian government and its donor (France, Germany). 2) Framework Agreement (for each PA) between FPRCI-CI and OIPR. 3) Yearly funding agreement between FPRCI-CI and OIPR.
Conditionalities (Success condition #1)	To receive payments, Paramount Chiefs, local authorities and FECs should refrain from harmful practices in and around GRNP. BSA agreements shall be breached otherwise.	To benefit from land tax benefits, private landowners must implement their management plan. This is subject to annual verification by Provincial conservation authority.	To receive yearly annual funding from FPRCI, OIPR should implement its annual operation plan (completion rate). Subsequent disbursements shall be cancelled otherwise.
Intermediation for long-term relations (Success condition #2)	RSPB protecting biodiversity in the country and links with the government since the 1990s.	NGOS such as WWF and Birdlife SA protecting biodiversity in the country and linking with government authorities since 1995.	Bilateral donors (GiZ, KfW and AFD) in the country since independence.
Capacity building (Success condition #3)	Capacitate paramount chiefs, CSSL, National Protection Area Authority (NPAA), GoSL.	Capacitate Provincial authorities' reps, Treasury reps, etc.	Capacitate FPRCI-CI, OIPR, PA management teams at the decentralized level.
Sustaining 'champions' (Success condition #3)	A group of influential politicians actively support the project.	Very variable level of political willingness across Provinces, as evidenced with the different number of personnel recruited for BDS and contrasted smoothness of administrative processes.	Ministry for Environment involved from the beginning in setting FPRCI-CI; influential members of civil society on the FPRCI's board of Directors; very capacitated and motivated personnel at OIPR level.

REPLICATING CONTRACTUAL APPROACHES? DISCUSSING SUCCESS CONDITIONS

Arguably, the contractual approaches described do not display much highly qualified financial engineering. Rather than supplanting public finance, in all three cases innovative private funding constitutes a complement. The analysed case studies indicate that the most significant innovation consists in the renewed governance, combining both public and private involvement through contractual approaches. To generate additional funding and improve protected area management these contractual approaches build on a number of common principles: 1) the enforcement of conditionalities, 2) the existence of intermediary organizations to build and fund long-term relationships, and finally 3) sustaining "champions" and building capacity at both the local and national level. Table 2 above displays how in each case under scrutiny these principles were operationalized on the ground, while the following explains this in greater detail.

- **Success condition #1: A contractual approach with conditionalities**

Conditional agreements are central to the success of all three cases investigated. In each of them new governance architecture has emerged, where public, private and civil society actors' involvement is coordinated through institutional arrangements that define respective rights and responsibilities (Figure 1). Conditions attached to these contracts importantly explain the actual delivery of conservation results. Conditionalities induce verification and corresponding payments directly and explicitly depend on the observed realization of outputs. In the three cases studied, such conditional contractual agreements are applied at two different but complementary levels.

At the local level, individual farmers and rural communities are contracted to change their business-as-usual practices and adopt more sustainable land-use techniques. In Sierra Leone, the government and RSPB

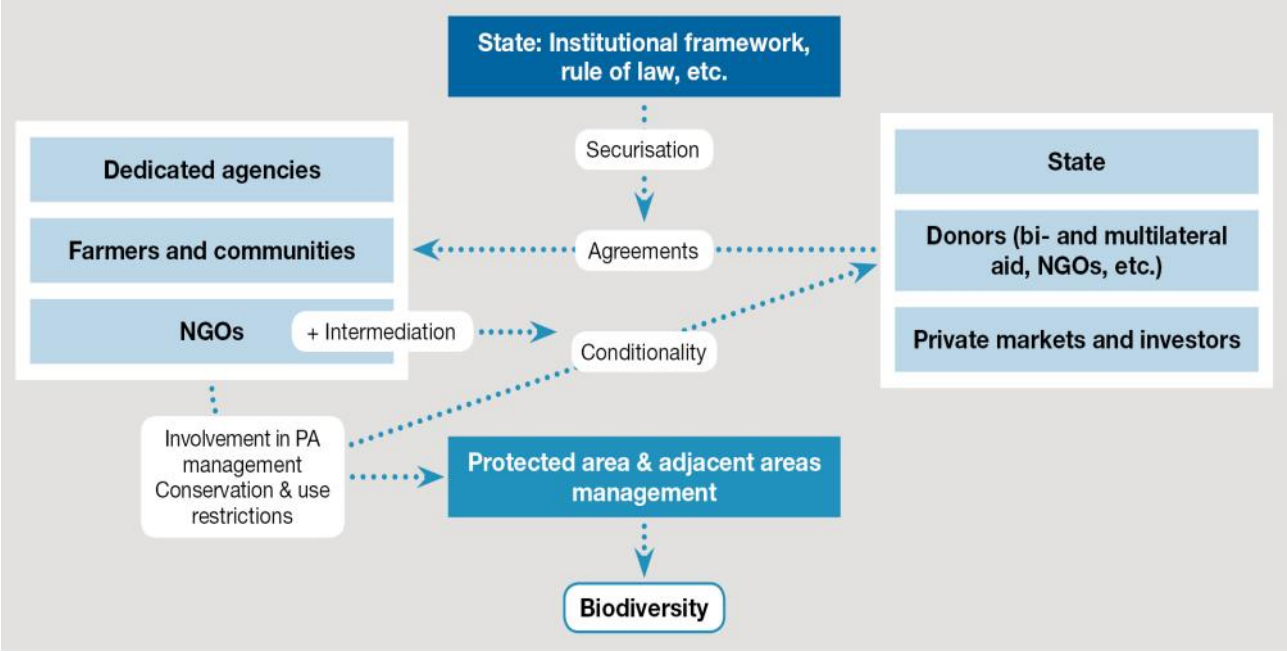

Figure 1: General governance design for contractual approaches Source: Lapeyre & Laurans, 2016.

first signed a conservation concession agreement to secure the Gola forest reserves' integrity, where local communities are compensated for the loss of rights and for adherence to the management plan (stopping logging and slash-and-burn agriculture). The newly registered company limited by guarantee and the government then additionally signed similar benefit sharing agreements with forest edge communities situated within the leakage belt. In South Africa, to be granted annual tax deductions private landowners need to respect a Biodiversity Stewardship agreement they have signed with the provincial conservation authorities. In both cases, contracts – be they payments for ecosystem services or conservation easements – are signed and involve payments that are, importantly, conditional to behaviours, actions and results agreed on in advance. In Sierra Leone, paramount chiefs must do all in their power to prevent poaching as well as slash-and-burn agriculture in and around the protected area. In South Africa, farmers must implement a management plan. In turn, if agreed conditions are not fulfilled, benefits can be withheld.

At the institutional level, the contractual approach is further reinforced by the design of new and innovative arrangements where public, private and civil society actors join to coordinate their efforts and improve protected area management. In Côte d'Ivoire, following typical concepts of New Public Management (Ferlie et al., 1996; Barzelay, 2001), a conservation-devoted agency, OIPR, was created by law to manage the national network of protected areas. The *ad hoc* entity is autonomous, and its board as well as its executive management independently manage funds based on agreed operational plans, although under the administration's supervision and with partial funding from the Ministry. In Sierra Leone, a specific private entity, a company limited by guarantee, was also set up where the government and NGOs share responsibilities and rights as regards the management of the Gola Rainforest National Park. This private company acts as an independent vehicle where public, private and NGO actors clearly define their respective roles, beyond political changes and funding cycles.

In both cases, the government is now 'steering not rowing', using market and quasi-market mechanisms in delivering public services, and separating politics from the management of public services (Marshall, 2008). Traditional boundaries of the State are modified (Birner & Wittmer, 2004) and a new principal-agent relationship is introduced, whereby the *ad hoc* agency is now responsible for reaching a set of negotiated objectives. In Côte d'Ivoire OIPR is accountable to both the Ministry, as well as the Foundation for Parks and Reserves in Côte d'Ivoire (FPRCI), which annually funds recurrent costs for several protected areas within the OIPR network. In the latter case, OIPR and FPRCI sign a yearly funding agreement where disbursements are conditional to fulfilling certain milestones.

In all, whether through public-private partnerships, co-management structures, shared governance (Borrini-Feyerabend et al., 2013), service contracts, or other governance arrangements, the contractual approach with conditionalities attached is arguably successful in improving protected area management (European Commission, 2015). As compared with a situation where

conservation activities are totally integrated within governmental administration, the contractual approach replaces the hierarchical relationship involved in public administration, where incentives are diluted and monitoring costs are significant (Mookherjee, 2006), and thus may potentially prove more service-oriented. This can increase cost effectiveness, policy capacity, responsiveness, monitoring and evaluation.

- **Success condition #2: intermediary organizations are key for long-term relationships**

The instruments described, based on contractual arrangements and attached conditionalities, are indeed complex tools. Hence, these need stability, continuity in time, as well as a good level of trust and understanding shared by all stakeholders. In turn, this requires organizations to link with all partners on a perennial basis to coordinate actions, mitigate conflicts and smooth processes and negotiations. NGOs and support agencies that provide technical assistance as well as multi- and bilateral donor money are therefore key to shape these mechanisms on the ground (Mermet et al., 2014).

Promoting and implementing innovative financial mechanisms requires the presence of already existing long-term relationships between support agencies and the involved local actors. In Côte d'Ivoire, German technical and financial cooperation agencies have been paramount in fostering funding and management of the Taï national park for many years. In Sierra Leone and South Africa, NGOs have also played, and still play, a crucial intermediary role. RSPB has been central in linking the Government of Sierra Leone, paramount chiefs and local communities on the ground, whereas environmental NGOs such as Birdlife South Africa play a crucial role as intermediaries between the Provincial administration, the national administration, the tax services and the landowners.

Innovative funding and incentive tools actually require a myriad of actors that already operate in and around protected areas and provide their expertise in cultural mediation, science, technical capacity, facilitation and brokering. The introduction of an innovative contractual approach is thus neither an absence of, nor a simplified role for, intermediaries and social-political processes. Rather, the promise lies in using players and processes differently from those of other instruments. Instead of starting new processes, innovative mechanisms open up space for new chains of intermediaries that may deliver better results in some cases where other instruments using other chains of intermediaries cannot (Mermet et al., 2014: 73-74).

- **Success condition #3: Building capacity and sustaining 'champions'**

Innovative financial instruments are complex mechanisms that need long-term support. Hence, they are social constructs that require people to be involved in their design and implementation.

All three cases indicate the importance of highly capable 'champions'. At the political and regulatory level, these champions need to work in ministries and public administration. In Sierra Leone, few people strongly support GRNP. In South Africa, continued development of the Biodiversity Stewardship approach relies on Provinces' support. In the Western Cape, Provincial authorities have dedicated 24 staff members to the BDS approach. In Côte d'Ivoire, the Ministry for Environment has lobbied for the creation of FPRCI. Such champions form the backbone of innovations' success and sustainability; building trust and investing in longer-term relationships with influential and like-minded people is a priority that should be recognized.

At the local and operational level, building capacity allows for smooth implementation of mechanisms. For effectiveness and sustainability reasons, a multitude of stakeholders who understand the contractual mechanisms at work are needed. These stakeholders should include park managers, *ad hoc* agency managers, government officers, NGO field staff as well as representatives from local communities and individual farmers. Without such shared understanding, for instance from paramount chiefs in Sierra Leone, resentment and conflicts will emerge based on misunderstandings while participation will decrease. Explaining rules, rights and responsibilities of stakeholders, as well as conditionalities and processes involved is an essential investment to guarantee the longer-term success of such innovative financial mechanisms.

THE SCALE'S THE LIMIT? DISCUSSING CHALLENGES OF CONTRACTUAL APPROACHES

Achievement of these principles often brings challenges and institutional frictions. Indeed results from the three case studies also highlight a number of limitations. These challenges may jeopardize the sustainability of innovative financial mechanisms for African protected areas and their capacity to be further replicated at a larger scale.

First, mobilizing markets – be they carbon or financial – might prove limited and unpredictable for protected area funding. A recent report indicated a total market value of

Adjacent communities in the market of the town of Tai, near the Tai National Park in Ivory Coast © Kafougue (Wikimedia Commons)

only US$ 216 million for forestry offsets in 2012 (Peters-Stanley et al., 2013), while the number of REDD+ projects has been decreasing since 2010 (Simonet et al., 2015). Easements, water credits, and carbon are actually not large fungible market revenue streams and cannot be considered "plain vanilla opportunities" (NatureVest & EKO Asset Management Partners, 2014). With respect to financial markets, the 2008 crisis and current low interest rates similarly limit possibilities to generate significant returns, for instance for environmental trust funds.

Second, the existence of significant transaction costs might hinder the implementation of this kind of instrument. The analysis presented here indicates that all three mechanisms strongly rely upon complex and numerous contractual arrangements: between landowners, NGOs and public administration; between private and public donors and dedicated *ad hoc* agencies; between donors and governments. Having to elaborate and then manage multiple contracts is a large burden felt by all partners. Future partners have to be looked for and approached, contracts and agreements have to be designed, negotiated and signed, and obligations need to be enforced and monitored. All these activities (commonly phrased as "transaction costs" in economic analysis) are not directly related to protected area management and biodiversity conservation. In South Africa, private landowners need to liaise and contract not only with the Provincial government but also with the South African National Biodiversity Institute (SANBI), the national government as well as with the tax administration. Getting the agreement signed off by the Provincial authorities can impose more than a one-year delay. In Sierra Leone, RSPB first signed a Conservation Concession Agreement with the government and then a benefit-sharing agreement with all seven chiefdoms. Now a private company limited by guarantee has been set up to sell voluntary carbon units. For this, a joint-venture agreement has been signed with CSSL and the government, a benefit-sharing agreement was signed with chiefdoms, additional and specific agreements were signed with each of the 122 forest-edge communities, and hundreds of agreements were signed with all family landowners having traditional land rights inside GRNP.

Innovation involves significant transaction costs, which are to be accounted for when evaluating the real efficiency of the contractual arrangements designed (Williamson, 1991; Birner & Wittmer, 2004). Accounting for these costs might better inform decision makers and practitioners when deciding over the boundaries of the

In Sierra Leone, benefit-sharing agreements are signed with forest edge communities to incentivize them and ensure enforcement of regulations © Annie Spratt (Unsplash.com)

State in protected area management (Birner & Wittmer, 2004). Contractual arrangements should not, however, be ruled out because of their significant transaction costs. First, it remains to be seen whether contractual arrangements incur higher transaction costs than those that would be generated by more traditional arrangements. As demonstrated by Cumming et al. (2015) in South Africa, public costs may be significant. Second, transaction costs involved in designing innovative mechanisms are primarily supported during the instrument's starting phase. Hence, whereas this might be a significant burden in the beginning, this should dramatically decrease during the running phase, when results from the innovation (conditionality, incentives, monitoring) become tangible. In the mid- to long-term, such mechanisms may well be cost-effective.

Finally, it is necessary to examine other sources of institutional friction. To ensure its stability and sustainability the new complex governance architecture needs to be understood and legitimate at the local level. Clear understanding of the scheme was not always shared by local communities and their paramount chiefs around GRNP in Sierra Leone. Additionally, their real full participation in discussing agreements and contractual conditions is unknown. In TNP in Côte d'Ivoire, socio-economic measures for poor adjacent communities were not always prioritized by FPRCI and OIPR when they contractually agreed on conditional yearly funding. The complex innovative institutional arrangements studied within the three case studies might have fallen short of widely including stakeholders, especially at the protected area local level. Without such equity – both procedural (actual participation, not mere tokenism) and distributive (economic support) – a resulting lack of legitimacy will trigger and accelerate misunderstanding, resentment, conflicts and park encroachment, and will increase transaction costs. Designing and respecting social and environmental safeguards are crucial when implementing innovative financial mechanisms on the ground.

CONCLUSION

In response to the challenge of filling both funding and management gaps for conservation in Africa, this paper has investigated three examples of "innovative finance" for protected areas. Our findings indicate that innovation can be found much less in finance than in governance. Financing sources do not make use of sophisticated and highly qualified finance engineering in all three case studies analysed. Rather, they are different forms of official development assistance mixed with NGOs' donations and public endowment or subsidies, with limited private funding so far.

Yet since financing sources of various origins are to work together, contracts and contract-based relations are paramount in this new type of organization. This contractual essence produces a need for security, accountability of the funds' recipients, and verifiable effectiveness of policy implementation. This contractual nature may explain both the main reasons for observed success as well as the challenges ahead, should this kind of organization be employed more extensively in the future.

Regarding success factors, the strength of conditions and enforcement thereof is favoured by the fact that funding is based on a specifically defined series of commitments to manage the areas as per plans, and that support from the funders is subject to the confirmation of implementation. The second success factor, the role of NGOs and development agencies as crucial intermediaries, could go unseen since it is generally not present in explicit regulatory texts, nor in established institutions. Yet all three case studies proved highly dependent on support from such intermediaries. The third success condition is directly related to the human factor. Even the most streamlined and crafted mechanisms eventually benefit from individuals who are in a position to support the initiatives and are willing to invest their time, their credibility and their skills in the setting up and in the day-to-day running of these projects.

Considering such achievements and success factors, a question thus arises: why would conservation not be extensively financed and managed based on this kind of approach? Whereas the three studied cases proved up to the task of protecting areas on a quite large scale, it appears that their ability to provide for conservation at the national scale is limited by what makes their very success: their contracting and tailored nature, with associated transaction costs, their dependency on personal involvement, and the need for enduring support from well-staffed intermediary organizations. It is important to note that in all three cases support organizations were international NGOs or agencies rather than local grassroot ones; without increased local legitimacy this might become another, important, limit to the generalization of these approaches.

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ENDNOTES

[1] www.leadinggroup.org/rubrique20.html. Created in 2006 under the leadership of France, Chile, Brazil and Spain, the Leading group is an informal network that currently brings together sixty-six States and international organizations, non-governmental organizations (NGOs), local entities and private foundations dedicated to the eradication of poverty and the preservation of global public goods (incl. biodiversity).

[2] More precisely, part of the 9.5 million Euros was actually disbursed into FPRCI's sinking fund so as to immediately cover TNP's operational costs. The other part is capitalized on FPRCI's endowment fund so as to generate interest payments that will cover TNP's costs in the (near) future.

[3] Although park rangers are not armed, they are allowed to arrest intruders and community members undertaking illegal activities within the National Park and hand them to the police for prosecution. If necessary, a Rapid Response Unit from the local Police is called to join the rangers to assist with the arrests.

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Elephants on the shore of Lake Edward, Queen Elizabeth National Park © Grégoire Dubois

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RESUMEN

Las áreas protegidas y la conservación se financian de manera inadecuada en todo el mundo, especialmente en África. En respuesta a este desafío, los "mecanismos financieros innovadores" están concebidos para hacer uso de los mercados y los acuerdos contractuales para facilitar financiación adicional y garantizada. El uso de estos instrumentos en el ámbito de la conservación de la naturaleza ha aumentado en los últimos años. Los proponentes de los instrumentos sostienen que pronto podrán cubrir el déficit de financiación. Sus críticos advierten que estos instrumentos pueden favorecer las prioridades del mercado, lo que podría llevar a subestimar los objetivos generales de conservación. Este artículo analiza el funcionamiento práctico de tres casos de mecanismos financieros innovadores para las áreas protegidas africanas. Reúne las percepciones sobre la posibilidad de reproducirlos, tanto con respecto a su diseño contractual, como a sus repercusiones y factores de éxito, y los desafíos encontrados. El documento plantea que estos enfoques contractuales dependen esencialmente de la imposición de condiciones, de mantener relaciones de largo plazo a través de organizaciones intermediarias, y de la búsqueda de líderes y la creación de capacidades. Los desafíos que se evaluarán en el futuro incluyen la variabilidad de los mercados y la importancia de los costos de transacción.

RÉSUMÉ

Les aires protégées et la conservation de la biodiversité restent sous-financées au niveau mondial, en particulier en Afrique. Afin de répondre à ce problème, les « mécanismes innovants de financement » visent à faire appel aux marchés et aux approches contractuelles pour mobiliser et sécuriser des flux financiers additionnels. Le recours à de tels instruments dans le domaine de la conservation de la biodiversité a ainsi augmenté ces récentes années. Pour leurs promoteurs, ces instruments vont rapidement permettre de combler les besoins de financement. Mais pour leurs détracteurs, leur utilisation favorise le développement de marchés aux dépends d'objectifs environnementaux plus fondamentaux. Afin de contribuer utilement à ce débat, cet article présente en détail comment, dans trois cas différents d'aires protégées africaines, ces mécanismes innovants de financement fonctionnent *dans la pratique*. Il fournit des éléments d'analyse sur leur potentielle réplicabilité, étant donnés leur architecture contractuelle, leurs impacts environnementaux et leurs facteurs de succès, ainsi que les limites qui y sont associées. En substance, cet article indique que des approches contractuelles innovantes mises en œuvre pour financer et efficacement gérer les aires protégées africaines dépendent fortement 1) du strict respect des conditionnalités négociées, 2) du maintien de relations de long-terme assurées par des organismes faisant office d'intermédiaires, 3) du renforcement des capacités des acteurs nationaux et locaux, et 4) de l'existence de « champions » qui soutiennent activement ces mécanismes. Bien sûr, des questions subsistent avant d'augmenter l'échelle de mise en œuvre de tels instruments ; au premier rang desquelles sont la fluctuation imprévisible des marchés (financiers ou carbone) et le niveau élevé des coûts de transaction qui sont associés à ces approches contractuelles.

THE CHALLENGES OF THE ANTHROPOCENE FOR BIOSPHERE RESERVES

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ABSTRACT

This paper reviews how well Biosphere Reserves are prepared to respond to the challenges of the new era of the Anthropocene, including the expected breaching of some planetary boundaries. In this context, the endeavour of sustainable development requires critical re-examination and Biosphere Reserves should move further towards embracing more integrated and effective forms of sustainable livelihoods for their inhabitants. This means placing people even more at the heart of Biosphere Reserve policy and management, and enabling people to become pioneers and ambassadors for realizing effective sustainability in all Biosphere Reserves. This also means that Biosphere Reserves and related institutions have to work towards true integration of their ecological, social and economic potentials, and set up a framework of genuine sustainability governance. This paper widens the concept of Biosphere Reserves to provide creative transformation towards more liveable, sustainable landscapes as a global network. If this is achieved, it will be easier for Biosphere Reserves to pursue and nurture the implementation of the Sustainable Development Goals (SDGs) as their renewed central purpose.

Key words: Biosphere Reserves, Anthropocene, Sustainable Development Goals, Sustainable livelihoods, Planetary boundaries

THE CHALLENGES OF THE ANTHROPOCENE

This paper reviews the challenges of the new era of the Anthropocene, including its underlying causes and how Biosphere Reserves could develop further to better respond to them. A critical reflection of the concept of sustainable development is provided as a foundation for offering some ideas for a creative transformation away from quasi-independent collections of reserves towards more liveable, equitable and sustainable biosphere landscapes.

According to Steffen et al. (2007, p.614), "human activities have become so pervasive and profound that they now rival the great forces of nature and are pushing the Earth into planetary terra incognita". Four out of nine planetary boundaries (Figure 1) have already been exceeded: climate change, impacts on biosphere integrity, land system change and bio-geochemical cycles (Steffen et al., 2015).

The challenge of managing the Anthropocene encompasses the urgent need for innovative ways in which to showcase sustainable living practices in the light of dominating unsustainable patterns of human consumption (e.g. meat consumption, see Stoll-Kleemann & O'Riordan, 2015). Sustainable development is often described as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). This is so frequently quoted that readers' eyes glaze over the familiar words in the same way as seasoned air travellers ignore the mandatory safety advice from the cabin crew. Although it is within our abilities to redefine the Anthropocene to enable future generations to flourish in a decent and habitable world (O'Riordan & Lenton, 2013), it remains very difficult in an environment driven primarily by the fortress mindsets promoting economic growth to meet all the criteria for real sustainability. Present patterns of growth are contradictory to all three dimensions of sustainability (Asara et al., 2015; Hueting, 2010; Kallis et al., 2015; Kothari et al., 2014; Muraca, 2012). Hueting (2010, p. 525) asserts, "our planet is threatened by a wrong belief in a wrongly formulated growth". There is strong evidence of a tight correlation between GDP growth and environmental destruction (Muraca, 2012). The

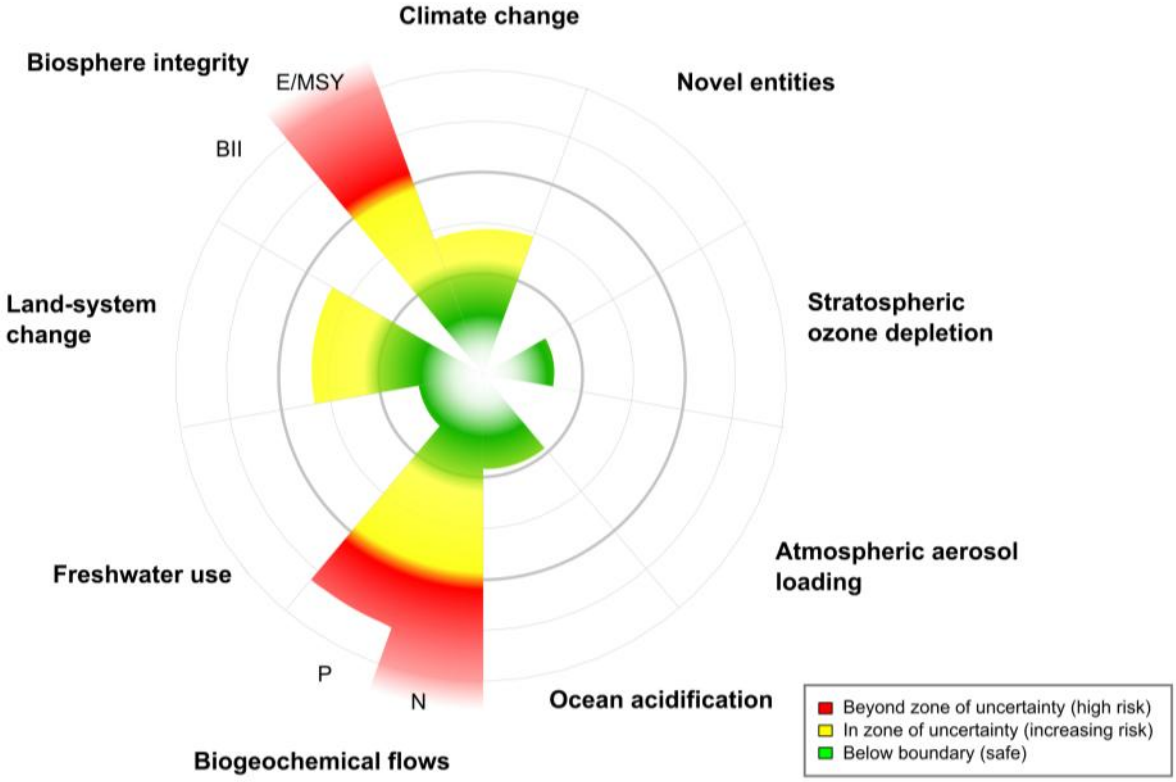

Figure 1. Current status of the control variables for seven of the planetary boundaries (from Steffen et al., 2015).

exploitation of resources at a rate that exceeds the regenerative capacity of ecosystems has been linked to the assumption of economic growth as the unique goal of economic activity (Muraca, 2012; Asara, 2015).

Yet there is still dispute aplenty about the role of economic growth and the social and economic dimensions of sustainability. Mainstream economists emphasize a constant rise in total GDP as the prime economic goal. They place less emphasis on the redistribution of income or of other wellbeing benefits of economic growth among all citizens. Others challenge this hegemony of wealth: "... the so-called 'trickle-down effect' by which the worst off in a society automatically would benefit from an overall increment in wealth does not seem to hold anymore even in terms of mere income" (Muraca, 2012, p.540). This widespread unjust distribution of wealth effects is difficult to change because of power relations: "Commodification, which is part and parcel of growth, is eroding sociality and mores. Care, hospitality, love, public duty, nature conservation, spiritual contemplation; traditionally, these relations or 'services' did not obey a logic of personal profit" (Kallis et al., 2015, p. 6; see also Kothari et al., 2014).

The sustainable way forward is the evolution of societies in which fewer natural resources are used and life is organized differently with "sharing, simplicity, care, and the commons as primary significations" (Kallis et al., 2015, p.5). Equitable downscaling of production and consumption would engender the creation of a new set of local commons with innovative forms of living and producing, such as eco-communities, cooperatives, urban or rural gardens, and local currencies (Marshall, 2016).

One approach here would be to create landscapes that took care of the needs of both humans and the natural environment coupled in responsible cooperation. Such lived-in landscapes would correspond to large tracts of land where biodiversity conservation is practised in coherence with people living and working in the area and striving for sustainable livelihoods. Different models of living landscapes already exist, of which the Biosphere Reserve model is the best known (UNESCO, 1996; Batisse, 1997; Ishwaran et al., 2008, Coetzer et al., 2014; Bridgewater, 2016; Reed, 2016).

What does the dawn of the Anthropocene mean for Biosphere Reserves and protected areas as conceived by practitioners? Establishing and managing protected areas is still a common strategy for enhancing ecological integrity. Yet in the Anthropocene, the destructive activities of human beings can become so overwhelming that such protected areas are no longer a safeguard. Watson et al. (2014) have argued that protected areas are becoming ripe for declassification and vulnerable to resource extraction because governments in both developing and developed countries (such as Australia,

the United States and Canada) have heavily reduced their support towards protected areas "through disproportionate funding cuts, reductions in professional staff and by ignoring their own policies" (p.70). "This practice has been labelled protected area downgrading, downsizing and degazettement (PADDD), where downgrading is the legal authorization of an increase in the number, magnitude or extent of human activities within a protected area; downsizing is the decrease in size of a protected area through a legal boundary change; and degazettement is the loss of legal protection for an entire protected area" (Watson et al., 2014, p.70). All three forms are increasing of PADDD are increasing (Mascia et al., 2014). This analysis shows that the problems with the dominant role of economic growth are not prevented by even by the legal strength of protected areas because the choice by governments to 'ignore their own policy' is the apparent inevitable outcome of the growth diktat. It is important to note here that economic growth is not a necessary condition for sustainable development. In fact, the opposite appears to be true: a clear contradiction between sustainability and economic growth is evident, and the "pathway towards a sustainable future is to be found in a democratic and redistributive downscaling of the biophysical size of the global economy" (Asara et al., 2015, p.375; see also Kothari et al., 2014). It is clear that on the local level in areas adjacent to protected areas, such as Biosphere Reserves, it is desirable to have some economic growth from which local people directly profit.

While one part of the Biosphere Reserve concept still seeks to focus on managing core zones for biodiversity conservation, it also tries to respond creatively to the underlying causes of ecosystem destruction by piloting more sustainable land use and living options in all realms of life (hopefully, based on the sufficiency principle).

BIOSPHERE RESERVES AND THEIR ROLE IN IMPLEMENTATION OF THE SUSTAINABLE DEVELOPMENT GOALS

Biosphere Reserves, launched by the Man and the Biosphere (MAB) Programme of UNESCO in 1970, form a worldwide network of representative landscapes, with 669 sites across 120 countries. Their primary goal is to serve as learning sites for information exchange on environmental policy, sustainable development, and appropriate management practices (UNESCO, 1996). Furthermore, they were explicitly designed to be experimental where environmental change could be monitored and remediative policies or practices could be 'tested' (UNESCO, 1996; Batisse, 1997; Köck & Arnberger, 2017; Price et al., 2010; Reed, 2016).

According to the Statutory Framework (UNESCO, 1996), Biosphere Reserves are expected to fulfil three main complementary functions: the conservation function of in situ conservation of natural and semi-natural ecosystems and landscapes; a development function to foster sustainable economic and human development; and the logistic function to support research, monitoring, environmental education and training. These functions are implemented through a zonation system, including one or more core areas (strict protection), buffer zones (sustainable management), and transition areas that can extend beyond the territory where cooperation with local people for sustainable development can be organized (UNESCO, 1996).

The Lima Action Plan (LAP) and the MAB Strategy (both valid until 2025) are founded on the continuity of the Seville Strategy and the Statutory Framework of the World Network of Biosphere Reserves (WNBR). The important new element within the LAP is the goal "to help Member States and stakeholders to urgently meet the SDGs through experiences from the WNBR, in particular through exploring and testing policies, technologies and innovations for the sustainable management of biodiversity and natural resources and mitigation and adaptation to climate change"(UNESCO, 2016, p. 2). Concerning climate change, the emphasis has changed: within the Madrid Action Plan (2008) a stronger focus was put on climate change, whereas in the LAP, the focus is much more on the implementation of the SDGs (of which climate change mitigation and adaption is one of 17 goals) (UNESCO, 2008). The most recent and also most detailed summary of the development of UNESCO's MAB Programme can be found in Köck and Arnberger (2017).

Coetzer et al. (2014, p.83) warn that, "conceptually the Biosphere Reserve model is attractive, yet the practical reality is likely to be challenging". One reason is that Biosphere Reserves remain under the sovereignty and legislation of the country in which they are designated. Thus, the State can ignore the requirements of any designation, as well as the management objectives of the individual protected areas contained within the Biosphere Reserve. A further reason is that the implementation of the MAB Programme is struggling with horizontal integration at the local level, as well as vertical integration with national authorities (Pool-Stanvliet, 2014).

The result is a considerable gap between the Biosphere Reserve concept and reality worldwide (Bridgewater, 2016; Cuong et al., 2017a; Ishwaran et al., 2008; Price, 2002; Reed, 2016; Stoll-Kleemann & Welp, 2008). This

gap is mirrored in their heterogeneity. Although, theoretically, all Biosphere Reserves included in the WNBR share the same rationale, overall goals, and designation and assessment criteria, local contexts and multiple management approaches provide ample diversity and variation of management (Ishwaran et al., 2008).

One example is the South African Biosphere Reserve network, with its excellent conservation-related legislation and strategies addressing pressing topics such as sustainability and climate change. Yet South African Biosphere Reserves do not feature significantly in the national system of legislation and policies. In effect, each Biosphere Reserve is usually left to find its own ways to successfully make a difference through effective implementation of the MAB Programme (Coetzer et al., 2014; Pool-Stanvliet, 2014).

Further examples come from the Czech Republic, Hungary and Poland, where the MAB label is sometimes perceived as a "cosmetic add-on without content" (Schliep & Stoll-Kleemann, 2010). This can be ascribed to a number of causes, such as a perceived lack of effectively managed Biosphere Reserves; inadequate knowledge of the inherent opportunities for promoting the MAB Programme; visionary shortcomings with regard to the true nature of sustainable development; and the non-political nature of Biosphere Reserves (Pool-Stanvliet, 2014; Schliep & Stoll-Kleemann, 2010).

A survey of Vietnamese Biosphere Reserves showed that 55 per cent of respondents were concerned about the gap between theory and implementation, mainly because of the lack of legal status nationally (Cuong et al., 2017a). The traditional management practice in Vietnam is strongly based on laws and regulations, and the lack of a national framework might be a reason for delaying participation and collaboration under the Biosphere Reserve approach for most of the sector-based staff and managers. Lack of legal status can, however, provide a certain level of flexibility, allowing for adaptive interpretation and application of the central laws and regulations in order to fit local conditions (Cuong et al., 2017a). In Vietnam, nearly all the Biosphere Reserves are directly under the authority of the provincial government, which includes parks and protected area authorities, as well as other sectors such as agriculture, forestry, fisheries and tourism (Cuong et al., 2017a).

Generally, one of the most important purposes of Biosphere Reserves is to develop and initiate cooperation among authorities and other involved parties (UNESCO, 1996; Bouamrane, 2007; Schultz et al. 2011, UNESCO 2015, 2016). Strengthening Biosphere Reserves' advisory bodies to serve better management boards by adding representatives from different interest groups and agencies is one way to institute better overall cooperation (UNESCO 2015, 2016, Köck & Arnberger, 2017). In cases where a Biosphere Reserve administration does not have a strong regulatory role, it could nevertheless become an initiator and mediator of efforts towards improved participation and cooperation. This would also bundle limited resources, which has been mentioned previously as an obstacle to effective participation (Stoll-Kleemann & Welp, 2008; Schultz et al. 2011; Pool-Stanvliet, 2014).

The task of effectively engaging communities in the governance and management of Biosphere Reserves is a complex one that involves many hurdles. Substantial long-term commitments of financial and human resources are needed to establish continuity, competence and trust. Power asymmetries between conservation institutions and local populations, and among local actors themselves, need to be better related and resolved. Parties capable of and willing to work for common conservation compromises need to be found, championed and negotiated with (Cuong et al., 2017b; Pool-Stanvliet, 2014; Stoll-Kleemann et al., 2010; Stoll-Kleemann & Welp, 2008).

These ideal conditions are rarely in place. In addition, factors beyond the control of the Biosphere Reserve communities and their management, such as structural poverty, corruption and weak governance may overwhelm even the best-designed programmes, with degradation and destruction of biodiversity as the final output of these failures (Cuong et al., 2017b; Stoll-Kleemann et al., 2010).

In cases where the Biosphere Reserve administration has a strong regulatory function in regard to land use and construction activities, such as in some areas of Germany, the administration might be too involved in promoting nature and landscape-protection interests to be acknowledged by all actors as a legitimate 'neutral' governing partner (Stoll-Kleemann & Welp, 2008). In most Biosphere Reserves a number of agencies are involved in management, requiring messy negotiation strategies. Many bodies still perceive the typical Biosphere Reserve administration primarily as an authority for promoting nature conservation to the point of single-mindedness (Stoll-Kleemann & Welp, 2008). The many advantages of the special status of Biosphere Reserves as model regions, as stated in the Statutory Framework and the Seville Strategy, should be better acknowledged and tested.

Village next to the Sontecomapan sand spit on the outlet of the Sontecomapan lagoon, Buffer Zone, Los Tuxtlas Biosphere Reserve, Veracruz, Mexico © Cristina de la Vega-Leinert

PROBLEMS AND POTENTIALS FOR SUSTAINABLE DEVELOPMENT IN BIOSPHERE RESERVES

Nevertheless, the question remains as to how Biosphere Reserves can fulfil their promise on innovative thinking towards inclusive environmental management and being laboratories for research and education. Sustainable development lies at the heart of Biosphere Reserves, yet it remains contested. Kothari et al. (2014) criticize the concept of sustainable development "as an oxymoron" because it offers an inadequate response to unsustainability and inequity. Kallis et al. (2015, p. 5) add that sustainable development expresses "the denial of any ultimate collective end as well as the denial of anything but ascent. Development becomes self-referential: development for the sake of development".

It is necessary to examine carefully the SDGs themselves before they are implemented in Biosphere Reserves. Kothari et al. (2014 list nine points of critique of which three are relevant to the theme of this paper. This is because they should be considered in Biosphere Reserves much more than is currently the case. The first is that culture, ethics and spirituality are rarely considered, and the "importance of cultural diversity, and of ethical and spiritual values (especially towards fellow humans and the rest of nature) is greatly underplayed" (Kothari et al., 2014, p. 365). Secondly, "unbridled consumerism is not tackled head-on". Without attending to this, "the majority of humankind will never have the space needed to become more secure and genuinely prosperous" (Kothari et al., 2014, p. 365). And thirdly, and of particular importance for the evolution of a spatial concept such as that of Biosphere Reserves: "global relations built on localization and self-reliance are missing". The authors argue that "there is little attention to the need to create relatively self-reliant communities" in which a degree of genuine democratic autonomy prevails (Kothari et al., 2014, p. 365). One interesting example of more self-reliance is the establishment of local currencies (such as the Brixton Pound, the Totnes Pound or the Bristol Pound) because this is a way to achieve a low-carbon society via more transparent economies based on local ownership. Supply chains can be shortened and dependence on fossil-fuel-intensive transport infrastructure reduced. It is an appealing idea to be applied in Biosphere Reserves because these kinds of local money schemes are among the most immediate and tangible manifestations of a transition that captures the spirit of the place where one lives[1].

To be effective, "sustainable development [should] depoliticize genuine political antagonisms about the kind of future one wants to inhabit" (Kallis et al., 2015, p. 9). This suggests that Biosphere Reserves should follow the general vision of an 'ecologizing society' and demonstrate how it could work. This, in turn, means that they have to imagine and enact alternative visions to modern development instead of merely implementing better or greener development as an alternative.

Kothari et al. (2014) list and explain a range of various (cultural and social), more philosophical notions that

BOX 1: SUSTAINABLE DEVELOPMENT GOALS OF THE UNITED NATIONS

1) End poverty in all its forms everywhere

2) End hunger, achieve food security and improved nutrition and promote sustainable agriculture

3) Ensure healthy lives and promote well-being for all at all ages

4) Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

5) Achieve gender equality and empower all women and girls

6) Ensure availability and sustainable management of water and sanitation for all

7) Ensure access to affordable, reliable, sustainable and modern energy for all

8) Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all

9) Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

10) Reduce inequality within and among countries

11) Make cities and human settlements inclusive, safe, resilient and sustainable

12) Ensure sustainable consumption and production patterns

13) Take urgent action to combat climate change and its impacts

14) Conserve and sustainably use the oceans, seas and marine resources for sustainable development

15) Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss

16) Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

17) Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

Source: UN, 2015, p.14

have emerged in various regions of the world which seek to envision and achieve a more fundamental transformation. One example would be *Buen Vivir* (South America), a culture of life that encompasses harmony with nature; cultural diversity, and pluriculturalism; co-existence within and between communities; inseparability of all of life's elements (material, social, spiritual); opposition to the concept of perpetual accumulation; return to use values; and collective governance even beyond the concept of value. Others are South Africa's ethical concept of *Ubuntu* (and its analogues in other parts of the continent), with its emphasis on human mutuality; *Swaraj* in India, with its focus on self-reliance and self-governance; and from Europe, *degrowth,* the hypothesis that we can live well with less.

These more authentic worldviews and forms of life should be highly appreciated and fully incorporated within Biosphere Reserves, as they unify many of the principles promoted by the UNESCO MAB Programme. They are responses that are perfectly adapted to the encompassing environment and have evolved bottom-up from the grassroots level. Depending on the local, regional or national culture, different approaches can be adapted in different Biosphere Reserves.

SDGs *must* (not 'should') guide all development policies and strategies of all nations from now on as part of the 2030 Agenda on Sustainable Development. In 2015, the UN General Assembly agreed that progress towards reaching these 17 goals with their 167 targets will be assessed on a regular basis, with a major global stocktake set for 2030. These are outlined in Box 1. The concept beyond the agenda, with its new coherent way of thinking about how issues as diverse as poverty, education and climate change fit together and entwine economic, social and environmental targets in the 17 Sustainable Development Goals (SDGs) as an indivisible whole, is completely in line with that of Biosphere Reserves. The Biosphere Reserve concept sees them offering innovative thinking towards socially inclusive environmental management and being designed as laboratories for research and education. As Nilsson et al. (2016, p. 321) point out, it is important that countries interpret the SDGs according to "their national circumstances and levels of development" because "differences in geography, governance and technology make it dangerous to rely on generalized knowledge". SDGs are frequently criticized for overlapping, for confusing targets and idealism, and for being seemingly irrelevant to the main drivers and power -broking processes of conventional diplomacy and economic policy.

Sustainable Tourism in the Spreewald Biosphere Reserve, Germany © Reynaldo Paganelli_fotolia

In the light of the general goals of Biosphere Reserves as described above and the requirements of the LAP in particular, Biosphere Reserves should contribute to the implementation of the SDGs. The links to SDGs 13, 14 and 15 are obvious and need no further explanation; SDG 11 is interesting for Biosphere Reserves with significant urban populations; and SDG 12 offers a solution to many of the above-mentioned problems related to economic growth. The worldwide network of Biosphere Reserves (as well as regional, national, and in some countries, even local Biosphere Reserve networks) is in itself an interesting opportunity to implement SDG 17, but it is too early to explore in detail here.

Nilsson et al. (2016, p.320f) explain what makes the task more complex and offer what should function as a warning for Biosphere Reserve managers: "Implicit in the SDG logic is that the goals depend on each other — but no one has specified exactly how. International negotiations gloss over tricky trade-offs. Still, balancing interests and priorities is what policymakers do — and the need will surface when the goals are being implemented. If countries ignore the overlaps and simply start trying to tick off targets one by one, they risk perverse outcomes. For example, using coal to improve energy access (goal 7) in Asian nations, say, would accelerate climate change and acidify the oceans (undermining goals 13 and 14), as well as exacerbating other problems such as damage to health from air pollution (disrupting goal 3)."

For policy makers in general, as well as for Biosphere Reserve managers in particular, coherent policies and strategies demand: "a rubric for thinking systematically about the many interactions — beyond simply synergies and trade-offs — in order to quickly identify which groups could become their allies and which ones they will be negotiating with. And they need up-to-date empirical knowledge on how the goals and interventions of one sector affect another positively or negatively" (Nilsson et al., 2016 p. 321).

It follows that the discussion of the relevance of individual SDGs to Biosphere Reserves needs time and reflection, and in addition, the profound and thorough analysis of given projects and experiences in Biosphere Reserves.

Two specific examples have been picked to present here: SDG 11 stresses the role of cities and human settlements for sustainability. Indeed, urbanization is an important feature of the Anthropocene and among "the most critical

Cat Ba Biosphere Reserve, an archipelago of 366 limestone islands in northern Vietnam © Equilibrium Research

transformations that has had profound impacts on land use from local to global scale since the mid-twentieth century" (de la Vega-Leinert et al., 2012, p.26). More than half of the world's population lives in cities; furthermore, urban growth is most rapid in developing countries. In both emerging and developed countries, it represents one of the greatest challenges to ensuring basic human welfare and the functioning of viable ecosystems. Whereas the poor people who inhabit them have only limited access to basic services, are deprived of meaningful participation in decision-making, and face extreme vulnerability to natural disasters, urban areas are also loci of concentrations of knowledge, innovation and productive resources that could be harnessed by Biosphere Reserves. Therefore, de la Vega-Leinert et al. (2012) argue for Biosphere Reserves as learning laboratories to foster sustainable initiatives and practice at urban–rural interfaces. They can be seen as priority areas and large-scale laboratories for observation of the effects of global change on ecosystems (e.g. significant warming and increased nitrogen deposition).

It is useful to include urban–rural interfaces, where major environmental and societal transformations are occurring, and which critically affect the availability of and access to natural resources. This provides a welcome opportunity to found initiatives that adequately help to value and protect ecosystems for their own sake, as well as to improve local livelihoods (de la Vega-Leinert et al., 2012). Despite serious restraints due to a lack of powers and resources, Biosphere Reserve managers, by adjusting and revisiting their practices, have evolved power and responsibilities in actively supporting small but critical transformations at the local scale near large cities. In this respect, we suggest key areas in which Biosphere Reserve managers can make a difference. These include encouraging social learning, positive leadership, accountability and transparency, while recognizing and valuing the contribution local populations can make to shaping conservation action (de la Vega-Leinert et al., 2012).

Concerning SDG 12, while positive examples of sustainable consumption and production can be found (often at the micro-scale), in general, land scarcity is driving marginalized peasant farmers to convert forest to pasture or intensify cropping in and around Biosphere Reserves. This threatens the integrity of primary forest patches in core zones (de la Vega-Leinert et al., 2016; Tejeda-Cruz et al., 2010).

For example, pressure on agricultural land in the wake of the sharp increase in meat and dairy-product consumption, and the concomitant demand for huge swathes of terrain devoted to livestock feed cultivation (especially of soya and maize), constitute a major problem that is also detrimental to the implementation of sustainability in Biosphere Reserves worldwide (Foley et al., 2011; Garnett et al., 2013; Godfray et al., 2010). The consequences of the accompanying dramatic increase in the intensification of agriculture have not spared Biosphere Reserves from the land-grab that now affects protected areas around the world (European Green Party, 2013; Watson et al., 2014). Two recent papers in the magazine *Environment* attest to this destruction of Biosphere Reserves in the Brazilian Cerrado (Lahsen et al., 2014; Sawyer & Lahsen, 2016).

Even in Germany, where, according to the Federal Environment Agency (UBA), 60 per cent of agricultural land is used for the intensive production of feed for animal products (meat, dairy products and eggs), and a further 20 per cent for bioenergy plants (UBA, 2015), agricultural production is placing increasing pressure on Biosphere Reserves. Furthermore, the negative consequences of non-sustainable intensive land use are extending into Biosphere Reserves (see text and maps for Europe and Germany in Levers et al., 2016; Garnett et al., 2013; Stoll-Kleemann & Kettner, 2016). This makes it clear that the future of Biosphere Reserves depends less on classical nature conservation measures than on individual consumption patterns and the political and social pressures exerted by the true beneficiaries of this development: primarily, large-scale agri-businesses (Stoll -Kleemann & O'Riordan, 2015; Stoll-Kleemann & Kettner, 2016).

It is obvious that Biosphere Reserves face a number of challenges, both familiar and new, and that the issue of sustainable consumption will have to be more forcefully addressed – in practice and not merely in theory (e.g. through information centres or other environmental-education activities organized by Biosphere Reserve staff). In order to overcome these challenges, Biosphere Reserve management requires a political tailwind through the provision of human and financial resources that are adequate to meet the range of its tasks, combined with courageous political support, particularly vis-a-vis the agribusiness lobby (including fertilizer, pesticide and seed producers). In particular, the reduction of subsidies promoting environmentally destructive practices will reduce pressure on biodiversity and improve sustainability both inside and outside Biosphere Reserves.

Dyfi Biosphere, a biosphere reserve in mid-Wales, UK © Equilibrium Research

A search for new criteria for the establishment and transformation of Biosphere Reserves seems to be needed. These criteria should embrace both natural and human relationships and values. Here is where Biosphere Reserves should become showcases of the SDGs and beyond (including sustainable living patterns and consumption habits) and portals of the positive message of the Anthropocene.

CONCLUSIONS

The era of the Anthropocene is characterized by the breaching of planetary boundaries. Although some Biosphere Reserves have the potential to offer positive effects in terms of working through local economies with the long-term goal in mind to help strengthen fair-trade regimes and to deliver social fairness and justice for all of their inhabitants, Biosphere Reserves are not islands. The impacts of a globalized world, with a few big (and sadly often corrupt) players in the energy area, forestry and agricultural spheres, weigh heavily on what happens

within them. Tackling sustainability successfully goes against the grain of prevailing neoliberal economics and power politics. The overwhelming concern regarding the failure of both conventional government and of the markets to deliver fair sustainability has been universally regretted (Asara et al., 2015; Biermann et al., 2012; Kallis et al., 2015; Kothari et al., 2014; Marshall, 2016; Muraca, 2012). It is therefore a sign of the maturity of the Anthropocene that Biosphere Reserves are beginning to embrace decency, ecosystem care, and human well-being.

Hence, there is an urgent need to introduce innovative ways in which to showcase sustainable living practices in the light of dominating unsustainable patterns of growth and human consumption. The sustainability prize is the evolution of societies in which fewer natural resources are used and life is organized differently with "sharing, simplicity, care and the commons as primary significations" (Kallis et al., 2015, p.5).

The idea of widening the purpose of Biosphere Reserves offers an innovative way to combine sustainability with decent livelihoods. The global growth in the number and area of Biosphere Reserves, as well as their embrace of SDGs, are already positive developments.

In line with the current MAB Strategy and the LAP, Biosphere Reserves still need to build trust through real relationships with communities and other relevant stakeholders (UNESCO, 2015; UNESCO, 2016). To make this happen, they need to be conceived and then established through real local and community-led processes. Stakeholders need to be convinced of the added value of implementing the Biosphere Reserve model amidst a range of regional and national initiatives.

A range of public participation, moderation and conflict-management approaches, as well as statistical-survey methods, has been outlined in the relevant literature and handbooks (cf. e.g., Bouamrane, 2007; Creighton, 2005).

Biosphere Reserves can provide a dynamic framework for the establishment of valuable laboratories to address the challenges of the Anthropocene and contribute to a more sustainable world. In order to achieve this, some – or preferably all – of the visions described above, such as strengthening the urban–rural link and emphasizing the much needed critical assessment of the concepts of growth and sustainable development, and even the SDGs themselves, have to be taken more seriously. Only then will progress towards more responsible patterns of sustainable living based on sufficiency, such as Buen Vivir, be possible.

ENDNOTE

[1] transitionnetwork.org/stories/has-related-content

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RESUMEN

Este artículo analiza la capacidad de las reservas de biosfera para responder ante los desafíos de la nueva Era Antropócena, incluyendo la vulneración prevista de algunos límites planetarios. En este contexto, el esfuerzo del desarrollo sostenible precisa de un reexamen crítico, y las reservas de biosfera deben avanzar hacia la adopción de formas más integradas y efectivas de medios de subsistencia sostenibles para sus habitantes. Ello implica situar a las personas aún más en el centro de la política y la gestión de las reservas de biosfera en procura de que se conviertan en pioneros y embajadores para alcanzar una verdadera sostenibilidad en todas las reservas de biosfera. Significa asimismo que las reservas de biosfera y las instituciones relacionadas tienen que trabajar en pro de una verdadera integración de sus potencialidades ecológicas, sociales y económicas, y establecer un marco de verdadera gobernanza de la sostenibilidad. Este documento amplía el concepto de reservas de biosfera para facilitar una transformación creativa hacia paisajes más habitables y sostenibles como una red global. Si esto se lograra, para las reservas de biosfera sería más fácil perseguir y fomentar la implementación de los Objetivos de Desarrollo Sostenible (ODS) como su finalidad primordial renovada.

RÉSUMÉ

Cet article examine comment les réserves de la biosphère se préparent à répondre aux défis de la nouvelle ère de l'anthropocène, y compris au dépassement prévu de certaines limites planétaires. Dans ce contexte, l'effort de développement durable nécessite un réexamen critique, et les réserves de biosphère se doivent de tendre vers l'adoption de moyens de subsistance durables plus intégrés et plus efficaces pour leurs habitants. Cela signifie placer les individus encore plus au cœur du programme d'administration de la réserve de la biosphère et leur permettre de devenir des pionniers et des ambassadeurs afin de réaliser une durabilité efficace dans toutes les réserves de biosphère. Cela signifie également que les réserves de la biosphère et les institutions connexes doivent œuvrer pour une véritable intégration de leurs potentiels écologiques, sociaux et économiques, et mettre en place un cadre de gouvernance réellement durable. Cet article vise à élargir le concept de réserves de biosphère afin de les orienter vers une transformation créatrice de paysages plus viables et durables en tant que réseau mondial. Si cela est réalisé, il sera plus facile pour les réserves de biosphère de poursuivre et de favoriser la mise en œuvre des Objectifs de Développement Durable (SDGs), ce qui est leur objectif fondamental.

COST-EFFECTIVE RESOURCE ALLOCATOR: A DECISION SUPPORT TOOL FOR THREATENED SPECIES MANAGEMENT

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ABSTRACT

Faced with increasing rates of biodiversity loss and modest conservation budgets, it is essential that natural resource managers allocate their financial resources in a cost-effective manner and provide transparent evidence for extra funding. We developed the 'Cost-Effective Resource Allocator', a Microsoft Excel-based decision support tool to assist natural resource managers and policy makers, to prioritize the set of management strategies that maximize the total number of years that a suite of species is expected to persist given a budget constraint. We describe this tool using a case study of four locally threatened species from the Australian Commonwealth National Park of Christmas Island in the Indian Ocean. These include: a native fern (*Pneumatopteris truncata*), the Christmas Island Red Crab (*Gecarcoidea natalis*), the Golden Bosun (*Phaethon lepturus fulvus)*, and Abbott's Booby (*Papasula abbotti*). Under a hypothetical budget of 8,826,000 AUD over ten years, in which all species are considered equal, our tool recommends funding: fern propagation and planting, rat control, cat control, and Yellow Crazy Ant (*Anoplolepis gracilipes*) survey and control. We found that the cost-effectiveness rankings of these strategies were sensitive to the importance that assessors' assigned to different species. The 'Cost-Effective Resource Allocator' can accommodate input from up to eight assessors, and analyse a maximum of 50 management strategies for 30 species.

Key words: Conservation planning, expert elicitation, Microsoft Excel, prioritization, resource allocation, threatened species

INTRODUCTION

Confronted with increasing rates of biodiversity loss (Barnosky et al., 2011) and an underfunded global conservation budget as a result of low political and public support (McCarthy et al., 2012), natural resource managers face hard choices concerning how best to allocate funding across many threatened species. Structured frameworks based on cost-effectiveness analysis can help managers achieve the greatest gains for threatened species survival per dollar spent by trading off the expected benefits of candidate conservation strategies against their likelihoods of success and cost (Bottrill et al., 2008; Cullen, 2013). Despite the development of several approaches to cost-effectiveness for conservation decision making (summarized in Cullen, 2013), they often require a high level of technical expertise that may hinder their application on the ground. To make coherent allocation of finite resources more accessible we need to provide more user-friendly tools for prioritizing threatened species' conservation.

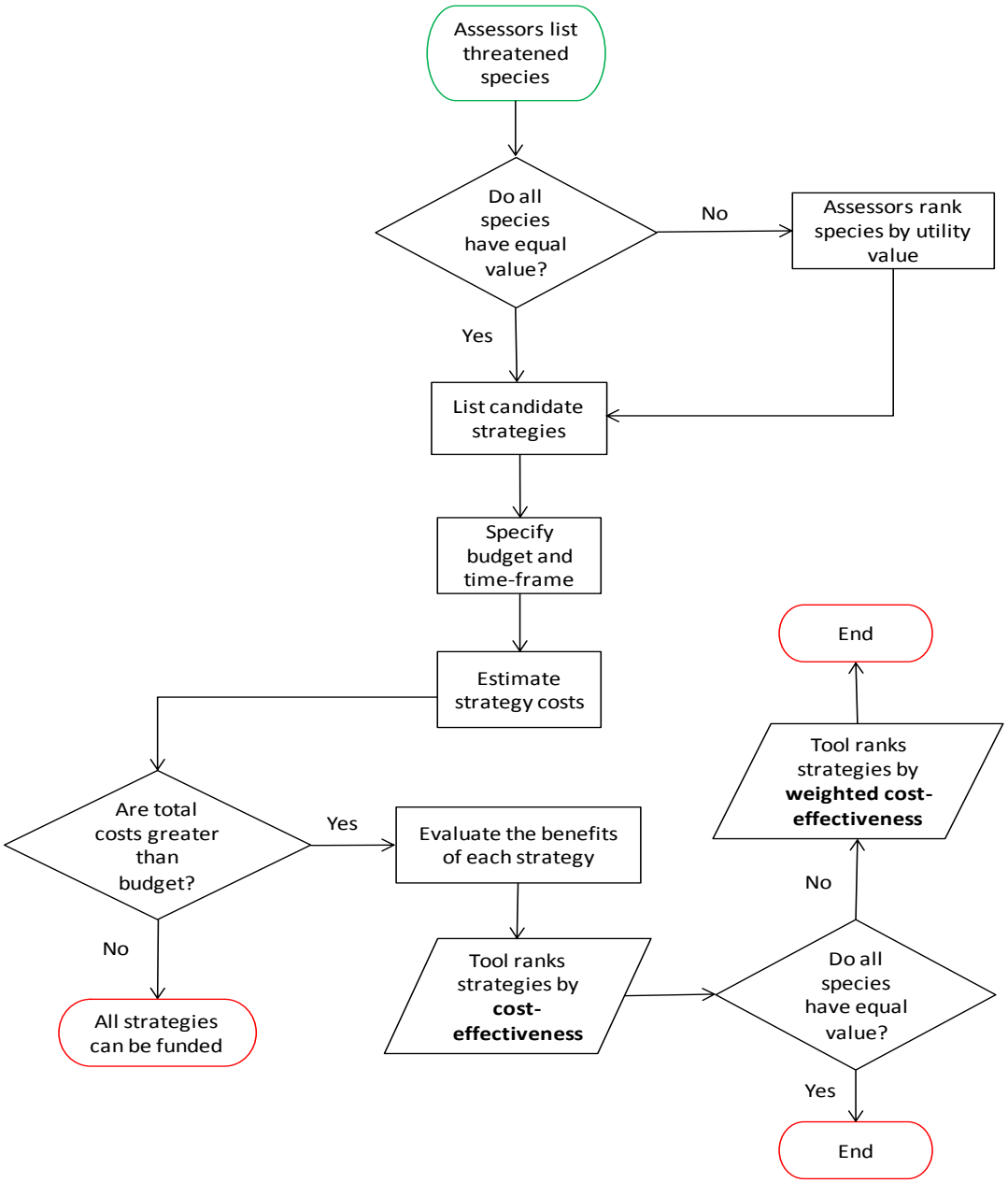


Figure 1. Flowchart representing the steps involved in the 'Cost-Effective Resource Allocator' decision support tool.

Cost-effectiveness frameworks have been applied to optimize conservation investment in New Zealand (Department of Conservation, 2013), the Australian state of New South Wales (New South Wales Government, 2013), and across the Kimberley (Carwardine et al., 2011), Lake Eyre (Firn et al., 2013), Pilbara (Carwardine et al., 2014), and Kakadu National Park (Woinarski & Winderlinch, 2014) regions of Australia. These approaches can include simple spreadsheet methods where the benefits of alternative management strategies are divided by their cost (e.g. Auerbach et al., 2014; Carwardine et al., 2012), algorithms which iteratively remove low-ranking strategies and update cost-efficiency rankings (e.g. Joseph et al., 2009; Chadés et al., 2015), and spatially explicit systematic conservation planning software that solve integer programming problems (e.g. Marxan and Zonation; Ball et al., 2009; Moilanen, 2007). Complex approaches may provide normatively better decision support, but they can be difficult to implement and interpret for practitioners. Moreover, current methods commonly require experts to estimate the likely benefits of candidate management strategies using direct, probabilistic judgements (the 'probability of persistence' of a species; e.g. Carwardine et al., 2012; Joseph et al., 2009), which can be prone to error and bias (Lagnado & Sloman, 2004; O'Hagan et al., 2006; Bolger & Wright, 1994).

In this paper we provide a more tangible benefit estimation procedure by adapting the IUCN Red List Criteria (IUCN, 2001) to a local context, and make the process of calculating cost-effectiveness easily accessible, using a series of linked Microsoft Excel worksheets. This paper is a guide to the tool and details the process

For most of the year, Christmas Island red crabs (*Gecarcoidea natalis*) are found within the island's forests, only migrating to the coast once a year to breed. ©Martina Di Fonzo

involved in collecting the information required for the analysis. We provide users with a transparent decision-making process to determine which on-ground conservation strategies should be funded to maximize the sum of expected extant years for a set of threatened species, while taking into account assessors' uncertainty and distinctions in the value attributed to different species.

We developed this tool with the input of potential users from two Australian Commonwealth National Parks (Uluru-Kata Tjuta and Christmas Island National Parks), and refined it based on further feedback from two park staff (one of whom had no prior experience of the tool). The tool can accommodate input from up to eight assessors and can be used to analyse a maximum of 50 candidate management strategies for a total of 30 species. It can be expanded to include more assessors, strategies and species, if required. We recommend that the tool be operated by a single assessor/expert, charged with eliciting information from the remaining experts using the instruction sheets in Appendices S3 and S4. We describe how the tool identifies the best conservation strategies using a case study of four locally threatened species from Christmas Island National Park, an Australian territory in the Indian Ocean.

AN EXAMPLE: PRIORITIZING MANAGEMENT STRATEGIES FOR FOUR THREATENED SPECIES IN CHRISTMAS ISLAND NATIONAL PARK

We held an expert elicitation workshop with seven Christmas Island National Park staff in June 2014 to determine the strategies required to conserve four native species (a fern (*Pneumatopteris truncata*), the Christmas Island Red Crab (*Gecarcoidea natalis*), the Golden Bosun (*Phaethon lepturus fulvus)*, and Abbott's Booby (*Papasula abbotti*)), and the expected benefit of these strategies following their implementation over 10 years. The information was collected using the following steps (Figure 1), which involve: listing the species and strategies of interest, estimating their cost and benefits, and ranking them according to cost-effectiveness. These steps are represented within the spreadsheets that form the 'Cost-Effective Resource Allocator' tool (see Appendices S1 and S2 for additional screen shots to illustrate the steps below).

- **Part A – Setup**

Step 1: List biodiversity assets, generation length and assessor

The 'species and assessors' sheet requires the names of the focal species (Table 1), and their generation lengths. Generation length is defined as either the average age of mothers within a population (for animals) or the median time until germination (for plants; IUCN Standards and Petitions Subcommittee, 2010). We included species' generation length to compare the benefits of alternative strategies across different species (as applied in the IUCN Red List of threatened species; IUCN, 2001; further explained in step 5). This sheet is also used to record the identity of the assessors, after which they are represented by a single letter in the remainder of the worksheets. This ensures that their responses remain anonymous and do not influence the views of other experts.

Step 2: Weight species differently (optional)

The tool has the option of explicitly recognizing that species within an ecosystem are not all considered equal. For instance, if a species is iconic, endemic or listed at the national level, it may be allocated a higher 'value' in relation to other species. Appendix S3 provides

Table 1. Species names and generation length

Species name	Generation length (years)
Abbott's booby	16
Christmas Island red crab	12
Golden bosun	11
Native fern species	4

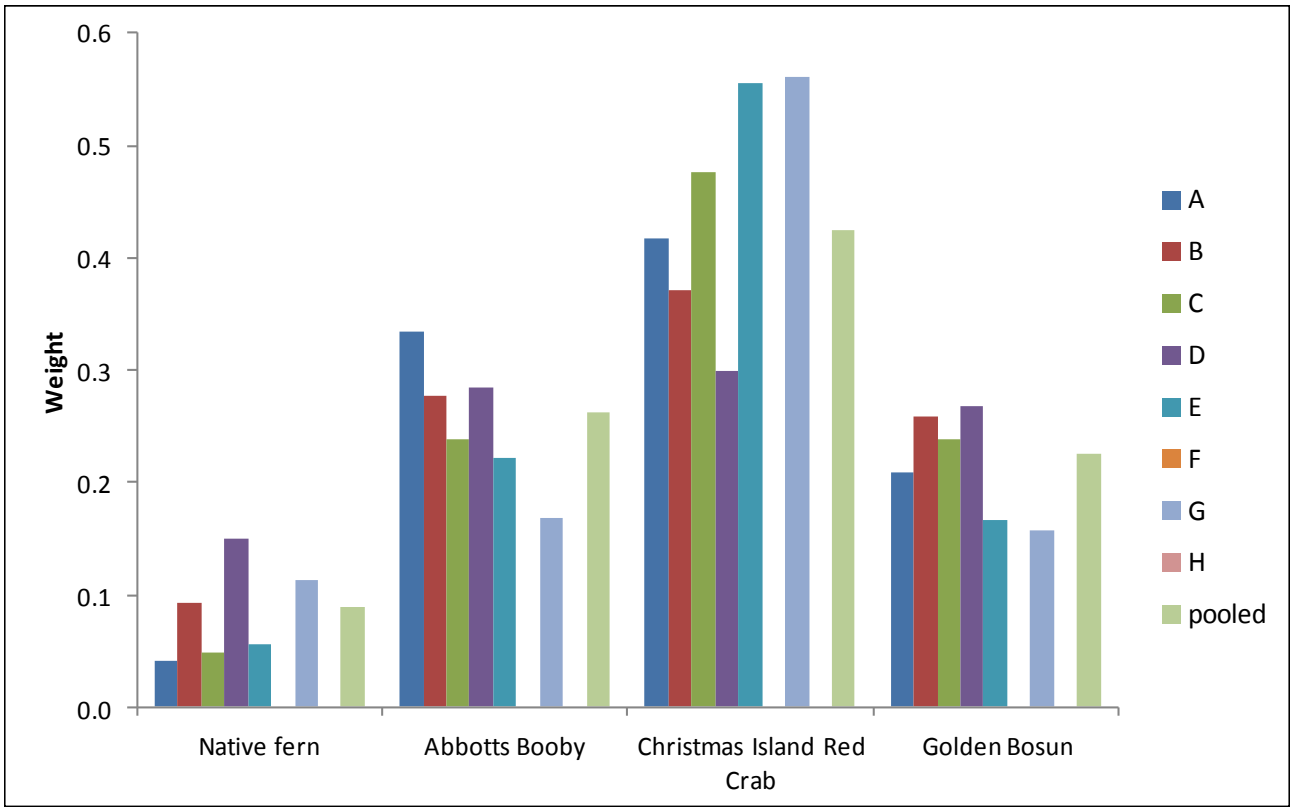


Figure 2. Species' value weightings, based on assessors A-H (where available), and pooled judgements. Gaps exist where assessors did not provide a value. All figures have been output from the Cost-Effective Resource Allocator tool.

instructions to the assessors for ranking species based on their perceived value. Columns B-H of the 'value-judgements' sheet can be used to record the basis for the assessors' value judgements (determined through informal group discussions), whereas columns L-S collect the assessors' precise rankings of species out of 100. 'Phylogenetically distinct' refers to whether the species is evolutionary distinct, with few extant relatives, and therefore more important for maintaining phylogenetic diversity, contributing to functional diversity and adapting to future conditions than species from diverse lineages, which are assumed to have greater genetic redundancy (Vane-Wright et al., 1991; Crozier, 1997). The value-based characteristics listed on the sheet can be altered as appropriate. Once the value judgements are collated, the graph below summarizes each species' weights, based on the proportion of the total value allocated to all species by each assessor (Figure 2). The pooled weights represent the species' ranking in proportion to the sum of all the assessors' rankings across species.

Step 3: List candidate strategies and their impact on species

Management strategies that may benefit the threatened species should be listed in the 'strategy table' sheet, preferably as individual strategies. When strategies must be implemented together to achieve their full conservation benefit, they can be combined within a single strategy. This option should be used sparingly as the tool cannot recognize if the same action is included in several strategies and may overestimate management expenses. Note that this tool is only applicable to *in-situ*, on-ground strategies due to the difficulties in assessing the benefit and probability of success of *ex-situ* strategies, such as conservation breeding programmes, or the impact of 'research and monitoring' strategies, which have no immediate benefit. From row 57 onwards, users must specify which species are impacted by each strategy.

Step 4: Specify the budget and time-frame

The 'budget' sheet requires input of the annual resources available for employing personnel and the monetary resources for on-ground activities. This spreadsheet contains a discount rate (specified in cell B13) that adjusts the cost of strategies for the effects of inflation over the planning period. The discount rate can be specified by the user. We do not recommend setting a long planning period (specified in cell B5) as this will reduce the accuracy of predicted changes in population size.

Step 5: Estimate costs

The cost of each management strategy can be broken down according to its annual set-up, operating and maintenance costs, and then adjusted based on the discount rate. For instance, in our case study, Yellow

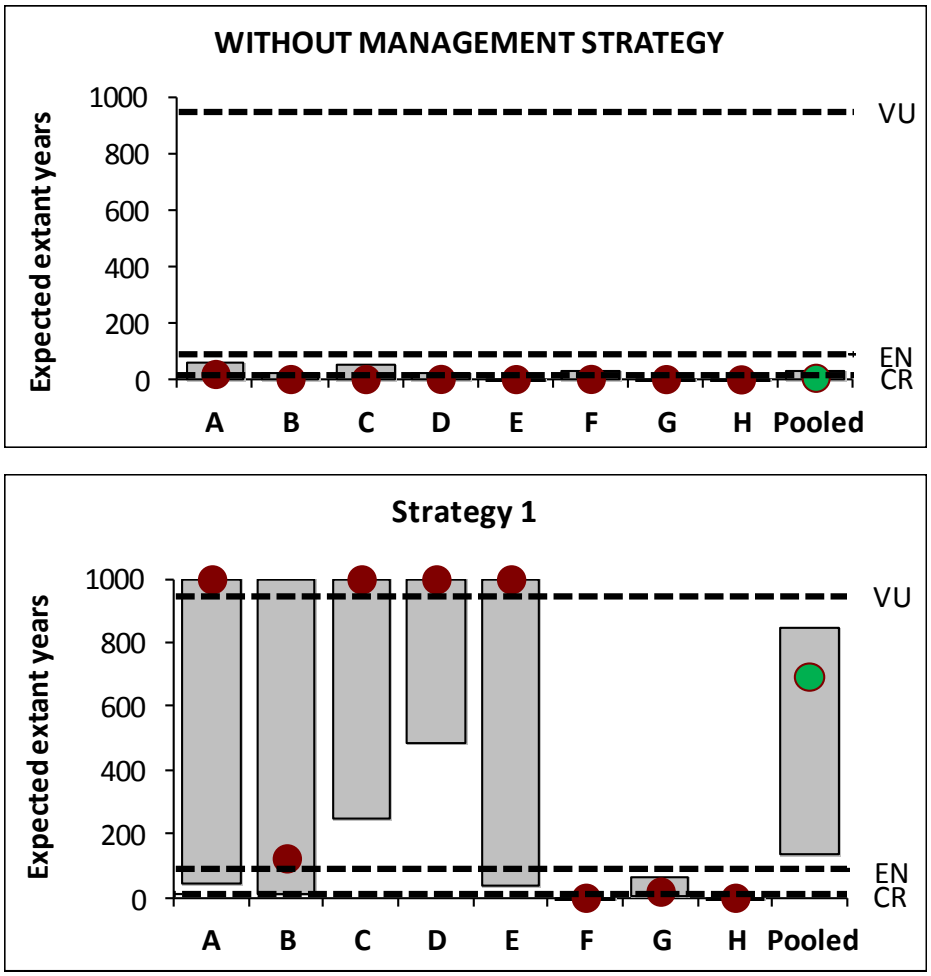


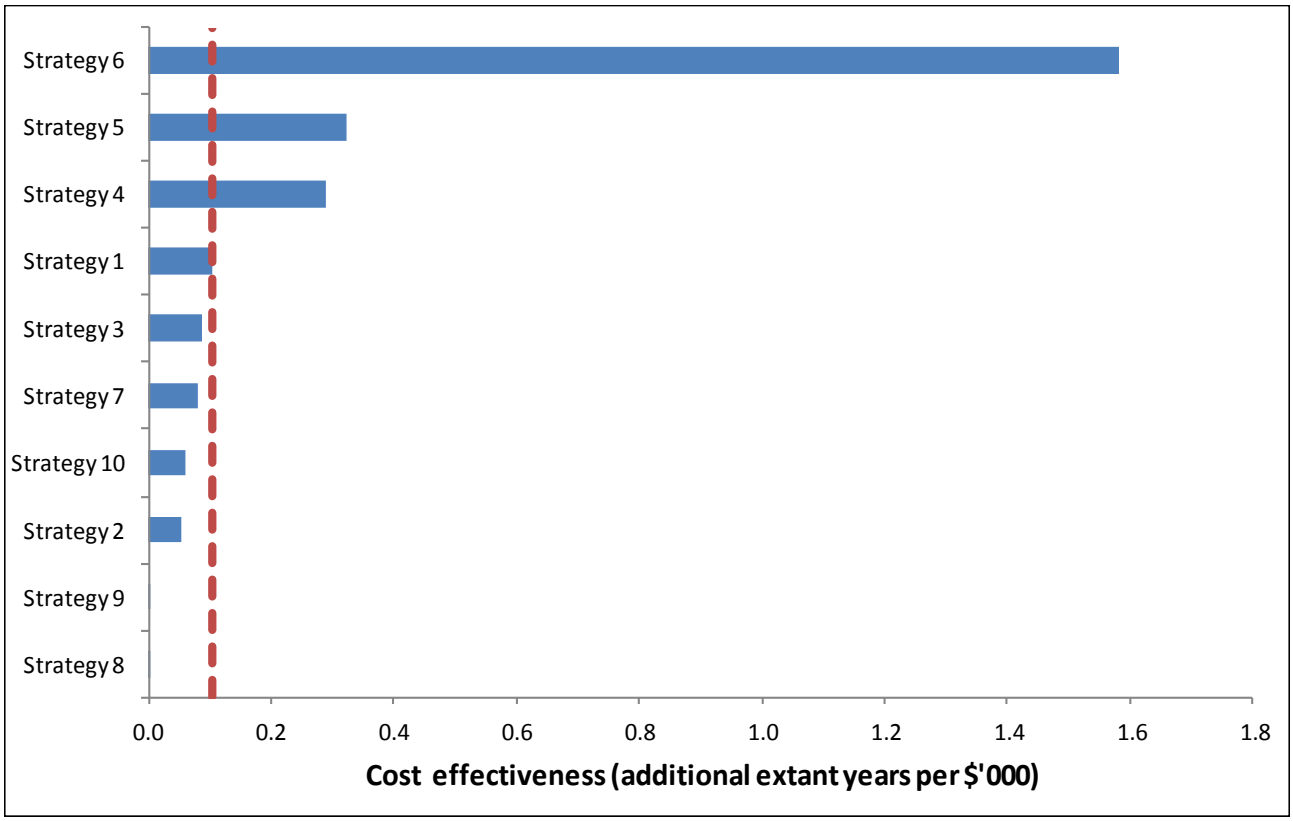
Figure 3. A (top) Expected extant years that the Christmas Island Red crab will persist without management at the end of the 10 year planning period. B (bottom) Expected extant years that the Christmas Island Red crab will persist following the implementation of Strategy 1 (Yellow Crazy Ant survey and control) at the end of the 10 year planning period. Bars A – H illustrate each assessor's judgement separately, and the pooled bar represents their harmonic mean. The red dots represent the best estimate according to different assessors and the green dot represents the pooled estimate. The error bars are represented in grey. The horizontal dashed lines represent the number of extant years which a species would be expected to persist if they were listed as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) according to the IUCN Red List.

Crazy Ant (YCA; *Anoplolepis gracilipes*) survey and control requires 1,200 hours of personnel time, and 350,000 AUD of operating materials annually over 10 years, resulting in a total cost of 6,902,000.05 AUD. If the total funding required for all management strategies is less than the total amount provided in the budget sheet there is no need to continue this analysis as all strategies can be funded. If the total funding required is greater than the total amount provided in the budget, then the analyst has two options: 1) assess whether it is possible to reduce the cost of any strategy (through running a 'reduced conservation programme') in order to meet the funding budget, or 2) start the process of prioritizing strategies by following the steps below.

- **Part B – Perform Assessments**

Step 6: Determine the benefit of each strategy for each species

A separate 'benefit calculation sheet' must be completed for each species, which contains the assessors' evaluations of the benefit of each management strategy for each species, as well as a baseline scenario of the species' likely persistence without conservation management. We addressed the difficulties associated with eliciting benefit through judgements of 'probability of persistence' (which mainly occur due to managers' unfamiliarity with the probability metric; Bolger & Wright, 1994), by basing the expert elicitation process on more well-known notions of population decline and abundance. We also anticipate that asking for information that is closer to managers' expertise will result in better quality judgement (Bolger & Wright, 1994; Kynn, 2008). In particular, we determined benefit using simplified variants of IUCN Red List Criteria A (percentage population decline), D (number of mature individuals) and E (probability of extinction; IUCN, 2001). We asked assessors to predict the percentage population decline and number of mature individuals at the end of the planning period under best-case, worst-case and most likely scenarios with and without each candidate management strategy (a strategy table is provided in Appendix S4 to collect assessors' responses). Once the information is entered, the tool converts these values into species' 'expected extant years' using the calculations detailed in Appendix S5. The tool presents each species' expected extant years under the scenario where no management strategies were applied, and following the application of each individual management strategy with confidence intervals of 80 per cent (intervals can be adjusted according to user preferences; Figures 3 A-B; see Appendix S5 for full methods).



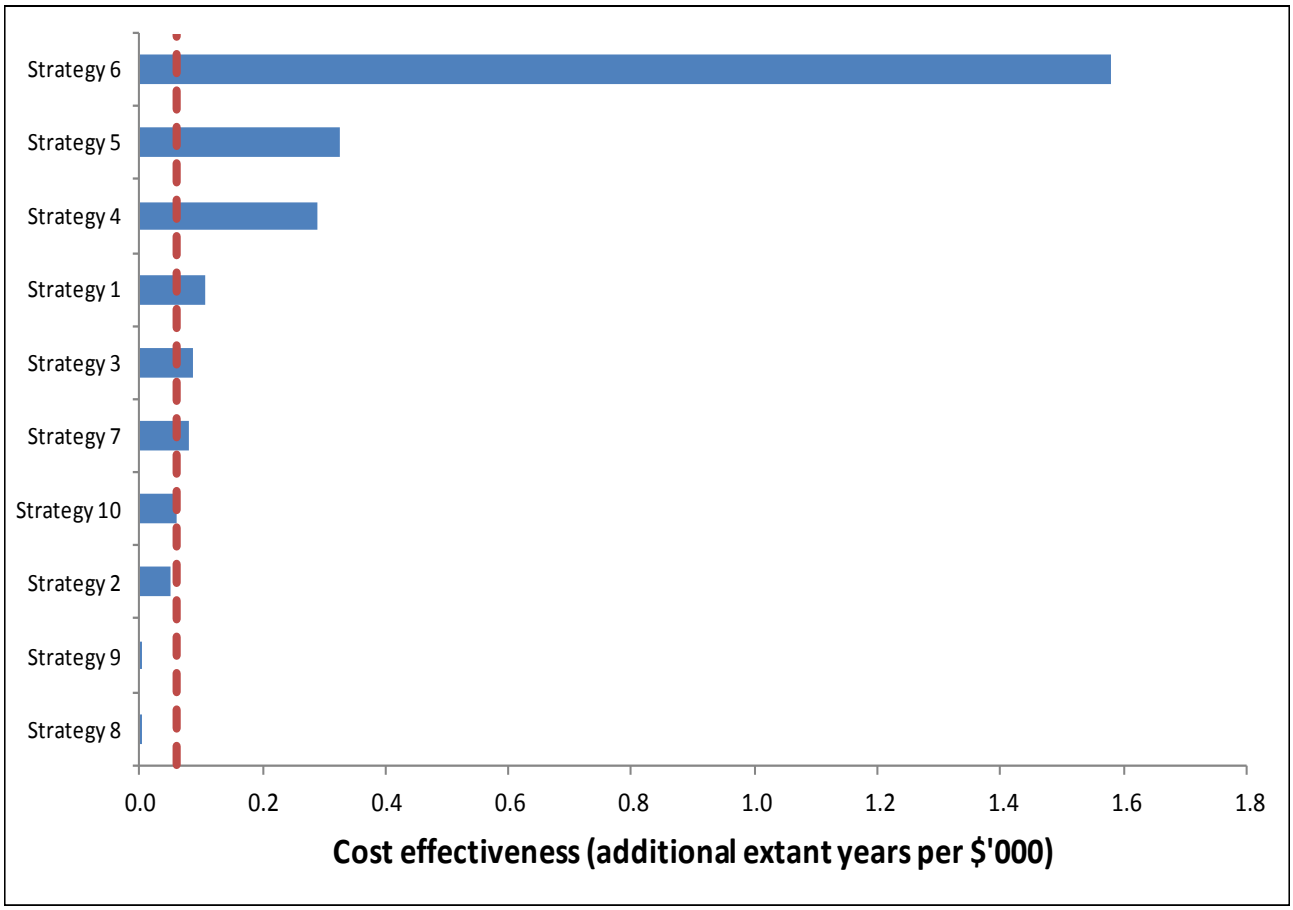


Figure 4. A (top) Cost-effectiveness ranking of each strategy where all species are considered equal. The red dashed horizontal line indicates the budget threshold, below which no further strategies can be funded. B (bottom) Cost-effectiveness ranking of each strategy where all species are considered equal and the budget is increased by 50 per cent.

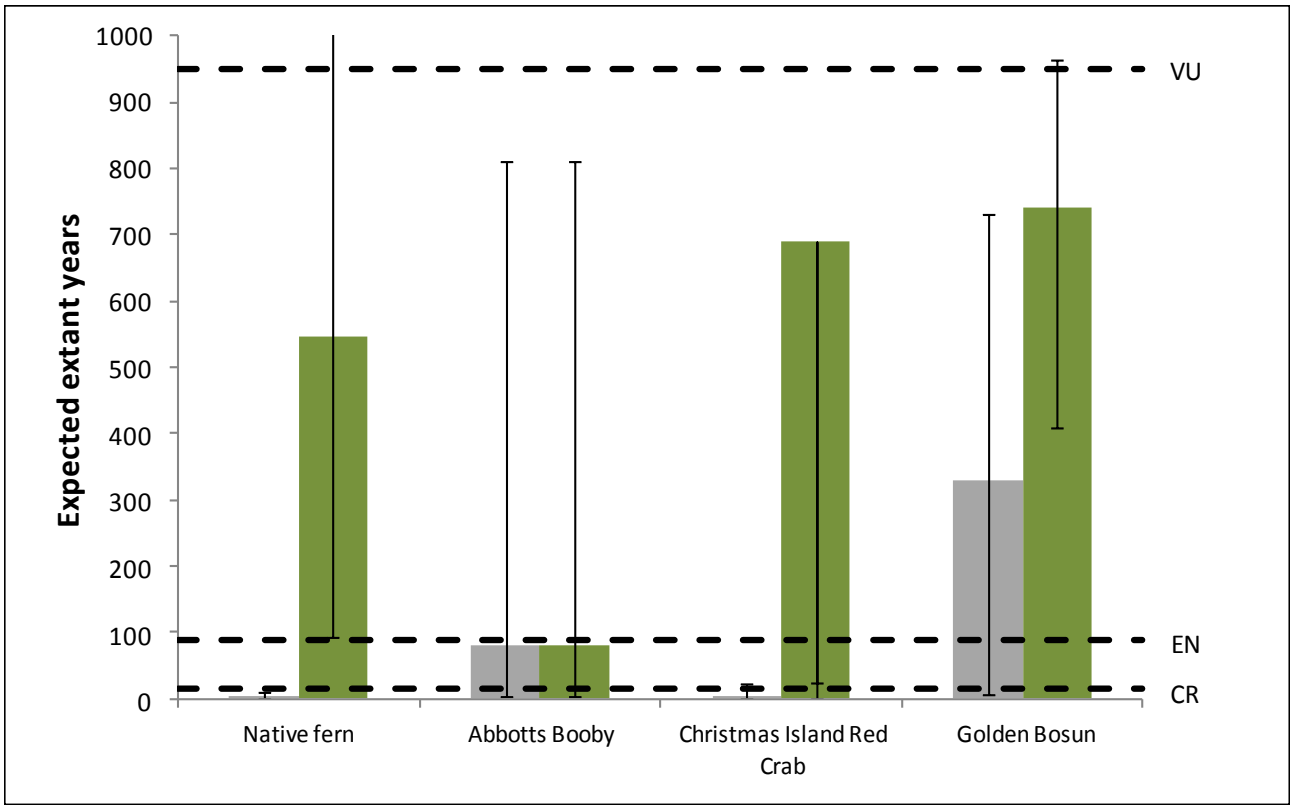


Figure 5. Species expected extant years with (green bars) and without management (grey bars) based on funded strategies in Figure 4 A. Dashed horizontal lines indicate different IUCN Red List category thresholds. The error bars represent 80 per cent confidence intervals.

- **Part C – Explore outputs**

Step 7: Management strategies are ranked by cost-effectiveness

Once all the species have been assessed, the first 'outcomes' sheet ('outcomes – all species equal') calculates the overall number of expected extant years conveyed by each management strategy by aggregating the differences in expected extant years with and without the strategy across all species where this strategy has been applied. The overall number of expected extant years conveyed by each strategy is then divided by their total cost (across all species), providing a list of strategies ranked by cost-effectiveness (Figures 4 A-B). Within this scenario, all species are considered equal.

The dashed vertical red line reports the critical cost-effectiveness threshold for the specified budget: strategies with bars extending beyond this threshold or touching the red vertical dashed line fall within the budget, and those that do not touch the line are insufficiently cost-effective for the budget. The column to the left of the figures (column V) allows the user to specify the inclusion or exclusion of certain strategies, and view their effect on the cost-effectiveness rankings. When all species in our case study are considered equally valuable, fern propagation and planting (strategy 6) is the most cost-efficient strategy, followed by rat control (strategy 5), cat control (strategy 4), and YCA survey and control (strategy 1). No further strategies can be funded under the current budget.

Within the same spreadsheet, users will find a figure illustrating the impact of funding those strategies that meet the cost-effectiveness threshold on the survival of threatened species (Figure 5). The grey bars refer to the predicted expected extant years in the absence of any management intervention, whereas the green bars represent the expected extant years resulting from funding the strategies that meet the cost-effectiveness threshold. The graphs are truncated at 1,000 years on the *y*-axis, which equates approximately to delisting a threatened species. Cells H5, H6 and H7 display the specified budget, the total cost of all funded strategies, and the amount of 'loose change', which we define as the difference between the budget and the total cost of all selected strategies. Loose change arises because the tool stops selecting strategies once the next most cost-effective strategy breaches the budget constraint. The next most cost-effective strategy may be too expensive to fund, resulting in a large amount of 'loose change', which could be used to fund other strategies. To resolve this issue, the user can manually include affordable strategies (cells V7-V57) in a sequence consistent with cost-effectiveness up to the point where no further strategies can be afforded. The user may also manually include or exclude strategies depending on their own management

View of Christmas Island National Park forests and coastline © Martina Di Fonzo

requirements. The 'outcomes' sheets also include a figure illustrating the expenditure on personnel and cash resources (i.e. operating funds) for the funded strategies over the planning period, and a figure displaying changes in the number of species under different extinction risk categories before and after management. The remaining charts have been left empty, as only four species were included within our case study.

The subsequent 'outcomes' sheets present the candidate management strategies ranked according to their weighted cost-effectiveness (calculated by multiplying their cost-effectiveness estimate by the value of the species they benefit). The 'pooled' outcomes results assume that the value judgements of all assessors have equal weighting, whereas 'outcomes – A' to 'outcomes – H' present the weighted cost-effectiveness rankings according to each individual assessor's value judgement. In our case study, the pooled value-adjusted cost-effectiveness strategy rankings do not differ from the 'all species equal' results, however some changes in rankings occur when each assessor's value adjustment is considered in turn. For instance, assessors E and G's rankings substitute 'YCA Survey and Control' as the second most cost-efficient strategy, in the place of 'rat control'. This occurs because YCA control benefits Christmas Island Red Crabs, which is the species that was weighted highest by assessors E and G.

Step 8: Manipulate the budget (optional)

The user may return to the original 'budget' worksheet and change the median annual salary, the annual allocation of personnel and cash resources, or the time horizon for planning to assess how potential decreases/ increases in funding or project length may impact the list of priority strategies and the total species' expected extant years. Alternatively, if the user is interested in observing how a percentage change in the budget may affect the outcomes, they can manipulate the 'Budget scenario' cell (H4) in the 'outcomes – all species' worksheet to view how this affects all subsequent worksheets. An increase in funding will shift the cost-

effectiveness threshold closer to the left-hand side of the 'cost-effectiveness' figures in the 'outcomes' worksheets, allowing more strategies to be implemented. Similarly, the user will observe an increase in the number of species listed with lower extinction risk categories, higher cash and personnel cost estimates, and a greater number of expected extant years following management intervention. A decrease in the budget will move the cost-effective threshold to the right and cause the opposite changes. In our case study, a 50 per cent increase in the budget (i.e. setting the budget scenario to 150 per cent) would enable the implementation of three more strategies (strategy 3, 7 and 10; Figure 4 B) and result in downlisting all species to the IUCN Red List extinction risk category of 'vulnerable'

DISCUSSION

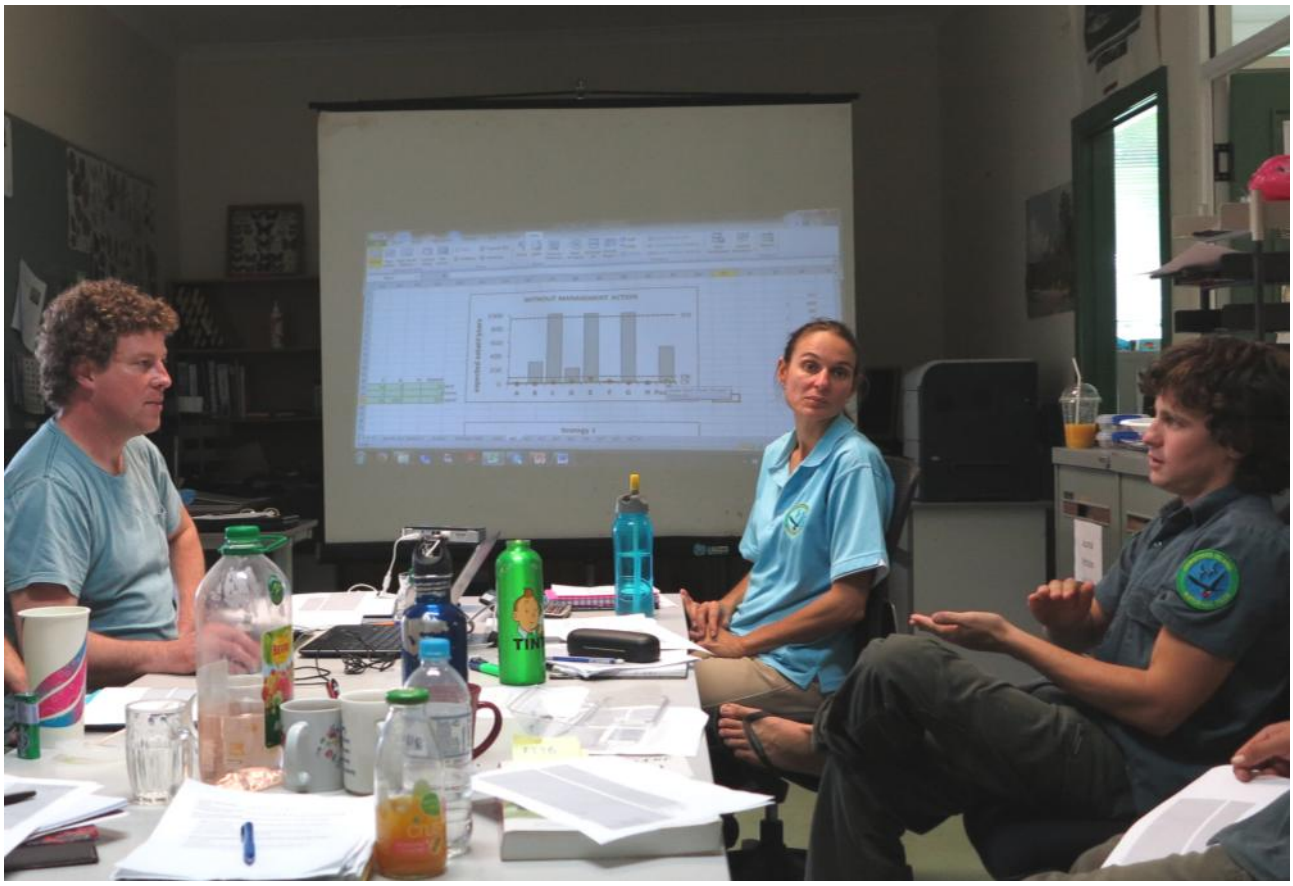
There is still a tendency to prioritize species (e.g. flagships; Verissimo et al., 2011) in conservation biology despite natural resource management being tied more specifically to the application of precise management strategies, with explicit costs, benefits and feasibilities (Game et al., 2013). We fill this gap by providing a user-friendly decision support tool based on cost-effectiveness calculations, which determines the set of management strategies that achieve the highest number of expected extant years across a group of threatened species given a budget constraint. The 'Cost-Effective Resource Allocator' is an advancement over approaches that prioritize the conservation of species with no consideration of data uncertainties or potential management trade-offs (as discussed in Tulloch et al., 2015). This tool also builds on previous frameworks (e.g. Joseph et al., 2009), as prioritizing at the strategy-level allows for more flexible resource allocation across multiple species (described in Game et al., 2013). It also provides a further example of a non-target based conservation prioritization framework, where the objective is to maximize the sum of expected extant years across a group of species, as opposed to maximizing the number of species that meet a specific persistence target (see Di Fonzo et al., 2016 for further examples of this approach, Chadés et al., 2015).

In addition to prioritizing management strategies according to their cost-effectiveness, the 'Cost-Effective Resource Allocator' offers the option of adjusting the results by excluding or including specific strategies, and through weighting strategies according to their value. Although weights have already been applied within species-level prioritization exercises (based on phylogenetic distinctiveness; Joseph et al., 2009; Bennett et al., 2014), this tool allows management strategies to be weighted according to a variety of favourable characteristics (e.g. whether they benefit species of iconic status, economic value or keystone importance). Additionally, managers can use the 'Cost-Effective Resource Allocator' to explore the impact of increasing or decreasing budgets on species' expected extant years, which can be useful for budget planning and as justification for greater funding if the current budget does not cover all proposed strategies.

The 'Cost-Effective Resource Allocator' does not have the capacity to evaluate the benefits of *ex-situ* captive breeding or research and monitoring activities as their outcomes require a series of probabilistic judgements that are not included in our spreadsheet file. We acknowledge that this shortcoming may be an issue for analysing species that are dependent on such management strategies (e.g. the Christmas Island Blue-tailed Skink (*Cryptoblepharus egeriae*) is entirely reliant on captive breeding; Smith et al., 2012). In situations where such strategies are expected to be beneficial, natural resource managers could apply approaches specifically designed for evaluating these strategies, such as the framework of Canessa et al. (2014) to determine the most cost-efficient *ex-situ* release strategy, or the value-of-information analysis of Maxwell et al. (2015) for deciding between gaining new information or funding direct management. The values obtained from these approaches could be included within this tool and evaluated against other strategies.

A second simplification of this tool is its assumption that the implementation of multiple management strategies will extend species' extant years in a straightforward, additive manner, which may not always be the case. Indeed, the combination of different strategies may lead to a range of synergistic and/or antagonistic effects (but see Auerbach et al., 2014 for an approach which considers co-variation between the benefits and costs of different actions). Furthermore, our tool assumes that the return-on-investment of different management strategies is linear, however it may be more plausible for increasing management effort to result in diminishing species' benefits (e.g. as represented by Wilson et al., 2009; Di Fonzo et al., 2016), which would slightly alter the results. The tool also assumes that all management strategies should be fully implemented to obtain their desired conservation outcomes, which may not always be the most cost-effective option depending on the form of their return-on-investment relationship (e.g. Cattarino et al., 2016).

Finally, this tool does not account for possible interspecific interactions (e.g. mutualisms, commensalisms, or predation), which may reduce



Expert elicitation discussions with Christmas Island National Park staff © Martina Di Fonzo

species' extant years if ignored. Resource allocation algorithms that account for these specific issues could be applied in situations where this is the case (e.g. Chadés et al., 2015; Firn et al., 2013).

The 'Cost-Effective Resource Allocator' is freely available, and can be operated with basic knowledge of Microsoft Excel. To further aid managers, the tool employs a simplified form of the IUCN Red List Criteria to ascertain the benefit of candidate management strategies for locally threatened species, which is an approach that we believe delivers a more rigorous and unbiased estimate than through direct elicitation of species' probabilities of persistence. This tool goes one step further in adapting the Red List Criteria to provide a continuous assessment of benefit, which allows for greater resolution than if the categorical Red List threat status (i.e. Critically endangered, Endangered and Vulnerable) were employed on their own. We hope that by developing a more user-friendly and accessible tool for prioritizing threatened species conservation, we can help natural resource managers achieve the greatest benefits for biodiversity per dollar spent.

ACKNOWLEDGEMENTS

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SUPPLEMENTARY ONLINE MATERIAL

Appendix S1. 'Cost-Effective Resource Allocator' spreadsheet tool. Assessors' identities have been replaced with fictional names.

Appendix S2. Tutorial with spreadsheet screenshots for each step.

Appendix S3. Instructions for undertaking value judgements.

Appendix S4. Strategy tables for expert elicitation.

Appendix S5: Steps for determining the benefit of each candidate action.

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RESUMEN

Ante los crecientes índices de pérdida de biodiversidad y los modestos presupuestos de conservación, es esencial que los administradores de los recursos naturales asignen sus recursos financieros de manera eficaz en cuanto a costos y que aporten pruebas transparentes para una financiación adicional. Desarrollamos el programa "Asignación eficaz de los recursos en función de los costos", una herramienta de apoyo a la toma de decisiones basada en Microsoft Excel para ayudar a los administradores de recursos naturales y a los responsables de la formulación de políticas a priorizar el conjunto de estrategias de gestión que maximizan el número total de años que se prevé persistirá un grupo de especies bajo una determinada limitación presupuestaria. Describimos esta herramienta utilizando un estudio de caso sobre cuatro especies amenazadas localmente del Parque Nacional de la Isla Navidad del Commonwealth de Australia en el Océano Índico. Estas incluyen: un helecho nativo (*Pneumatopteris truncata*), el cangrejo rojo de la Isla de Navidad (*Gecarcoidea natalis*), el rabijunco (*Phaethon lepturus fulvus*) y el piquero de Abbott (*Papasula abbotti*). Con base en un presupuesto hipotético de 8.826.000 dólares australianos en diez años, en el que todas las especies son consideradas iguales, nuestra herramienta recomienda financiar: la propagación y siembra de helechos, el control de ratas y gatos, y el estudio y control de la hormiga loca (*Anoplolepis gracilipes*). Determinamos que las clasificaciones en cuanto a costos de estas estrategias eran susceptibles a la importancia que los evaluadores asignaban a las diferentes especies. La herramienta “Asignación eficaz de los recursos en función de los costos” puede incorporar el aporte de hasta ocho evaluadores y analizar un máximo de 50 estrategias de gestión para 30 especies.

RÉSUMÉ

Afin de faire face à l’appauvrissement de la biodiversité et aux budgets de conservation limités, il est essentiel que les gestionnaires des ressources naturelles administrent leurs ressources de manière efficace, et puissent fournir des justifications pertinentes pour toute demande de financement additionnel. Nous avons mis au point un module de rentabilité et d’allocation des ressources: «Cost-Effective Resource Allocator», un outil d'aide à la décision basé sur Microsoft Excel pour aider les gestionnaires des ressources naturelles et les décideurs à hiérarchiser des stratégies de gestion qui optimisent le nombre d’années de survie possibles d’espèces dans le cadre de contraintes budgétaires. Nous présentons cet outil en nous appuyant sur une étude de cas basée sur quatre espèces localement menacées au parc national de l'île Christmas du Commonwealth d'Australie, situé dans l'océan Indien. Il s'agit notamment d'une fougère indigène (*Pneumatopteris truncata*), du crabe rouge de l'île Christmas (*Gecarcoidea natalis*), du Bosun d'or (*Phaethon lepturus fulvus*), et du Fou d'Abbott (*Papasula abbotti*). Avec l’hypothèse d’un budget de 8 826 000 AUD sur dix ans, et en partant du principe que toutes les espèces sont considérées comme égales, notre outil recommande le financement de: la propagation et de la plantation des fougères, la lutte contre les rats, le contrôle des chats et la surveillance et la lutte contre la fourmi folle jaune (*Anoplolepis gracilipes*). Nous avons constaté que le classement coût-efficacité de ces stratégies pouvait varier selon l'importance que les évaluateurs assignent aux différentes espèces. Cet outil peut incorporer la contribution de jusqu'à huit assesseurs et analyser un maximum de 50 stratégies de gestion pour 30 espèces.