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IUCN WCPA WORLD COMMISSION ON PROTECTED AREAS

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protected planet

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)

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

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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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PARKS: THE INTERNATIONAL JOURNAL OF PROTECTED AREAS AND CONSERVATION

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EDITORIAL

Marc Hockings, Managing Editor

Issue 24.1 is the first issue published in the new timetable of publication dates in May and November, spacing the two issues more evenly during the year. Submissions to *PARKS* continue to grow as it consolidates its role as a peer-reviewed journal linking researchers and managers of protected areas. At the same time the journal is and should remain primarily a resource for people actively involved in establishing and managing protected areas with the majority of papers accepted to include practical management information.

The papers in this issue illustrate this well with a diverse set of papers from Africa, the Arab States, South Asia and North America as well as more globally focussed papers on issue of protected area policy and management. Most of the papers include specific information or recommendations that can be used by managers in their work. Rouphael, for example, in his paper on monitoring achievement of conservation goals in marine protected areas, addresses an issue that is often challenging for managers and he provides practical advice on statistical approaches to support sound decision-making.

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. A number of papers combine authorship across researchers and managers, perhaps none more explicitly that the paper by Dudley and colleagues that compiles the views of practitioners and researchers on research priorities for protected areas. Papers by Mkanda et al., Eustace et al. and Uddin and Parr bring together authors from management agencies, consultants and training institutions to report on joint work undertaken in protected area management.

Issue 24.1 introduces a new design for *PARKS* and we introduce the capacity for people to register on the *PARKS* website (parksjournal.com) for a mailing list that will advise readers when a new issue is released.

IMPLEMENTATION OF THE PERIODIC REVIEW REQUIREMENT IN THE ARAB-MAB NETWORK: LESSONS FOR IMPROVING BIOSPHERE RESERVE EVALUATION

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ABSTRACT

Biosphere Reserves have been managed worldwide to demonstrate three integrated functions within their triple zonation scheme: conservation of natural and cultural values, logistic support and sustainable socio-economic development. Evaluation of these functions is formalised within the Periodic Review process whereby reports are submitted every ten years with the primary intent to evaluate the effectiveness of Biosphere Reserve concept implementation locally. However, the effectiveness of the Periodic Review as an evaluation system is poorly understood, and studies that document its regional implementation are lacking. Here we present the first regional review of the Periodic Review evaluation within the ArabMAB network. Using a mixed methods approach, we assess compliance with the Periodic Review report submission requirement, and quality of Periodic Review reports based on a novel approach. Our results show that the Periodic Review is characterised by significant delays (mean = 7.6 years), with five of 27 reports missing. Report quality for seven available reports varies, with most rating as low to average quality, and many lacking essential elements to assess Biosphere Reserve concept implementation as defined by Article 4 of the Statutory Framework of the World Network of Biosphere Reserves. We discuss factors that hinder successful compliance with the Periodic Review requirement regionally, and offer recommendations for improving Biosphere Reserve evaluation.

Key words: ArabMAB network, evaluation, management effectiveness, Man and the Biosphere (MAB), periodic review, UNESCO Biosphere Reserve

INTRODUCTION

Biosphere Reserves and the world network

Biosphere Reserves (BRs) are internationally designated sites under UNESCO's Man and the Biosphere (MAB) programme. Their main aim is to demonstrate model sites for sustainable development. Based on the conceptual definition laid down by UNESCO (1996) in the Statutory Framework of the World Network of Biosphere Reserves, BRs are designed with a triple zonation scheme that consists of core, buffer and transition zones. The three zones serve three integrated functions: (1) conservation of natural and cultural values, (2) logistic support for monitoring environmental change, research, education and training and (3) sustainable socio-economic development (UNESCO, 2017a).

Since the first designation in 1976, the World Network of Biosphere Reserves (WNBR) has grown to comprise 669 sites in 120 countries (UNESCO, 2017a), organised into regional networks: (1) AfriMAB for Africa; (2) IberoMAB for Latin America and the Caribbean; (3) EuroMAB for Europe and North America; (4) ArabMAB for Arab States; (5) the sub-regional networks of Asia and the Pacific; and (6) the inter-regional REDBIOS network. Regional networks are a key feature of the MAB programme and aim at fostering the exchange of knowledge and experience while promoting regional collaboration between BRs (UNESCO, 2017b).

Biosphere Reserve evaluation

Though designated internationally by UNESCO, BRs remain under the jurisdiction of their States. It is therefore the State's responsibility to ensure that appropriate governance and management plans are developed and operationalised by the BR governing institutions (public, private, NGOs or a combination of several institutions). Due to the complexity of the BR model both in concept and practice, its evaluation has evolved slowly relative to the general Protected Areas Management Effectiveness (PAME) evaluation discourse, and remains in need of improvement (Matar & Anthony, 2017; Price et al., 2010).

In 1995, the need for introducing an evaluation system for BRs was recognised by the MAB Secretariat, based on an evaluation of the 1984 Action Plan for Biosphere Reserves (Price, 2002). In response, the Periodic Review (PR) requirement was introduced after the Seville meeting in 1996, as the official process for the evaluation of BR implementation (UNESCO, 1996). As defined by the UNESCO-MAB programme, its overall objective is "to improve the biosphere reserves' quality and functioning as sites for testing and demonstrating approaches to sustainable development" (UNESCO, 2017c). The evaluation tool is a standard form – the PR Form – designed by UNESCO-MAB in 1996, and later updated in 2013 (Table 1).

The PR Form's main objective is to evaluate the effectiveness of the BR concept implementation locally, as defined in Article 4 of the Statutory Framework (UNESCO, 1996). It therefore focuses on compliance with, and appropriateness of the triple zonation

Table 1. Structure of the old and new versions of the Periodic Review Form

Structure	Old version titles (1996)	New version titles (2013)
Chapter I	Name	Biosphere reserve
Chapter II	Country	Significant changes in the biosphere reserve during the past ten years
Chapter III	Physical characteristics	Ecosystem services
Chapter IV	Zonation	The conservation function
Chapter V	Human activities	The development function
Chapter VI	Research and monitoring programmes	The logistic function
Chapter VII	Education, training and public awareness programmes	Governance, biosphere reserve management and coordination
Chapter VIII	Institutional arrangements	Criteria[a] and progress made
Chapter IX	Conclusion: Criteria[a] and progress made	N.A.

N.A. Not Applicable
Source: Adapted from Matar & Anthony, 2017
[a] Refers to Criteria of Article 4 of the Statutory Framework of the WNBR (UNESCO, 1996, p.17)

Dragon's Blood Trees (Dracaena cinnabari), Socotra Archipelago, Yemen © Rod Waddington

scheme; implementation of the triple functions requirements; local participation of authorities and communities in decision-making; collaboration with other BRs in the world network; and effectiveness of governance and operational mechanisms (plans, policies, programmes of work) (UNESCO, 1996). In order to assess compliance with and progress made on the above-mentioned elements, the PR Form 'asks' a series of qualitative questions and requests supporting documentation to validate claims made by the institution completing the form[1] (Matar & Anthony, 2017).

Periodic Review implementation and challenges

As of 1996, BRs were required to submit a PR report every ten years after their designation date, and all BRs designated before 1986 were expected to submit a first report in 1996 (Price et al., 2010; UNESCO, 1996). Until 2016, there were high levels of non-compliance with the PR requirement, in addition to major delays in response at an international level (Matar & Anthony, 2017; Price et al., 2010). For a long period (1996–2013), UNESCO-MAB authorities remained lenient with non-compliance, but the need for stricter enforcement was recognised in 2013, leading to the introduction of the Exit Strategy. The Strategy enabled UNESCO to withdraw a BR from the WNBR if it fails to: (1) submit a PR report after two warning letters are sent over a period of nine months since submission due date, or (2) fulfil the criteria of Article 4 after recommendations are made by the UNESCO-MAB Secretariat for corrective measures (Matar & Anthony, 2017; UNESCO, 2014). The implementation of the Exit Strategy recently gained momentum. As of May 2017, of 270 affected BRs in 2013, 126 (46.7 per cent) had satisfactorily responded to concerns on compliance with Article 4, by either submitting a follow-up report or a required PR report (UNESCO, 2017d).

As of 2017, the UNESCO-MAB Secretariat had received and examined 370 PR reports. The process resulted in the voluntary withdrawal of 38 BRs from the world network, with a massive recent withdrawal of 17 of 31 BRs in the United States (UNESCO, 2017c; 2017d). None of the withdrawn BRs were from the ArabMAB network, and all (except for one in the United States) were designated before 1987. The difficulty these early-designated BRs have in complying with the concept implementation lays mainly in applying the triple zonation scheme appropriately due to the designation approach used by UNESCO at the beginning of the MAB programme, that superimposed BR designation on existing protected areas (Ishwaran et al., 2008; Matar & Anthony, 2017). Though many sites remain challenged, the stricter enforcement of the PR requirement has generally yielded good results for many BRs in the world network, including revisions of zonation to better fulfil Article 4 criteria (Matar &

Figure 1. Map of Arab States

Anthony, 2017; Price, 2017). BRs that still present compliance issues, or those that have not yet submitted a PR, are given a last chance to do so by 2018–2019, and final decisions will be made in 2020 (UNESCO, 2017d).

Challenges faced locally by BR authorities in fulfilling the PR reporting requirement have been minimally documented and thus remain largely unknown. Sites designated before 1987 were found to have a higher rate of non-response, which is aligned with those that withdrew voluntarily from the network. In addition, a review of 12 countries showed that the costs of preparing one PR report could be considerable (Price et al., 2010). Peer-reviewed publications documenting national and regional experiences and challenges with PR implementation have been limited to the United Kingdom (Price, 2002) and Canada (Reed & Egunyu, 2013).

The need to research and document experiences of PR implementation in other regions beyond Europe and North America (i.e. EuroMAB) has been identified in a recent review of the discourse evolution of BR evaluation (Matar & Anthony, 2017). Researching and documenting local challenges faced by authorities is valuable for the improvement of BR evaluation. This in turn can help improve the potential of BRs to fulfil their conservation, development and logistic functions, therefore enhancing the MAB programme's contribution to the global sustainability agenda.

The ArabMAB network

The Arab region

Located at the crossroads between Asia, Europe and Africa, the Arab States consist of 22 countries as per UNESCO classification (Figure 1), including 12 countries in West Asia (Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic (or Syria), United Arab Emirates (U.A.E.), and Yemen); six in North Africa (Algeria, Egypt, Libya, Morocco[2], Sudan[3] and Tunisia); three in East Africa (Comoros, Djibouti, Somalia); and one in West Africa (Mauritania).

Although Arab countries share many cultural features including the Arabic language, and a common history,

Old cedar tree, Barouk Cedar Forest , Lebanon © Shouf Biosphere Reserve

they present large disparities in climate, ecosystems (deserts, wetlands, oases, forests, coastal and marine), socio-demographics, economic development, resources, political regimes and stability (Mirkin, 2010).

The ArabMAB programme and regional conservation efforts

The ArabMAB regional network currently includes 30 sites[4] in 11 countries (UNESCO, 2017e). Despite an unstable socio-political context, countries of the ArabMAB network have made significant efforts towards conservation in the past two decades by joining related multi-lateral agreements and following the global trends of expanding their protected areas network (Matar, 2015; Talhouk & Abboud, 2009; UNEP, 2010; UNESCWA, 2010). The impacts of these efforts on conservation and sustainability outcomes are not well understood, nor are the impacts of recent destructive conflicts (Syria, Yemen, Sudan). Nevertheless, there has been a recognised need for increased regional cooperation and the development of integrated solutions that reconcile conservation with sustainable development (UNEP, 2010; CBD, 2017). The MAB programme can therefore play a key role in promoting the integration of these goals, and help foster regional collaboration.

The ArabMAB institution

The ArabMAB network was established in Amman, Jordan in 1997, with the main objective of promoting cooperation and collaboration between the region's National MAB Committees, in order to facilitate and support the implementation of the MAB programme in the Arab States. Main themes of cooperation defined by the ArabMAB network include the designation and establishment of new BRs, and the implementation of common research and educational activities (UNESCO, 2017f).

The institutional structure of the ArabMAB includes the Arab Coordinating Council, elected and mandated for formulating general policies, issuing decisions that promote the network, and following-up on their implementation (Salem, 1998). This Council is composed of interested members of the ArabMAB

Table 2. Criteria of Article 4 of the Statutory Framework

	Criteria
1	Representative ecological systems – graduation of human interventions
2	Significance for biological diversity conservation
3	Approaches to sustainable development on a regional scale
4	Appropriate size to serve the three functions
5	Appropriate zonation to serve the three functions
6	Participation of public authorities and local communities
7	a) mechanisms to manage human use and activities b) management policy or plan c) authority or mechanism for implementation d) programmes for research, monitoring, education and training

Source: UNESCO, 1996, p.17

National Committees, who elect an ArabMAB Bureau responsible for administration and management between the two Council meetings. A regional Secretariat is also established in a host member country to coordinate activities with the main regional UNESCO office based in Cairo, and the international UNESCO-MAB Secretariat in Paris (Matar, 2015).

Research scope and questions

In the context of a larger study on the status of concept implementation and management effectiveness of BRs in the Arab region, we identified the need to assess the status of PR implementation within the ArabMAB network (Matar, 2015). Using the lens of adaptive management applied to BR management, we recognised the importance of assessing the effectiveness of the current BR evaluation system, namely Periodic Review, as an integral and key aspect of understanding BR concept implementation and management effectiveness. Here we address the following questions:

1. To what extent have Arab BRs been compliant with the PR submission requirement, and how does this compare to the global trend?
2. How can the quality of submitted PR reports be characterised relative to the report's main goal of assessing compliance with Article 4 of the Statutory Framework?
3. What region-specific factors impact the effective implementation of the PR, and compliance with the reporting requirement?
4. How can these findings inform further action to improve the evaluation of BRs in the Arab region?

METHODS

Assessing compliance with the PR report submission requirement

We collected online periodic review submission data available from UNESCO-MAB sources. When applicable, we compiled the number and dates of PR submissions per BR, and computed delays in the submission of a first PR report using the 10-year period (relative to the designation date) as the standard timeline. Since BRs designated before 1986 were required to submit their first PR report (PR1) in 1996, we used 1996 as their submission due date. As for compliance with second PR report (PR2) submissions, we calculated delays based on a 10-year additional period since submission of PR1, when applicable. Our results excluded BRs for which a PR was not yet required (i.e. designated < 10 years ago). For PR1 and PR2 submissions, only years are reported with no reference to months. Therefore we used a simplified estimate of delays by subtracting 'year PR submitted' from 'year PR due' for PR1 and PR2. The number of years of delay is therefore expressed as a negative value, while positive values indicate the number of years the report was submitted in advance of the due date.

Cattle in Lake Aboulmime, Djurdjura Biosphere Reserve, Algeria © M.D.S. Akli

Assessing PR report quality

In a second step, submitted PR reports were solicited from the UNESCO-MAB Secretariat, regional UNESCO offices, National Committees or directly from BR staff when accessible. Despite extended efforts, less than half were obtained (seven of 16 existing reports when data was collected in 2014). The reports were obtained in digital format and excluded appendices, and we obtained permission from the MAB Secretariat to use them for scientific research while respecting anonymity. All collected reports were completed on the old version (Table 1) of the PR Form, and submission languages included French and English. We analysed PR reports using document analysis, a method known to be useful when determining if programme implementation reflects programme plans and constituencies (Bowen, 2009). Using content analysis (Krippendorff, 2004), we assessed report quality, specifically the degree to which Article 4 criteria of the Statutory Framework (Table 2) were addressed in the PR report.

In the absence of a standard rating system for the quality of a PR report, we reviewed existing rating frameworks for other types of reports in the environmental reporting space. We found that Environmental Impact Assessment (EIA) reporting experts have developed a detailed evaluation framework useful to the analysis of PR reports. Given the large differences in the types and goals of the EIA report compared to the PR report, we selected three EIA report evaluation criteria that are relevant and generalizable to report quality analysis, in addition to substantive content as the main determinant of report quality. These include completeness, comprehensibility and coherence of structure and format (Sandham & Pretorius, 2008). In the old PR Form, questions directly assessing compliance with the BR concept implementation are concentrated in the Conclusion, that is, in Chapter IX (Table 1), the only chapter that explicitly requests the BR to explain how each of the criteria of Article 4 is applied in practice. However, since earlier chapters in the PR Form elaborate some aspects of Article 4 criteria, we considered overall content of the report when assessing report quality.

Our evaluation of quality yielded three ratings: Low for reports not addressing the criteria of Article 4 in Chapter IX at all, but partially addressing them through previous chapters in the report; Average for reports partially addressing the criteria of Article 4 through Chapter IX and previous chapters; and High for those adequately addressing all of Article 4 criteria including within Chapter IX.

Data analysis and recommendation development

To address our third research question, we then carried out a series of consultations with senior experts and regional consultants: Mr Faisal Abu-Izzeddin, senior

consultant and advisor of the Shouf Biosphere Reserve in Lebanon – who recently (2017) completed and submitted its first PR report; and Dr Ghassan Ramadan -Jaradi, Secretary-General of the National MAB Committee in Lebanon. These informal communications aimed at learning, through a case study from the region, (1) how the PR evaluation is conducted locally; (2) how it is perceived by an implementing BR; and (3) local perspectives on, and recommendations for, improving BR evaluation.

Finally, we analysed our results on compliance with PR submission and on report quality, in light of insights gained through the experience of an implementing BR in the region, and combined them with the relevant literature to evaluate the effectiveness of the PR in the ArabMAB region as the sole evaluation method required officially for BRs by the UNESCO-MAB Secretariat. Using the adaptive management framework as an analytical tool, we then conclude with recommendations for improving BR evaluation in the ArabMAB network.

RESULTS

Compliance with the PR report submission requirement

Compiled data collected from the literature review and online submission data was used to summarise the status of compliance of ArabMAB BRs with the PR process (Table 3).

The review of the overall submissions shows that a total of five of 27 (18.5 per cent) due PRs are missing for full compliance with the basic submission requirement, with a mean delay of 7.6 years (and growing). The unsubmitted reports are all PR2 reports for the four Tunisian BRs in addition to Radom in Sudan.
All 19 PR1 reports submitted were submitted with delay, ranging from one to 18 years (mean = 3.8). Only three of eight due PR2 reports were submitted from the ArabMAB network: Wadi Allaqi's PR2 report was the only one submitted on time (two years early) of all PR1 and PR2 reports, Dinder's PR2 was submitted with only one year delay, while El Kala's from Algeria was submitted with four years delay.

Ain Zhalta Cedar Forest, Lebanon © Shouf Biosphere Reserve

Table 3. Summary of Periodic Review submissions for ArabMAB network countries

	Biosphere Reserves[a]	Year of Designation[a]	PR1 due	PR1 actual submission[a]	PR1 delay	PR2 due	PR2 actual submission[a]	PR2 delay
ALGERIA	Tassili N'Ajjer	1986	1996	2014	-18			
	El Kala	1990	2000	2002	-2	2012	2016	-4
	Djurdjura	1997	2007	2011	-4			
	Chrea	2002	2012	2014	-2			
	Taza	2004	2014	2016	-2			
	Gouraya	2004	2014	2016	-2			
	Belezma	2015	N.A.					
	Tlemcen Mountains	2016	N.A.					
EGYPT	Omayed	1981, Ext 1998*	2008	2011	-3			
	Wadi Allaqi	1993	2003	2004	-1			
JORDAN	Dana	1998	2008	2014	-6			
	Mujib	2011	N.A.					
LEBANON	Shouf	2005	2015	2017[b]	-2			
	Jabal Al Rihane	2007	2017**					
	Jabal Moussa	2009	N.A.					
MOROCCO	Arganeraie	1998	2008	2010	-2			
	Oasis du Sud Marocain	2000	2010	2017[c]	-7			
	Atlas Cedar	2016	N.A.					
QATAR	Al Reem	2007	2017**					
SUDAN	Dinder	1979	1996	2001	-5	2011	2012	-1
	Radom	1979	1996	2001	-5	2011	N.S.	-6
	Jebel El Dair	2017	N.A.					
SYRIA	Lajat	2009	N.A.					
TUNISIA	Djebel Bou-Hedma	1977	1996	1999	-3	2009	N.S.	-8
	Djebel Chambi	1977	1996	1999	-3	2009	N.S.	-8
	Ichkeul	1977	1996	1999	-3	2009	N.S.	-8
	Iles Zembra et Zembretta	1977	1996	1999	-3	2009	N.S.	-8
UAE	Marawah	2007	2017**					
YEMEN	Socotra Archipelago	2003	2013	2016	-3			
	Bura'a	2011	N.A.					

N.A. Not applicable, N.S. Not submitted, Sources: [a] UNESCO (2017e), [b] Abu-Izzeddin (pers.comm.), [c] UNESCO (2017d)
* The 1998 extension date was retained for analysis, ** These sites were not included in this PR compliance analysis since their submission will be documented in the next MAB ICC meeting (2018)

Table 4. Summary of Periodic Review report quality (Country and Biosphere Reserve names omitted to respect anonymity)

ArabMAB Biosphere Reserve number	Overall quality rating	Complete	Comprehensible	Coherent structure and format
BR1	Average	No	No	Yes
BR2	High	Yes	Yes	Yes
BR3	High	Yes	Yes	Yes
BR4	Low	No	No	No
BR5	Low	No	No	No
BR6	Average	No	No	Yes
BR7	Average	No	No	Yes

Analysis of language preferences shows that Algeria, Morocco and Tunisia submitted PR reports in French, while Jordan, Lebanon, Egypt, Sudan and Yemen used the English Form.

Report quality and compliance with Article 4 of the Statutory Framework

Table 4 presents findings from content analysis of the seven accessed PR reports submitted between 2009 and 2013, from Algeria, Egypt, Jordan and Morocco.

Report quality for the ArabMAB PR reports varies with most (3/7) rating as Average. For the five reports that rated as Low or Average quality, the problem lies mainly in not adequately responding to direct questions relating to 'how the BR is addressing each of the criteria of Article 4 of the Statutory Framework', by either omitting completely Chapter IX (4/7) or only partially addressing it (1/7). Based on the latest MAB ICC report, BRs scoring Low on report quality in our analysis, include two of three Arab BRs still considered non-compliant with Article 4 criteria based on recent evaluations by UNESCO-MAB authorities (UNESCO, 2017d). Moreover, only two of the reports were consistently complete, comprehensible and maintained a coherent structure and format as prescribed by the Form.

DISCUSSION

PR review in ArabMAB compared to international implementation

Until 2016, there was still a large gap in PR implementation in the ArabMAB network, with 13 of 27 PR1 and PR2 reports still missing for compliance with the submission due date (Matar, 2015). However, with the recent submission of seven reports between April 2016 and May 2017 (UNESCO, 2017d), this gap was narrowed to five missing PR2 reports only. Therefore compliance was slow for the ArabMAB network until the Exit Strategy and related follow-up were enforced effectively in 2016–2017. This finding is aligned with the international response trend to the PR submission requirement (Price, et al., 2010; UNESCO, 2009, 2017d). However, comparison of our results with the findings from the Canadian review of the PR evaluation process (Reed & Egunyu, 2013) reveals striking differences in compliance both in the level of delays and report quality, that is, all 15 PRs due for submission by the Canadian BRs were submitted on time, and all reports included clear evidence of compliance with the criteria of Article 4 (Reed & Egunyu, 2013). These differences emphasize the importance of conducting further research and documenting factors impacting the effective evaluation of BRs in different regional and national contexts, in the aim of exchanging know-how and improving BR evaluation.

For the ArabMAB, the lack of adequate information on how Article 4 criteria have been addressed at the BR level, both in Chapter IX or elsewhere in the report, in addition to persistent delays in submission, reflect potential problems for PR implementation in the region. We identify some of these problems by complementing our findings with our communications with local BR authorities in Lebanon, and further triangulating results with existing literature on the ArabMAB network.

Regional factors impacting effective PR implementation

Lack of perceived benefit for management

A challenge that emerged through our discussions with local BR staff was that, at least in some cases, PR

reporting is perceived as an administrative task with no perceived benefit to the internal staff working on the management of the BR, that is, reporting only because it is required, without perceiving the value of the process as a positive self-serving and learning tool for management improvement (Abu-Izzeddin, pers. comm.). This is particularly relevant to BRs that are already complying well with the BR concept implementation, and maintain high standards of management (updated management plans and sound management practices), such as Shouf BR in Lebanon (Matar, 2015; Van Cuong et al., 2017). In this particular case, the PR reporting process is perceived as overly bureaucratic, with lengthy forms comprising vague and repetitive questions, and no benefit to local management beyond fulfilling the submission requirement for compliance with the UNESCO-MAB programme (Abu-Izzeddin, pers. comm.). This aspect can reduce motivation to complete the PR reporting on time – especially when the enforcement and follow-up by UNESCO-MAB was weak, as the PR evaluation is experienced more as a burden rather than a learning exercise. Moreover, the 10-year period between evaluations decreases the perceived value and seriousness of the PR overall, since "UNESCO-MAB is entitled to follow-up earlier than 10 years on effective implementation by designated BRs" (Abu-Izzeddin, pers. comm.).

Self-evaluation bias

Similar to findings concerning other self-evaluation management effectiveness assessment tools, we suggest that the PR process in our context may suffer from interviewee bias (Cook & Hockings, 2011; Papp, 2011). This deficiency results from self-serving or motivational biases in attributions of causality, whereby individuals tend to accept responsibility for positive outcomes and deny responsibility for negative outcomes (Bradley, 1978). Further expressions of these types of bias may result in either defensive or counter-defensive attributions by participants (Bradley, 1978), for instance, inflation of successes by BR managers if they feel the evaluation is directly linked to their job performance, or understating successes to attract

Shouf Biosphere Reserve Team, Park House, Maasser El Shouf, Lebanon, December 2017 © Shouf Biosphere Reserve

Internal meeting, Shouf Biosphere Reserve © Shouf Biosphere Reserve

additional resources for management. Secondly, the accuracy of expert opinion can vary greatly, with both evaluation and understanding of concepts highly dependent on the evaluator(s) selected for the assessment (Johnson & Gillingham, 2004). This particular challenge was confirmed in our informal communication, as it was felt that the PR reporting process, if conducted only by internal members and hired consultants, can be highly susceptible to such bias and "lovely documents can be produced but they don't reflect reality" (Abu-Izzeddin, pers. comm.).

Lack of communication and assistance

In response to the international implementation challenges of the PR process, the UNESCO-MAB Secretariat has expressed a commitment to offer technical support through UNESCO's regional offices (Matar & Anthony, 2017; Price, 2002; Price et al., 2010). Hence, in the case of the ArabMAB network, this is the responsibility of the Cairo regional office. However, a local MAB National Committee has reported the absence of communication between the regional office and individual BRs locally regarding the PR process (Ramadan-Jaradi, pers. comm.). In addition, the interviewed BR staff mentioned that the process consisted only of receiving notification from the MAB National Committee about the request to submit a 10-year PR report (with no offer of support or assistance), quickly completing the report collaboratively, submitting the complete report to the National Focal Point, and receiving no substantive feedback on its contents. This simple administrative procedure confirms the absence of channelled support from UNESCO authorities to BR local staff for the evaluation process in the ArabMAB regional network. The recent recommendation for technical missions to be financially covered by hosting countries to support the PR process (UNESCO, 2017d) partially addresses this issue. However, since costs are still prohibitive for many countries to conduct the PR evaluation, other approaches to support the evaluation process should be considered.

Language

The language preferences for PR reporting for most countries are consistent with respondent preferences

per country in a recent survey on the ArabMAB region (i.e. French for Algeria and Morocco, English for Egypt and Jordan, and Arabic for Sudan and Yemen) (Matar, 2015). Therefore, the absence of Arabic language as an option for PR reporting may be one of the causes of delays in PR compliance for countries demonstrating an Arabic language preference (Matar, 2015). Though the BR staff that we interviewed did not encounter a language problem, they did confirm that the meetings conducted as part of the PR process used the local Arabic dialect as the conversation language and that they had internal staff with a good level of English writing skills. However the senior advisor who completed the PR Form mentioned that "if another BR in the region does not have an internal staff member with the required language skills, they may need to hire an external consultant" (Abu Izzeddin, pers. comm.). This in turn would add to the cost of the process, which may create a burden on the BRs' rather limited financial resources for management (Matar, 2015). For example, the cost of PR preparation in Sudan was reported to be in the range of US$ 3–5,000 (Price et al., 2010), which was comparable to Germany, and is considered quite high relative to the Sudanese economy.

Political instability and conflicts

Political instability is one of the major adverse characteristics of the Arab region, which has its impact on conservation management mainly through shifting priorities towards more urgent issues. This includes mobilizing human and financial resources for defence, security and basic needs, and often shifting nature conservation lower on the list of national priorities (Matar, 2015).

The latest MAB ICC meeting report (UNESCO, 2017d) explains the lack of submission of the remaining five missing PR reports, with political instability and security issues in both Tunisia and Sudan (for Radom). However, for the specific situation of being in a conflict zone, UNESCO-MAB has taken a special decision to postpone the enforcement of PR report submission until the situation becomes more stable. In the ArabMAB network, the five affected BRs submitted the follow-up reports that address recommendations made by the MAB Advisory Committee based on their PR1, and were evaluated as compliant with Article 4 (UNESCO, 2017d). Nevertheless, destructive conflicts in the Arab region have been, and remain, a constant threat for natural and cultural heritage preservation.

CONCLUSION AND RECOMMENDATIONS

Though PR implementation has been challenging in the ArabMAB region, none of the Arab BRs have been withdrawn from the WNBR, and UNESCO-MAB's recent final evaluations based on the Exit Strategy mention only three BRs from the region as not yet complying with Article 4 criteria (UNESCO, 2017d). Moreover, there is a local will and interest to improve the situation of BRs and increase their resilience in the face of political turmoil (Matar, 2015). From that perspective, and in light of our results, we have co-developed with the practitioners in Lebanon a series of recommendations that address the identified challenges, and can help improve BR evaluation in the Arab region, and beyond as relevant:

1. Creating a simpler, briefer tool for PR evaluation that would capture the essential elements of BR concept implementation without being excessive in length.

2. Introducing external evaluators who are local or regional experts and speak the local languages. They should be confirmed and trained by UNESCO-MAB for conducting PR evaluations, and should have no conflict of interest in conducting the task.

3. Conducting evaluations every five years instead of 10, which would increase the perceived value of the evaluation for local BR staff and avoid protracted delays in capturing concept implementation problems that need more immediate actions (Matar & Anthony, 2017; Price et al., 2010).

4. Promoting communication between regional offices and MAB constituencies nationally, to gain a better understanding of local needs. In the absence of budgets for regional offices to host technical missions to the ArabMAB region, it would be useful to consider channelling technical assistance remotely if physical presence is not possible, and when relevant.

5. Finally, considering technological advances, it is not inconceivable to develop a digital, and more visual and interactive PR Form for the next generation of BRs. This can make the PR report a dynamic living document and improve interest and motivation to conduct the review by local staff, as compared to completing a lengthy form that "dies an immediate death after submission" (Abu-Izzeddin, pers. comm.).

ENDNOTES

[1] For a detailed description of the PR report submission procedures, refer to Matar & Anthony (2017); Price (2002); Price, et al. (2010); Reed & Egunyu (2013).

[2] Morocco is assumed to include the disputed Western Sahara in this study.

[3] Sudan still included South Sudan at the time this study was conducted (started in 2011).

[4] The transboundary reserve between Morocco and Spain, i.e. the Intercontinental Mediterranean

Biosphere Reserve was excluded due to its shared governance with a European country, Spain.

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RESUMEN

Las reservas de biosfera se han gestionado en todo el mundo para demostrar tres funciones integradas dentro de su esquema de triple zonificación: la conservación de los valores naturales y culturales, el apoyo logístico y el desarrollo socioeconómico sostenible. La evaluación de estas funciones se formaliza dentro del proceso de revisión periódica mediante el cual cada diez años se presentan informes con la intención principal de evaluar la eficacia acerca de la implementación del concepto de reserva de biosfera a nivel local. Sin embargo, la eficacia de la revisión periódica como sistema de evaluación es poco conocida, y faltan estudios que documenten su implementación a nivel regional. Aquí presentamos la primera revisión regional sobre la evaluación de la revisión periódica dentro de la red ArabMAB. Mediante un enfoque novedoso basado en métodos mixtos, evaluamos el cumplimiento con el requisito de presentación y calidad de los informes de revisión periódica. Nuestros resultados reflejan que la revisión periódica se caracteriza por retrasos considerables (promedio = 7.6 años), con un faltante de cinco de los 27 informes. La calidad de los informes para siete informes disponibles varía, siendo esta de baja a media en la mayoría de los casos, y muchos carentes de elementos esenciales para evaluar la implementación del concepto de reserva de biosfera según la definición del artículo 4 del Marco Estatutario de la Red Mundial de Reservas de Biosfera. Abordamos los factores que impiden el cumplimiento exitoso del requisito de revisión periódica a nivel regional y ofrecemos recomendaciones para mejorar la evaluación de las reservas de biosfera.

RÉSUMÉ

Les réserves de biosphère à travers le monde ont été gérées de façon à mettre en exergue trois fonctions intégrées dans le cadre du plan de zonage triple: la conservation des valeurs naturelles et culturelles, le soutien logistique, et le développement socio-économique durable. L'évaluation de ces fonctions est formalisée dans le cadre du processus d'Examen Périodique, selon lequel des rapports sont soumis tous les dix ans dans le but principal d'évaluer l'efficacité de la mise en œuvre du concept au niveau local. Cependant, l'efficacité de l'Examen Périodique en tant que système d'évaluation est mal comprise et les études qui documentent sa mise en œuvre régionale font défaut. Nous présentons ici la première revue régionale d'évaluation de l'Examen Périodique au sein du réseau ArabMAB. En utilisant une méthodologie mixte, nous évaluons la régularité dans la remise des rapports d'Examen Périodique, ainsi que la qualité des ces rapports, en fonction d'une nouvelle approche. Nos résultats montrent que l'Examen Périodique est caractérisé par des retards importants (retard moyen: 7,6 ans). Cinq des 27 rapports étant manquants. La qualité des sept rapports disponibles est inégale, la plupart des notes étant de qualité faible à moyenne, et plusieurs manquent d'éléments essentiels pour permettre une évaluation réelle de l'implémentation du concept de réserve de biosphère, tel que défini par l'article 4 du Cadre statutaire du Réseau Mondial des Réserves de Biosphère. Nous abordons ici les facteurs qui entravent le respect de l'exigence d'un Examen Périodique au niveau régional, et proposons des recommandations pour améliorer l'évaluation des réserves de biosphère.

'THE GIANT SLEEPS AGAIN?' - RESOURCE, PROTECTION AND TOURISM OF KAFUE NATIONAL PARK, ZAMBIA

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ABSTRACT

The phasing out of the Kafue Programme that aimed to secure critical habitats and species in the Kafue National Park and adjacent Game Management Areas was greeted with mixed reactions. Some stakeholders, particularly tour operators, were despondent; they postulated that the park would revert to the previous state of neglect. Other stakeholders, however, contended that the programme had achieved its purpose. Moreover, such despondency merely risked discouraging potential investors in tourism, the main source of revenue for the park. This study attempts to verify if the despondency was justified. It examines the resource, resource-protection effectiveness and tourism during and after the programme. The results are varied. While populations of 'key' wildlife species continued to grow, and numbers of tourists and the associated revenue had increased four years after the programme, illegal activity also increased to the level of the pre-programme period. Therefore, to a certain extent the concern was justified, the giant sleeps again and its potential remains untapped. It is essential for the Department of National Parks and Wildlife to take measures to curb the poaching of all species affected.

Key words: challenges, concern, resource, resource protection, tourism, revenue

INTRODUCTION

Proclaimed by the Governor of Northern Rhodesia (now Zambia) on the 20 April 1950 as a Game Reserve (Moss, 1976; Mwima, 2001), the Kafue National Park (KNP), one of the largest national parks in the world (about 22,480km2), was given its full national park status on 25 February 1972 under the National Parks and Wildlife Act. The park is considered to be one of the most important wildlife areas and eco-tourism destinations in Southern and Eastern Africa offering wilderness experiences of the "Real Africa" (Zambia Wildlife Authority, 2004). It has great potential for the development of a competitive nature-based tourism because of its exceptionally large variety of wildlife, distributed throughout in varying densities and diversity. Tourism activities include game drives, game viewing by boat, walking and bird safaris, river canoeing, angling, boat cruises, hill and rock climbing, great photo opportunities and trips to hot springs. Given such attributes, KNP has long had the potential to optimise the generation of revenue from its wildlife resources and fund most of its operations. However, there have been limitations to realising that potential.

Years of neglect led to the deterioration of the park's infrastructure and natural resources to a point where it required significant investment to restore the protection and management of its biodiversity (Zambia Wildlife Authority, 2004). It also faced several challenges, which included illegal off-take of wildlife and low tourism and associated revenue.

To address the challenges, the Zambia Wildlife Authority (ZAWA) implemented a project entitled Programme for the Development of Kafue National Park as a Model of Sustainable Economic Use and Biodiversity Conservation in a Management Extensive

Environment (known as the Kafue Programme) with co-funding from the International Development Association, and the Global Environment Facility (GEF) through the World Bank and the Norwegian and Zambian governments. The goal was to reverse the loss of biodiversity in the park and its adjacent Game Management Areas (GMAs) and to develop sustainable tourism by securing critical habitats and species.

After seven years (2005–2011) of implementation, the programme improved all aspects of park management. An assessment of the park's performance using the Management Effectiveness Tracking Tool (Stolton et al., 2003) indicated that the score improved from 41 to 62 per cent, that is, from a low intermediate to a high intermediate category. The park had improved management effectiveness by successfully addressing the threats and pressures that had led to its previous state. Subsequently, the park's status changed from 'Declining' to 'Recovering'. The programme's success was echoed by the Implementation Completion and Results report by the World Bank (2012) which concluded that "a foundation has been laid which provides experiences to learn from and achievements to build on".

To ensure sustainability, an exit strategy from the Kafue Programme included the formation of a business or cost -and-profit centre in 2010 with the aim that it would retain revenue from the park and use the money to pay staff salaries and fund operations without relying on ZAWA headquarters in the long term. To nurture it, the government contributed 36 per cent of the fledgling business centre's budget. This strategy was highly applauded by tour operators, park staff and other stakeholders. However, the applause was followed by despondency when the government, for unknown reasons, withdrew its contribution to the business centre after only one year of operation. Subsequently, the centre was closed; all revenues were once again remitted to ZAWA headquarters similarly to other protected areas. Once part of the headquarters' general fund, there was no guarantee that the monies would be reinvested in KNP.

The phasing out of the Kafue Programme, compounded by the closure of the nascent business centre, led some stakeholders to postulate that the park would rapidly revert to a state of neglect. This postulation seemed logical considering that Zambia's protected areas are under-performing in ecological, economic and social terms because of underfunding, resulting in inadequate law enforcement (Lindsey et al., 2014). Similar observations regarding the funding of protected areas in Africa have been made by Emerton et al. (2006), Dlamini and Masuku (2012, 2013) and Lapeyre and Laurans (2017). The concern was heightened by the experience in the South Luangwa National Park, the first protected area in Zambia to use the business-centre approach. It took 20 years of donor support before the park could break even.

In contrast, other stakeholders argued that given the programme's achievements, the park would not deteriorate to its previous state, surmising that such a postulation would merely discourage potential investors in tourism. These views essentially concurred with those of the World Bank and the Park Business Plan developed by PMTC-Zambia Limited (2008), which projected that KNP would break even within a period of five years of its implementation. Such an achievement, however, was contingent upon institutional reforms that would entail devolving financial management to the park as a cost-and-profit centre, integrating the interests of stakeholders in its management and economic development, and improving the efficiency of management systems. In view of the foregoing, this paper attempted to find out if the postulation that, following the phasing out of the Kafue Programme that aimed to secure critical habitats and species in the Kafue National Park and adjacent GMAs, the park would revert to the previous state of neglect was supported by the evidence. Hence the question 'The giant sleeps again?" In this context, 'the giant' refers to the park, which, at around 22,480 km2 , is undoubtedly a mega park.

METHODS

Study site

Located between 25°13'–26°46' E and 14°03'–16°43' S, KNP is almost centrally situated between Lusaka and Livingstone, Zambia's administrative and tourist capital cities respectively (Figure 1). It is one of the closest tourist resorts to these towns (Zambia Wildlife Authority, 2004).

Moss (1976) and the National Parks and Wildlife Service and Japan International Cooperation Agency (1999) describe the park as having a wide range of habitats, such as long classic dambos with extensive open grassland, seasonal stream flows and perennial pools. The vegetation includes Miombo *Brachystegia* species, Mopane (*Colophospermum mopane*), termitaria, riverine woodland, forests and thickets. The area includes at least 100 km of the most attractive stretches of the middle Kafue River and western shore of Lake Itezhi-tezhi, which have mature riparian and lacustrine woodland habitats, calm reaches interspersed by rapids

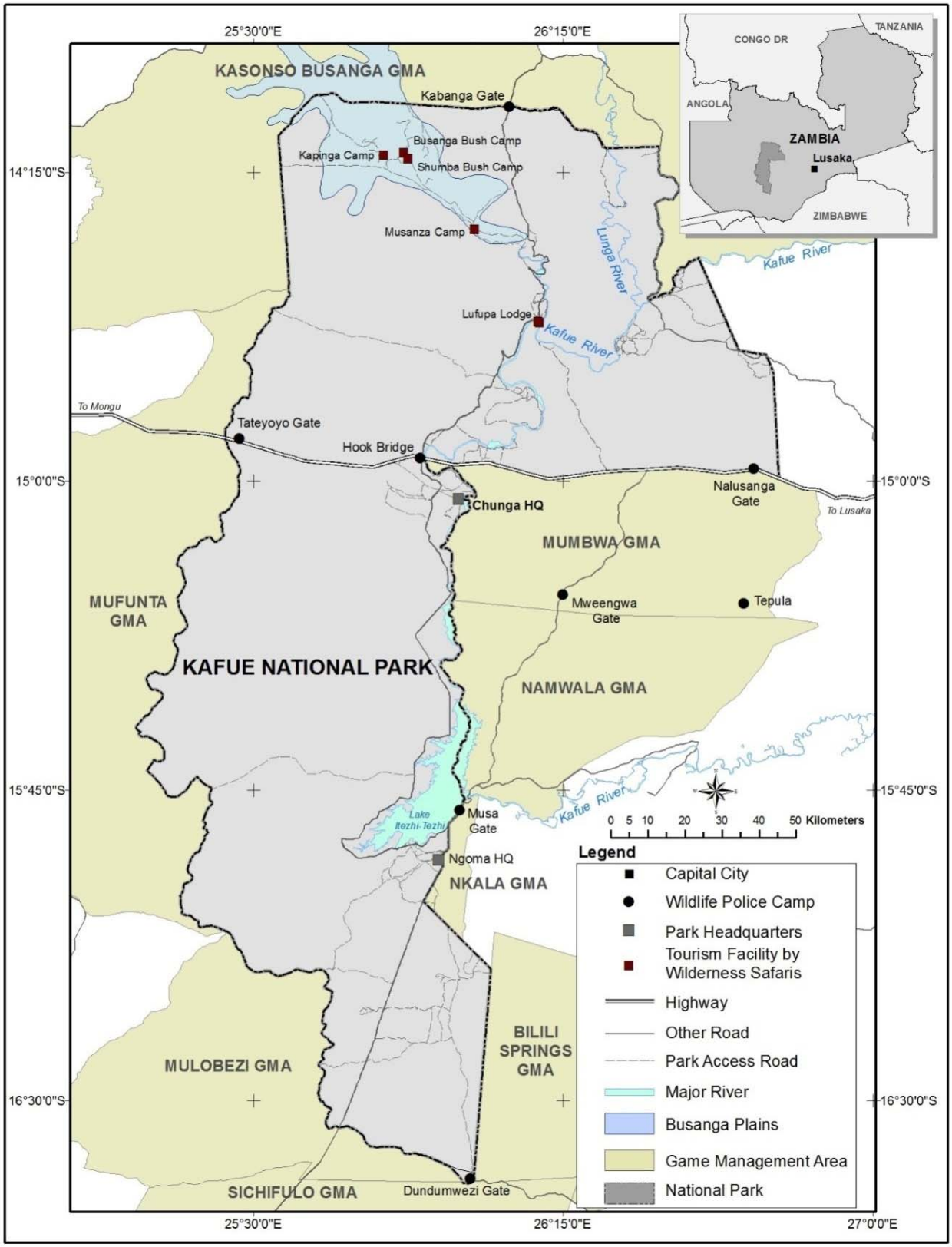


Figure 1. Map of Kafue National Park

and rocky pools, sandbars and grassy banks, offering abundant opportunities for fishing, bird watching, wilderness trails, canoeing, picnicking, and so on. Species recorded include 158 mammals, 481 birds (over half Zambia's species, and 80 per cent of all genera), 69 reptiles, 36 amphibians and 58 fishes. According to Moss (2007), the high-profile species include lion (*Panthera leo*), elephant (*Loxodonta africana*), buffalo (*Syncerus caffer*), leopard (*Panthera pardus)*, roan antelope (*Hippotragus equinus*), sable antelope (*Hippotragus niger)*, eland (*Taurotragus oryx*), cheetah (*Acinonyx jubatus*) and African wild dog (*Lycaon pictus*).

Data collection and analysis

The study analysed data on wildlife, law enforcement and tourism for the period 2005 to 2015, that is, 2005–2011 (during the programme) and 2012–2015 (post-programme). To address the study question, a trend analysis of the wildlife resource, effectiveness of resource-protection operations, and tourism was conducted. The wildlife resource was examined because it is the principal reason for the existence of the park, specifically, to control the aggressive attrition of wildlife populations (Mwima, 2001). Resource protection (law enforcement) was considered because it is a means of securing the wildlife; it minimises illegal activities, at least to a level where conservation objectives are not greatly impacted (Leader-Williams et al., 1990; Jachmann & Billiouw, 1997; Jachmann, 1998). Tourism was assessed because it is the main source of revenue for the park; the more tourists, the higher the revenue earned. Tourism also has an impact on poaching. A study by Jachmann et al. (2011) showed that there is a relationship between poaching and tourism; it declines with increasing numbers of tourists that act as a deterrent, but increases with a higher relative abundance of wildlife.

The resource

For the purposes of monitoring and evaluating the performance of resource protection efforts, the Kafue Programme had identified elephant, buffalo, puku (*Kobus vardonii*) and red lechwe (*Kobus leche leche*) as 'key' wildlife species. The Kafue Programme document does not explain why puku and lechwe, which are not even among the high-profile species (Moss, 2007), were selected as 'key' wildlife species.

Elephant tangle © Ben Coley

The authors determined the population trends of these species from the results of aerial surveys conducted between 2006 and 2015 (Zambia Wildlife Authority, 2006, 2013; Frederick, 2009, 2011; Department of National Parks and Wildlife, 2016a, b). The name of the Zambia Wildlife Authority was changed to the Department of National Parks and Wildlife (DNPW) in 2016 under the Zambia Wildlife Act No. 14 of 2014. Results of the 2013 survey were, however, excluded because no explanation was given for populations of elephant and buffalo that appeared to have increased three-and seven-fold respectively within a period of two years. These increases obviously exceeded the maximum intrinsic rates of increase of 5.5 and 12 per cent per year for elephant and buffalo respectively (Conservation Ecology Research Unit, undated; Jolles, 2007).

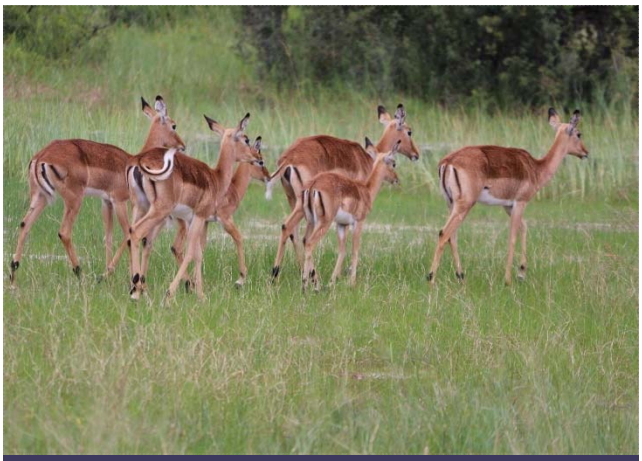
Resource protection

Cognisant of the fact that no single method is effective, DNPW uses a combination of different measures to reduce poaching in all of Zambia's protected areas. These include environmental education to raise the importance of conservation, co-management of natural resources in GMAs, and law-enforcement. According to the Zambia Wildlife Act No.12 of 1998, GMAs were established for the sustainable utilisation of wildlife. They provide for multiple use in the form of agriculture, forestry, grazing, wildlife conservation, hunting and fisheries management. By virtue of sharing common boundaries with national parks, however, they also act as buffer zones (Lewis et al., 1990; Lewis & Alpert, 1997). As such, they play an ecological role in that they cushion the negative impact of human activities on the national parks.

Out of the three approaches used to combat illegal activity, the authors opted to assess resource-protection by measuring patrol effectiveness because there is a quantifiable and direct relationship between the level of illegal activity and effort to reduce poaching. Such a direct relationship can be difficult to establish if assessing the effectiveness of environmental education and community-based natural resources management in reducing poaching. This contention does not intend to diminish the roles played by the other two approaches in natural resource conservation. Rather, it is the establishment of numerical evidence of their direct impact in combating poaching that is problematic. For example, in assessments of law-enforcement effectiveness, evidence such as indices of catch of illegal activity per effort is the more reliable method (Bell, 1984; Jachmann, 1998). We are not aware of similar approaches being used to assess the effectiveness of environmental education or co-management in combating poaching.

Besides the problem of deriving empirical evidence, community-based natural resources management, in its present form, takes place only in the GMAs under the Parks and Wildlife Act Nos. 12 and 14 of 1998 and 2015 respectively, although the involvement of communities in the management of wildlife and protected areas was initiated over three decades ago, in the mid-1980s in Zambia (Lewis et al., 1990). Within the GMAs, there is sharing of revenue from professional hunting between DNPW and communities. Additionally, on behalf of communities, community resource boards fund development projects, employ local residents in wildlife protection and management, and undertake any other activity that benefit the conservation of natural resources using revenue generated from hunting. Under the Acts, communities are expected to form community resource boards along geographic boundaries contiguous to a chiefdom in a GMA or an open area (not a protected area, but one with wildlife) to spearhead their participation in wildlife management. Although some authors, for example, Musumali et al. (2007) observed a general incongruence between community perceptions and expectations with regards to stewardship over community-based natural resources management, and Aurélie et al. (2009) have questioned its achievement in Africa, others extol the virtues of involving communities in wildlife and protected areas management (e.g. Infield, 1988; Child, 1996; Lewis et al., 1990; Hutton et al., 2005).

In terms of law enforcement, there are seven patrol types in KNP, long (≥21 days), short (≤5 days), day (8 hours or less), night, ambush, river and lake. Long and short patrols are deployed from the base to a patrol



Impala © Olga Laiza Kupika

camp using a vehicle, and return by the same means after 21 or 5 days respectively. From the patrol camps a standard 6-person patrol is conducted. During patrols, the number of illegal activities encountered and their locations are recorded on standardised patrol forms. The other data collected includes the number of staff on patrol, duration of patrol, areas covered, and the number of large mammals encountered by species and location. The duration of long patrols was, however, arbitrarily reduced to 10 effective patrol days after a study by Siamudaala et al. (2009) revealed that encounters with illegal activity, poachers and arrests declined after 5, 6 and 7 days respectively. Effective patrol staff-days do not include time spent on placement (moving between base and the patrol camp) and preparations (Jachmann, 1998, 2008a, b).

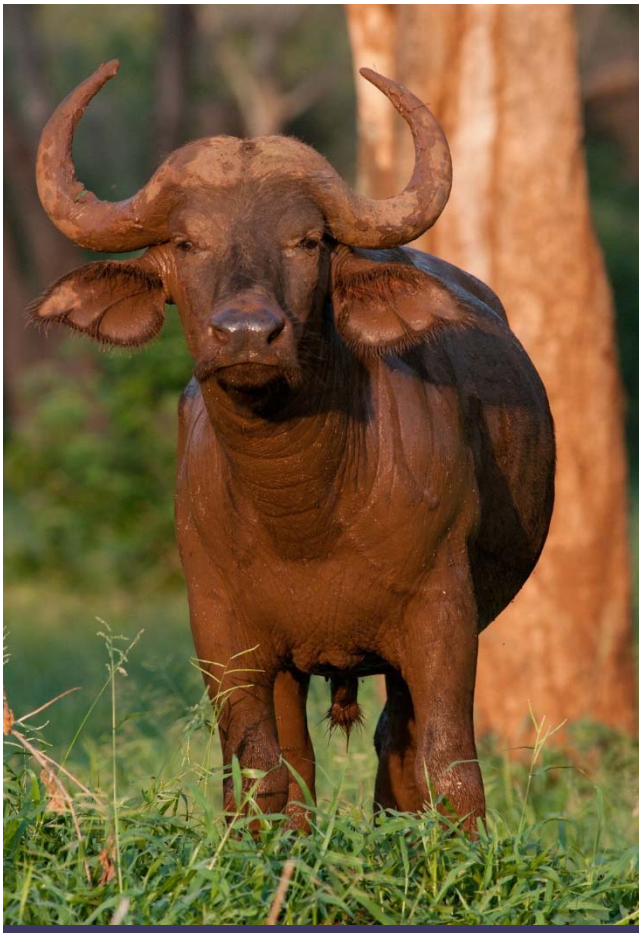
Various approaches to assessing law-enforcement effectiveness are given by Bell (1984) and Jachmann (1998), with Catch-per-Effort (C/E) method regarded as the most reliable. For this reason, we used this method to analyse the trend of law-enforcement effectiveness (C/E indices) from 2005 to 2015. The indices were calculated using the following formula by Bell (1984):

C/E = KI, where:
C = the "catch", i.e. the number of encounters with illegal activity per unit area per unit time;
E = the "effort", i.e. the index of patrolling effort per unit area per unit time;
K = the "capture constant" which defines the relationship between catch per effort and the amount of illegal activity per unit area per unit time; and
I = the amount of illegal activity per unit area per unit time.

To determine C/E indices, effective patrol staff days (effort) were calculated for the period 2005 to 2015. Effective patrol time was multiplied by the number of staff in the patrol group to give effective patrol staff-days per year. From the patrol forms, the study determined the number of serious offences (catch) per year, that is, those which directly relate to the illegal killing of wildlife, namely, poachers arrested, poachers observed, firearms/cartridges/ivory/skins confiscated, gunshots heard, poachers' camps found, animals killed, wire snares collected, and cartridges seen (Bell, 1984; Jachmann, 1998, 2008a, b). Data for 2015 was also obtained from the Game Rangers International-Kafue Conservation Project (GRI-KCP), a Zambian conservation-focused organisation working closely with the DNPW and other key stakeholders to protect Zambia's rich wildlife estate (Game Rangers International, 2017). The GRI-KCP project focuses on law enforcement within KNP and the adjacent GMAs.

Jachmann (2008a) arbitrarily set the acceptable amount of illegal activity value of 0.02 encounters with serious offences/effective patrol staff-day/ month, which in fact translates to the same index per year. The same value can be used as an annual index. As such, it was adopted to determine whether or not illegal activity was within an acceptable annual limit.

As part of the examination of law-enforcement effectiveness, operational budgets were also examined because they have a negative effect on poaching (Jachmann, 2008a). In Ghana, poaching declined with increasing camp visit frequencies and financial resources in protected areas. Expenditures (in US dollars) on law enforcement were extracted from annual budgets. Only recurrent costs, for example, consumables such as patrol rations, fuel for deployment and uniforms were considered. Capital costs such as equipment (GPS, handcuffs) and vehicles were excluded because they do not vary annually. Following the methods of Jachmann (2008b), expenditures were converted to amount/km2/ year.



Buffalo © Daniel Polakow

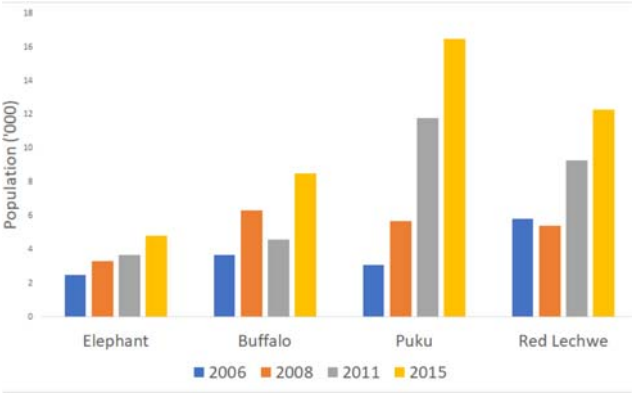


Figure 2. Population trends of 'key' wildlife species in the Kafue National Park, project period (2006–2011) and post project (2015)

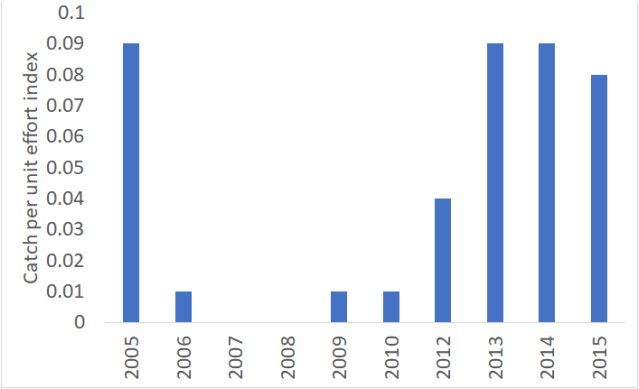


Figure 3. Trend of catch per effort 2005–2015, Kafue National Park, Zambia

Expenditures for 2015 include figures from the GRI-KCP. In 2014 a new project funded by the United Nations Development Programme (UNDP)/GEF covering KNP, West Lunga National Park, GMAs and Forest Reserves was implemented by ZAWA and the Department of Forestry to strengthen management effectiveness and generate multiple environmental benefits within and around protected areas. While there is an allocation for resource protection, actual amounts spent for this purpose in KNP were not easy to obtain. A total figure of US$3.0 million was purportedly spent on law enforcement. An attempt to obtain the data from the Chunga and Ngoma offices (see Figure 1) revealed that no money was remitted to the park by the UNDP/GEF project. In terms of recurrent costs, only rations, fuel and per diems are covered by the project, but the costs were not available. Given this challenge, the analysis excluded funding from the project. As will be seen later, exclusion of such data did not affect the results negatively.

Tourism

Tourism was assessed in terms of the number of tourists to the park and revenue generated. Tourists to the park fall into three categories, international, established residents and locals. International tourists pay in foreign currency, while established residents and locals pay in Zambia Kwacha, the local currency. Regarding revenue, the main sources are fixed and variable fees. The former relate to rental charges based on the size of the tourism facility, number of tourist beds, and length of the tourism season, while the latter cover visitors' sold bed-nights, bed levies, and park entry fees.

Data on tourists and revenue receipts (fixed and variable fees) were obtained from Chunga, Ngoma, and DNPW headquarters in Lusaka. Revenue collected in local currency was converted to US dollars using the prevailing exchange rate. While tourist numbers were available for all the years, data for variable fees was missing for 2010. As such, the number of tourists and the associated revenue for that year was excluded from the analysis. The missing data, however, does not negatively affect the trends in the number of tourists and amount of revenue.

RESULTS AND DISCUSSION

The resource

All populations of the 'key' wildlife species increased between 2005 and 2015 (Figure 2). It is evident that the momentum gathered in reducing illegal activity (Figure 3) during the KNP Programme led to the increases in populations of the species examined even four years after the project. That the populations increased after the programme suggests that in terms of the wildlife resource, the concern that the park would revert to its previous state may have been misplaced. Future data will tell whether or not the trend will change.

Resource protection

As expected, there was a high encounter rate of illegal activity as evidenced by the C/E index upon commencement of the project (Figure 3). However, it declined drastically during implementation of the programme, particularly between 2007 and 2008. The annual average C/E index during the programme was 0.02, the acceptable amount of illegal activity (Jachmann, 2008a) or a low illegal-hunting challenge (PMTC-Zambia Limited, 2008). After the programme, however, there was an increase in C/E indices, the annual average being 0.08 (Figure 3), a situation of moderate to high illegal-hunting challenge. This change from low to moderate or high illegal-hunting challenge vindicates those stakeholders who were concerned that the park would revert to its previous state.

Considering that the 'key' species continued to grow while the C/E indices increased, it may be inferred that the illegal activity may have mostly involved killing animals other than the 'key' wildlife species. This inference is supported by an examination of the carcass ratio of elephants, an indication of population trends (Douglas-Hamilton & Hillman, 1981). A carcass ratio is defined as the number of estimated elephant carcasses divided by the sum of all carcasses and the estimated elephant population. It is converted to a percentage by multiplying by 100. When the ratio is under 5 per cent, most of the carcasses are produced by natural mortality in stable or expanding populations. However, if over 8 per cent, the losses may be unsustainable and the populations are decreasing. Although there has been an increase in the carcass ratio, from 0.8 in 2006 to 5.5 per cent in 2015, it is attributed to the fact that the majority (242 of the 279 or 86 per cent) of the carcasses sighted in the most recent aerial survey were of individuals more than 10 years old.

The increase in poaching is undoubtedly a result of low operational budgets (Figure 4). PMTC-Zambia Limited (2008) stated that for a protected area with a low illegal -hunting challenge, which was the case during the programme, the minimum expenditure should be US$40.00/km², which is slightly lower than the average annual expenditure of US$44.00/km² on resource protection operations between 2005 and 2011. In contrast, the average annual expenditure after the programme was US$14.00/km². With the increased illegal activity after the programme, as evidenced by the high C/E indices, the operational budget is 11 times lower than suggested by PMTC-Zambia Limited(2008), which recommended an expenditure of up to US$160/ km² for a moderate to severe illegal-hunting challenge.

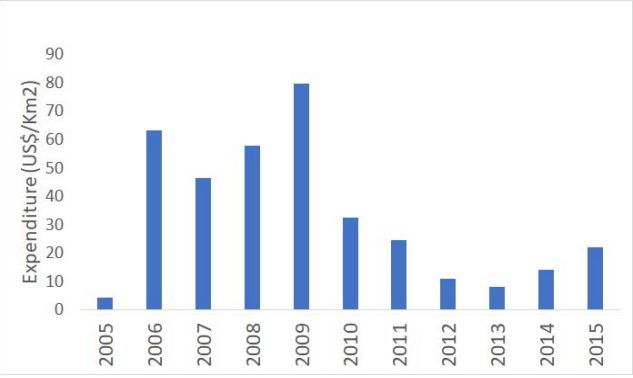


Figure 4. Trend of annual budget for law enforcement in Kafue National Park, 2005–2015

During the Kafue Programme, sufficient funding for resource protection helped to reduce illegal activity. This has not been the case after the programme. The additional funding from the two projects by GRI and UNDP/GEF is having very little impact on law-enforcement effectiveness. This inference is by no means intended to denigrate the two projects. It simply illustrates that more financial resources than are presently available are needed to once again fund law enforcement adequately. Further evidence of the need for adequate finances for law enforcement is given by Munthali (2017), who observed that this decline in funding has led to lack of capacity to procure items such as transport, fuel, rations, uniforms and field equipment (e.g. handcuffs, GPS sets, camping gear). Currently, the park is using old vehicles procured more than six years ago during the programme. These vehicles have become very expensive to maintain. With the reduction in the budget for resource protection, this situation is likely to worsen. The current situation also supports the views of those stakeholders who were concerned by the withdrawal of funding to the business centre, and its subsequent closure.

Considering the correlation between operational budget and law-enforcement effectiveness, it is logical to surmise that it is only a matter of time for the populations to decline again due to the increase in poaching. To avoid such a situation, it would be advisable to increase funding for resource protection.
The increase in illegal activity is evidence enough that the current co-management in the adjacent GMAs is not having the intended effect of cushioning the negative impact of human activities on the park. A full examination of the weaknesses of the co-management in GMAs and how this might be improved in KNP by strengthening the institutions and governance is a subject for future study. A study of two GMAs adjacent to the park, Namwala, which is disturbed by human settlements and cultivation, and Nkala, which is relatively pristine, concluded that institutions and governance were a factor in determining the ecological status of the two areas (Mkanda et al., 2014). Other authors have also noted that governance and institutions in co-management of wildlife and protected areas can be challenging (Musumali et al., 2007; Simasiku et al., 2008; Aurélie et al., 2009).

Tourism

There has been an overall increase in tourist numbers and revenue earned since 2005 (Figure 5a and b). Comparatively, there were more tourists to the park after than during the Kafue Programme. The annual average number of tourists during the implementation

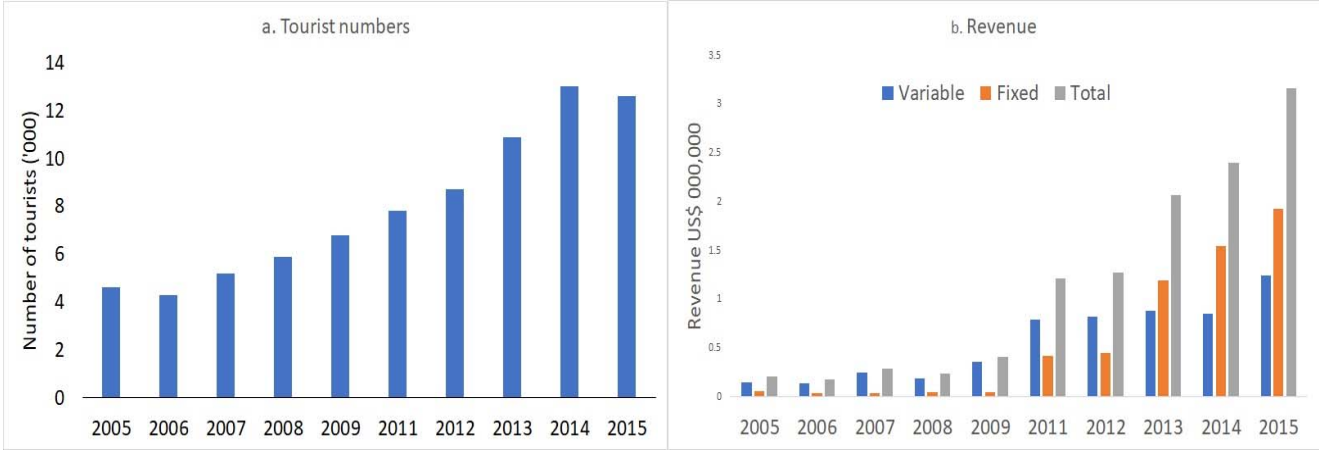


Figure 5. (a) Number of tourists, Kafue National Park, 2006–2016 (b) Revenue, Kafue National Park, 2006-2016

of the KNP programme was around 7,666 but increased by about 55 per cent to 11,250 in the four years from 2012 to 2015. Although there is a drop in the numbers of tourists after 2015 (Figure 5a), the figures are still higher than during the programme. Given the relationship between poaching and tourism (Jachmann et al., 2011), the slight decline in tourist numbers in 2015 could be the beginning of a downward trend.
In terms of revenue, it increased threefold after expiry of the programme, from US$1.2 million in 2012 to US$3.2 million in 2015 (Figure 5b). That more revenue is being collected than during the programme underpins the need to invest in resource protection, and ensure the sustainability of funds before the resource is further degraded.

Several reasons have led to the increase in tourist numbers and revenue. First, there was an increase in the number of tourist lodges and camps from seven with 120 beds in 2010 to 22 with 288 beds in 2015. The most remarkable achievement was the arrival of Wilderness Safaris in 2006, which established luxury tourist lodges at Lufupa and the Busanga Plains (see Figure 1). The increase in investment in tourism facilities is an indication of the attractiveness of the park not only for business by lodge owners, but also as a tourist destination. Tourists are motivated to visit national parks because of the attractions that they have to offer (Kruger & Saayman, 2010).

There were also significant infrastructural improvements, for example, three existing airfields were rehabilitated, and two were newly constructed. These works shortened the time of travel from Lusaka, the nearest city with an international airport. Shortening the travel time is an incentive for tourists to visit the park because short distances attract high numbers of visitors (Jachmann et al., 2011). Even access by road was improved; for example, the M9 single-lane highway that traverses the park was upgraded. While this road is of economic importance in that it provides the main access to western Zambia and the bordering countries of Angola and Namibia, it also shortened the distance between Lusaka and KNP. Besides the M9, bridges and internal access roads to lodges, as well as those for game viewing were also improved. New roads to provide access for game-viewing, specifically during the rainy season, were constructed around Lufupa Lodge. The new all-weather game-viewing roads inevitably extended the tourist season in the area around the lodge. Previously game viewing had been restricted to the dry season of June to November, as in the rest of the park.

The increase in the number of tourists to the park and the revenue generated supports the view of those stakeholders who contended that the achievements of the programme were a solid foundation to propel the park to greater success. These results reveal the futility of trying to predict the performance of a protected area after project funding is withdrawn. Those who were most concerned by the ending of the Kafue Programme may have been unaware or ignored the fact that project impacts are felt well beyond a project's life. Outcomes are documented through evaluative actions taken some time following project completion. This study serves as a proxy for such an evaluation.

However, it should also be stated that ecological impacts are seldom obvious in the short term; while they tend to have significant effects in the long term. Four years after the project is, therefore, not a long enough period for DNPW to be complacent about the population status of the key species and increased tourism. After all, the

increase in poaching such species not considered 'key' may be the manifestation of a more serious problem that will eventually include the poaching of 'key' ones. It is just a matter of time until the cumulative impacts of these illegal activities will slowly, but surely, erode the ecological integrity of the park unless they are addressed now. Measures are therefore necessary to curb the poaching of all species.

CONCLUSION

This paper sought to assess whether the park has indeed reverted to a state of neglect after the phasing out of the Kafue Programme and closure of the nascent business centre, as postulated by some stakeholders. While there is evidence that resource-protection operations are underfunded and illegal activity is on the increase, there is, however, no decline yet in the populations of the wildlife species we examined or tourism activity. However, considering the increase in illegal activity, a situation that will most likely erode the ecological integrity of the park unless the trend is reversed, we conclude that the giant is in the initial stages of a deep slumber and the full potential of the park is yet to be realised. It would, therefore, be appropriate, for DNPW to take measures to control illegal activity in the park.

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RESUMEN

La retirada progresiva del Programa Kafue, que tenía como objetivo proteger especies y hábitats críticos en el Parque Nacional Kafue y las áreas adyacentes de manejo de la caza, fue recibida con reacciones mixtas. Algunos grupos interesados, en particular los operadores turísticos, estaban desalentados; afirmaron que el parque volvería a su estado anterior de abandono. Sin embargo, otros opinaron que el programa había logrado su propósito. Por otra parte, tal desaliento podría simplemente influir negativamente en posibles inversores en turismo, la principal fuente de ingresos para el parque. Este estudio pretende constatar si el desaliento estaba justificado. Por consiguiente, examina los recursos, la eficacia en torno a la protección de los recursos y el turismo durante y después del programa. Los resultados son variados. Mientras que las poblaciones de especies silvestres clave siguieron creciendo y el número de turistas y los ingresos asociados aumentaron cuatro años después del programa, la actividad ilegal también aumentó a los niveles anteriores al programa. Por lo tanto, ciertamente había cierto grado de justificación en la preocupación, el "gigante" duerme de nuevo y su potencial sigue sin aprovecharse. Es indispensable que el Departamento de Parques Nacionales y Vida Silvestre tome medidas para frenar la caza furtiva de todas las especies afectadas.

RÉSUMÉ

Le retrait progressif du programme Kafue visant à protéger les habitats et les espèces prioritaires dans le parc national de Kafue et dans les zones adjacentes de gestion des gibiers, a été accueillie avec des réactions mitigées. Certains intervenants, en particulier les voyagistes, se sont montrés découragés : craignant que le parc revienne à l'état de désuétude passé. D'autres intervenants ont toutefois soutenu que le programme avait atteint son objectif. De plus, une telle attitude risquerait tout simplement de décourager les investisseurs potentiels dans le tourisme, principale source de revenus du parc. Cette étude tente de vérifier si le découragement est justifié. Dans ce but, il examine l'état du parc, l'efficacité de la protection de ses ressources et la qualité du tourisme pendant et après le programme. Les résultats sont mitigés. Alors que les populations d'espèces fauniques clés ont continué de croître et que le nombre de touristes et les revenus associés ont augmenté quatre ans après le programme, les activités illégales ont également crû pour revenir au niveau précédant le programme. Ceci confirme que dans une certaine mesure, l'inquiétude est bien justifiée, car le potentiel du parc reste largement inexploité. Il est essentiel que le Département des Parcs Nationaux et de la Faune prenne des mesures pour lutter contre le braconnage de toutes les espèces affectées.

PRIORITIES FOR PROTECTED AREA RESEARCH

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ABSTRACT

A hundred research priorities of critical importance to protected area management were identified by a targeted survey of conservation professionals; half researchers and half practitioners. Respondents were selected to represent a range of disciplines, every continent except Antarctica and roughly equal numbers of men and women. The results analysed thematically and grouped as potential research topics as by both practitioners and researchers. Priority research gaps reveal a high interest to demonstrate the role of protected areas within a broader discussion about sustainable futures and if and how protected areas can address a range of conservation and socio-economic challenges effectively. The paper lists the hundred priorities structured under broad headings of management, ecology, governance and social (including political and economic issues) and helps contribute to setting future research agendas.

Key words: protected areas, research priorities, stakeholder assessment, managers, researchers

INTRODUCTION

The rapid growth in number, extent and variety of protected areas implies that the demand for new and improved management expertise, knowledge and resources is increasing. Many protected areas are 'paper parks' with an absence of adequate management (Leverington et al., 2010). At the same time, environmental change, the emergence of new pressures such as globalised wildlife crime, and widening social expectations create many new challenges for protected area managers (Watson et al., 2014) and for other actors involved in protected area governance. Yet global policy instruments, including the CBD Aichi biodiversity targets (Woodley et al., 2012) and the UN Sustainable Development Goals (UN, undated) both include explicit targets related to protected areas. Carefully planned research, undertaken in collaboration with protected area managers and local communities (Hockings et al., 2013), can yield important new information with immediate practical application to support management. On the other hand, undertaking research does not necessarily translate into better practice, highlighting the need for effective knowledge exchange (Reed et al., 2014). A concise overview of protected areas research priorities therefore has the opportunity for wide application within the academic and research community, including topics for future PhD research, and with results that can benefit actors operating in the practical field of conservation planning and protected area management.

The following stakeholder-based review of protected areas research priorities follows similar efforts developed for conservation biology by Sutherland et al. (2009). Sutherland and colleagues sought input from over 700 people and organisations, generated over 2,000 questions, and used a voting system to prioritise results and a smaller team to consolidate, analyse and finally select the top 100 key research priorities. This approach ensured that many perspectives were included, but the group making the final selection was drawn mainly from the research community. Similar exercises were undertaken for agriculture (Pretty et al., 2010) and, more specifically, coral reef marine protected areas (Cvitanovic et al., 2012).

Given that academics and practitioners may bring different considerations to determining research priorities (Greggor et al., 2016) and priorities may differ depending on the social, economic and development context of countries (Mihók et al., 2015), this study used a different approach than that developed by Sutherland et al. (2009), by seeking input from a smaller selection of stakeholders, divided equally between researchers and practitioners. The aim was to generate a hundred research priorities from 50 specialists (i.e. two priorities per person). The approach was also informed by developing best practices in ensuring effective information exchange, which in particular stresses the need to develop two-way dialogue between researchers and stakeholders (Reed et al., 2014). Participants were thus chosen to represent, as far as possible, a wide range of biomes, countries, disciplines and backgrounds. A gender balance was also sought. Both professional researchers and people with hands-on experience in protected area designation, management, governance and support were included. All were offered authorship of the current paper, some preferred for various reasons to remain anonymous.

The result is not a comprehensive survey of research needs, but a targeted survey aimed at understanding different priorities amongst specific protected area stakeholder groups. The analysis sought both to explore what a series of specialists believed to be the most important research topics needed to support protected areas, and to start a conversation about whether academic researchers were generally addressing the subjects most important to those dealing with the practical issues of protected area designation, planning and management on a daily basis. We also considered whether researchers choose different topics than protected area managers in terms of subject areas and priorities.

The following analysis has identified a wide range of relevant topics, raised some interesting questions about shifting priorities and is already being used in helping to influence thinking in the IUCN World Commission on Protected Areas (WCPA).

METHODOLOGY

The method was based on purposive sampling, targeted to provide a wide variety of perspectives and themes. A list of potential participants with expertise in protected areas, or disciplines directly related to protected areas, was drawn up by the lead authors primarily from highly experienced practitioners who were members of the IUCN WCPA, and academics with a strong research focus on protected area issues. The participants were then emailed, by the lead author, asking for proposals "for two pressing research questions relating to protected areas, with 1–2 sentences about why they are important". Additional guidance asked for the questions to be as "specific as possible, and cover natural, socio-economic or political sciences".

Table 1: Breakdown of respondents by gender, location and background

	Researchers (male / female)	Practitioners (male / female)
Developed country	10/6	5/6
Developing country	3/6	8/6

Fifty people identified their top two research needs in protected areas, with a short explanatory text. The choice of participants, based on the opinion of the three lead authors, was intended to balance the sample with roughly equal representation of men and women; regional representation from developing and developed countries and representation of practitioners and researchers (Table 1). Practitioners included both managers of protected areas through to people working for non-government organisations or donor agencies, and researchers included natural and social science researchers from academia and from research or conservation organisations, covering a wide spread of disciplines. Respondents came from 32 countries, both developed and developing, representing people from all continents except Antarctica. Participants could either be identified as co-authors of the paper or remain anonymous.

Two forms of analysis were undertaken: a) expert review and grouping of responses by the lead authors, which was then peer reviewed by surveys participants; b) the development of word clouds of research priorities using NVivo research software (QSR International, 2015).

The expert review was carried out by dividing the responses initially into one of four overarching categories of research priority. The groupings under these categories are subjective, but help provide greater understanding of the results and make them useful for future initiatives (e.g. policy work carried out by IUCN WCPA). The categories were chosen to represent various aspects of protected areas: management, governance, ecological and social issues. Management encompassed topics that related to the operational and administrative processes undertaken by managers. Governance included topics related to the exercise of power and decision making and the extent to which stakeholders and communities are involved in these processes as well as the governance types (Dudley, 2008) used in managing protected areas. Ecological aspects included topics related to the management of species, ecosystems and elements of the natural environment of protected areas. Social issues focused on people and their interactions with protected areas including political and economic aspects. The research needs identified by respondents are presented under these four major categories with a range of sub-categories identified to group related research needs. Not all the responses fitted neatly into these categories and the analysis below is thus based on the expert judgement of the lead authors, confirmed through the peer review process undertaken by the 50 experts who took part in the survey.

RESULTS

The 100 priorities are presented below, grouped under the four categories (management, governance, ecological, social issues) identified above and then into sub-categories based on the dominant subject described. These categories are not always exclusive and some responses cover more than one category. Responses ranged from the very particular, in terms of both issues and geographical focus, to broader conceptual and philosophical issues. We recognise that this sometimes results in a certain unevenness in which issues are addressed, but this in itself is illustrative of the differing priorities amongst respondents. Apart from minor clarifications we have left responses as they were received. While recurrent themes were identified and are discussed below, none of the responses received were direct repetitions, although this is partly a matter of wording or perspective in some cases. This suggests, as might be expected, that the survey did not reach a 'complete' picture of research priorities, but also illustrates the diversity of priorities and challenges.

Management

Management covered a wide range of issues with the questions being subdivided below into issues relating to: planning, practical management methods, managing for environmental change including climate change, management effectiveness and capacity building inside and beyond the protected area.

Planning

Planning issues remain a priority for many, in both new and existing protected areas. Most of the planning topics identified went beyond the borders of the individual protected area to focus on protected area networks and

the role of protected areas in the wider landscape. With 20 - 40 per cent of land area under conservation in a number of countries (UNEP-WCMC and IUCN, 2016), land-use planning and trade-offs combine to form an increasingly potent political issue.

Individual responses:

1. Identification of conservation targets - species or ecosystems.
2. Identification of protected areas that are critical for conservation of threatened species (e.g. sites with a high fraction of the global distribution of threatened species, source sites for commercially valuable species, etc.).
3. Identification of currently unprotected sites important for the protection of key species (commercially valuable, identified as threatened by IUCN) and analysis of their tenure and use.
4. Defining an 'ecologically coherent marine protected area network'; implementation through 'rules of thumb', assessment and reporting.
5. How protected area management plans and implementation align with biodiversity conservation and broader objectives across the landscape (that includes multiple tenure).
6. The role of protected areas within landscapes.
7. The optimal land use mix in a protected area landscape, using target scenario analysis to show how different land use scenarios will impact on biodiversity, ecosystem values and social and economic outcomes.
8. In light of global ambitions for increased biodiversity conservation, whether scarce global resources for conservation are best directed on improving management and conservation of existing protected area or invested in establishing new protected areas.

Practical management methods

As might be expected, many respondents identified research focused on addressing immediate pressures, such as invasive species, problem animals or fire, and the challenges presented by sensitive management of culturally and spiritually important sites within a protected area.

Individual responses:

9. Developing innovative tools for conservation, including particular reference to testing and applying innovative tools to combat invasive animals and plants.
10. The most appropriate interventions of handling problem elephants and other wildlife species relating to community property and crop destruction.
11. The best way of eradicating invasive species that have affected the vegetation structure in protected areas.
12. Managing fire across the protected area system in a landscape to ensure that multiple objectives (e.g. life and property protection, species conservation, amenity etc.) are met at appropriate scales.
13. Ecological restoration of natural landscapes from a long-term perspective.

Managing for environmental change including climate change

Many of the priorities focused on the question of environmental change, and particularly climate change, which has, in recent years, developed from a theoretical or future issue into a practical day-to-day management challenge for many protected area agencies (Lemieux et al., 2011). While there is certainly some repetition here, there is also a wide range of issues raised, from broad-ranging questions about the ability of protected areas to function under climate change to quite specific management-related responses, and ways to encourage learning and adaptation on the ground.

Individual responses:

14. The most effective approaches in protected area management for dealing with pressures that are external, such as climate change risks.
15. How protected areas can prepare for long-term, potentially transformative ecological changes while still addressing today's management challenges.
16. Conservation practices that are effective for climate change adaptation – developing an evidence base for climate change adaptation practices.
17. The capacities that will enable protected area management and governance to support anticipatory learning and decision-making in the face of uncertainty.
18. The present and potential impact of protected areas on adaptation and mitigation strategies for climate change, and the scope for some re-designing taking climate change into account.
19. What vulnerability assessments tell us about future priorities for protected areas, particularly with respect to connectivity and corridors.
20. How protected area networks should (or should not) change spatially to adapt to climate change, including the importance of spatial design versus

other qualities (e.g., maintenance of diversity, continuity in time, old-growth, native species).

21. How widely climate change adaptation practices are being carried out and what managers are (or are not) doing to deal with climate change (that they weren't already doing before).
22. Considering that climate change could threaten the habitat of micro-endemic and migratory species within protected areas, how to design and practice assisted migration to guarantee future habitat for these species.
23. Feasible practices to address the challenge that climate change could increase the temperature in several turtle-nesting beaches, thus disrupting the natural proportion of sex ratio.
24. How to plan marine protected areas to protect habitats and species in a changing climate, including the need to conserve 'ecosystem space' for locations where species are shifting their distributions in response to warming waters, but are not yet currently seen as important for biodiversity.
25. The capacity of existing protected area coverage and effectiveness to withstand prevailing climate change impacts in the mountains.

Management effectiveness

Increasing management effectiveness runs like a thread through many of the issues raised including in the sections above. While some respondents are still looking for information about measuring success, and incorporating new technologies into this process, most now are focused on applying the results through better understanding of common management failures, enabling conditions of success, and the importance of financial resources in effectiveness.

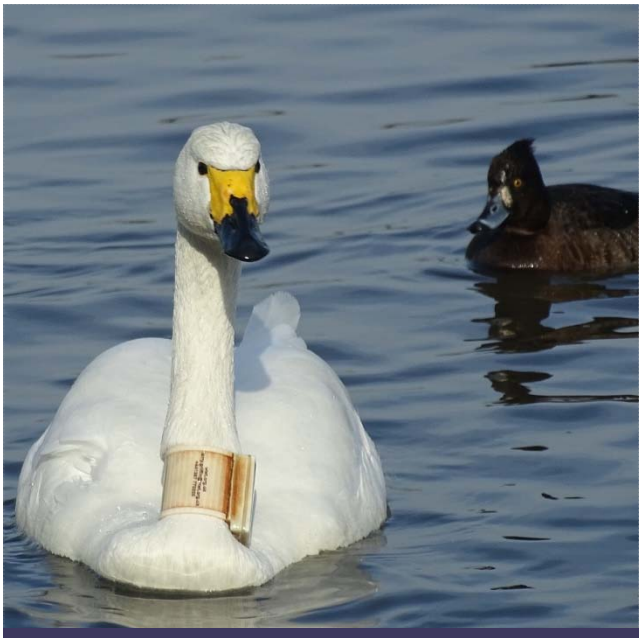
Individual responses:

26. The ecological performance of protected areas, post-establishment, in meeting their biodiversity and related objectives, and the predictors of this performance.
27. The application of information technologies in protected areas.
28. Identifying the common failures that prevent a protected area management plan from guiding improvement of management effectiveness.
29. The enabling conditions for good management of protected areas, and whether these differs country by country due to national policies.
30. Whether the level of conservation success, as measured by area protected, management effectiveness and threat reduction, correlates with the budgetary allocation to conservation by national government.

Within the management effectiveness topic, many responses focused particularly on monitoring and are presented separately below. Monitoring remains a priority for achieving effective protected area management, yet it is often an early victim of budget cuts by central government (Cook & Hockings, 2011). Issues varied from specific research needs to a desire for performance indicators that could provide an accurate picture of conservation success and thus help to unlock new funding streams for protected areas.

Individual responses:

31. Monitoring of population status of endangered species.
32. How new technology can be used to improve monitoring of protected areas.
33. How to better share methods to evaluate conservation status of protected areas, by measuring ecological quality or degradation, and setting management or restoration targets.
34. Mapping habitat degradation and loss across protected areas in Asia – categorizing them on the basis of integrity of habitat/species, to yield a vulnerability ranking of high priority protected areas through a categorization of key threats (especially infrastructure) and drivers.
35. More precise information on the presence of invasive species in individual protected areas, along with studies to assess the trends and correlates of this phenomenon in protected territories globally.



Monitoring species provides information for a range of research projects © Equilibrium Research

36. Identifying short-term performance indicators correlated with the magnitude and direction of protected area impacts, and thus suitable for protected area managers and their funders to use to make real-time decisions.
37. Identifying the equivalent of a ton of carbon emitted in terms of a simple measure of success for biodiversity conservation, which is responsive enough to inform decision-making in real time and robust enough to act as a proxy for all protected areas, to attract investment and find efficiencies.

Capacity building inside and beyond the protected area

Finally, under management, the role of protected areas in education, both of their own staff and of the visiting public: how much do protected area managers need to know in order to do their job? How can protected areas be used as laboratories or learning sites for wider investigations into sustainable land and water management?

Individual responses:

38. The role of protected area management authorities in environmental education and in providing and promoting interpretation signage of the natural and cultural values of their sites.
39. Protected area management authorities' role in relation to capacity building courses for their staff.
40. Use of protected areas as workshops to observe, analyse and manage the relationship between humans and global heritage, including nature and ecosystems, but also a broader living system of interconnected components, connected in co-evolutionary processes.

Social assessments (here of protected areas benefits in Colombia) are increasing being seen as important components of protected area management © Equilibrium Research

41. Where to draw the line in tasks and curricula for protected area staff, at a time when park managers are increasingly expected to be knowledgeable about ecological, social, legal, financial, administrative and management issues, and also to be gender and governance sensitive.

Ecological

A number of the responses strayed away from everyday management to look at ecological aspects in broader terms – evolutionary theory, extinction debt, ecological and human history and the wider ecological role of protected areas. These broader questions were raised by both researchers and practitioners.

Cross-biome issues

A number of the responses addressed global questions about evolutionary theory, extinction debt, migration and connectivity, looking beyond the borders of the protected area into the wider landscape and seascape.

Individual responses:

42. Integrating evolutionary theory into conservation management.
43. The level of extinction debt still to be paid by protected areas, and how this varies between areas.
44. The networks of protected areas required to protect migratory species at all stages of their movements.
45. How protection of degraded areas can be used as a strategy for enhancing biodiversity.
46. The validity of protection laws insofar as the perceived or assumed impact of people, drawing on paleo-histories of human impact on (the measurable elements of) biodiversity.
47. Loss of landscape connectivity; how to ensure connectivity within protected area networks and the integration of protected area ethics in the surrounding landscape.

Tiger researcher in Sikhote-Alin Nature Reserve, Russia
© Equilibrium Research

Biome-specific issues

Finally, in this section, questions addressed three of the most significant biomes: forests, wetlands and marine, including the land-sea interface.

Individual responses:

48. The dynamics of forest ecosystems in protected areas.
49. For fire-affected parks, better information on past fire regimes, and changes in fire regime, especially with arrival of humans and/or establishment of park management.
50. Assessing where the big transformational changes projected in wetlands due to climate change will occur first and to the greatest extent.
51. Better integration of the land-sea interface.
52. The use of marine protected areas in relation to spawning and nursery areas.

Social

Responses focused on the implications of protected area establishment and management for people including economic aspects, on management responses and on the growing role of protected areas as providers of ecosystem services.

Implications for communities

Three closely related priorities suggest that there is still a lot to be learned, or perhaps compiled and analysed, on the impacts of protected areas on people. Two of the responses aimed specifically at costs, one more neutrally implied both costs and benefits.

Individual responses:

53. The impacts of protected areas on local livelihoods from the community perspective, drawing on representative voices from a broad range of areas.
54. Protected areas as a threat to local and indigenous communities; analyses at global and regional levels.
55. The factual and historical costs and benefits of living close to protected areas, assessed in terms of a meta-study of existing research, including the extent of historical and present-day evictions of local people from protected areas and how these human rights issues are addressed.

Managing for social/cultural values

Allied to the group above, a set of priorities address social issues within and around protected areas. These include equity, sacred values, poverty alleviation and ecosystem services, and approaches to increase local engagement, along with using protected areas more generally to help society reconnect with nature.

Individual responses:

56. Identifying the causal mechanisms allowing protected areas to yield more desirable environmental and social outcomes.
57. Incorporating the Aichi Target 11 "equity" mandate into marine protected area establishment and management in an effective and timely manner.
58. The trade-offs between poverty alleviation and environmental outcomes of protected areas and how they can be managed more equitably.
59. How the cultural and spiritual significance of nature can be better understood and used to improve the governance and management of protected and conserved areas.
60. The main functions of sacred natural sites and how these can co-exist.
61. How much protected areas (and the ecosystem services that they protect) contribute to local and national economies.
62. Engaging local communities partnerships for effective protected areas management, to ease the burden on park staff and benefit local people (financially or through other benefits that attract people to engage).
63. The role and potential of protected areas for reconnecting people to nature.
64. Greater attention on landscape as a bridge between nature and culture, integrating both the negative and the positive impacts of conservation activities, including goods, structures and infrastructures, particularly in the context of iconic sites such as natural World Heritage.
65. Anthropogenic pressures on protected area resources and how to devise strategies that integrate protected area management and conservation with livelihood needs and development aspirations.

Ecosystem services

The role of protected areas as natural solutions to a range of socio-economic needs is identified, and linked to existing global commitments from the Convention on Biological Diversity and the UN Framework Convention on Climate Change.

Individual responses:

66. Ecosystem service and protected areas.
67. Detailed assessment of how protected areas support human health and well-being.
68. Improving the mapping and quantification of protected areas role in water management.
69. How a protected area system contributes to a nation's social and economic development, comparing different scenarios with different levels of intactness to show the economic and social consequences in the long run, if protected area systems are sub-optimally managed, diminished and fragmented.
70. How protected areas can be rationalized for human well-being through the perspective of ecosystem services, and their support for the Sustainable Development Goals, as a basis for investment in their management.
71. How and how much the global agenda on climate change has benefitted protected areas as natural solutions to climate change, including identification of these benefits (e.g. increased investments in protected areas, stronger policies, support). Ways in which the conservation community could improve these benefits.
72. Given Aichi Target 11, new creative strategies to effectively manage the growing protected area estate, to guarantee that protected areas keep on providing environmental services.

Financing protected areas

At a time of growing financial constraints and declining state allocations to protected areas, many wanted to learn more about how to pay for protection in the long term. Most protected areas today run with inadequate finances, with very lean staff and capacity and are therefore hampered in implementing sustainable management, proper research and monitoring.

Individual responses:

73. Ways for national parks to generate revenue by attracting private capital to fill gaps in public financing.
74. How to manage an adequate balance between enlarging protected areas as required by Aichi Target 11, and the growing need for development projects such as infrastructure, urbanization and agriculture.
75. Analysis of what is needed to make protected areas a viable "target" for impact investment, including size of investment protected areas can absorb, ability to provide evidence on the rate of return, etc.

Understanding community perspectives is an important issue for both researchers and managers © Marc Hockings

76. The factors that have been most effective in achieving long term financial security for protected areas, and the conditions that under-funded protected areas should strive to achieve.

Political aspects

Some people looked more generally at how those involved in protected area governance and management can understand and respond to growing demands on their time, increasing pressures and a global economic system that is often counterproductive to conservation aims.

Individual responses:

77. How protected areas can contribute to achieving the sustainable development goals.
78. Whether conservation education and awareness efforts have failed to target and reach the crucial decision makers in governments, i.e., people who can influence change and control the resources and political machinery to drive conservation.
79. The growing phenomenon of zones established within protected areas for development interventions that compromise and conflict with protected area categories and objectives.
80. Economic systems that allow or even provide incentives for activities that degrade protected areas and natural capital.
81. How to increase public support for environmental protection.
82. How broader support for protected and conserved areas can be generated through societal engagement and education.
83. Greater awareness of the importance of the social and political aspects for success in protected area management.
84. Identifying the intrinsic motivations that foster successful marine protected area engagement among communities and community members.

Governance

Issues of environmental governance have assumed a much more central role over the past two decades (Borrini-Feyerabend et al., 2013), particularly following the 2003 World Parks Congress in South Africa, and understanding of the importance of governance has increased among protected area practitioners. Implementation of rights-based conservation approaches since 2003 (Jonas et al., 2014) has shown that conservation and protected areas should go hand in hand with the implementation of human rights, especially those of previously disadvantaged people such as indigenous peoples and local communities.

Different governance types in protected areas

Many respondents raised issues related to various kinds of community or indigenous governance and shared governance approaches, suggesting that there is still much to be learned about their application and their role in protected areas in many countries. Legal and historical aspects of land tenure and access and other rights to land are often underplayed or ignored in establishment of various types of protected areas. This is a key issue in disputes, the need for participatory approaches and not least in reducing conflicts and sabotage.

Individual responses:

85. How differences in ownership and governance affect the effectiveness of protected areas in maintaining habitat and protecting species.
86. The relationship between protected area context and governance systems, and the most effective models in different contexts.
87. The legislative basis for the application of different protected area governance types in national legislation.
88. How privately protected areas can ensure long-term and effective conservation outcomes, including drawing lessons from their conservation incentives.
89. Necessary factors to enhance shared governance in protected areas in the Asian context.
90. Whether the 30 per cent of global protected areas that are transboundary, with different governance structures, contribute meaningfully to conservation goals.
91. The contribution of indigenous territories to avoiding deforestation (and related carbon emissions) as a complement to emission reductions achieved by protected areas.
92. The effectiveness of community-managed protected areas in conserving biodiversity and improving community livelihoods.
93. The most appropriate governance models for protected areas in the Pacific given over 40 years of conservation experience in the region.
94. Experiences of community conserved area development (marine and terrestrial) in the Pacific, to assess the opportunities and constraints to their successful development and maintenance.

General aspects of improving governance

Other priorities were more general, on understanding how different actors influence protected areas, ways to build greater support and understanding stakeholder perceptions.

Individual responses:

95. Where protected area managers and agencies derive their mandates from, given increasing emphasis on 'mainstreaming biodiversity' (e.g. through integrated regional development, conservation beyond protected areas, etc.).
96. The institutional arrangements that lead to successful management of sacred natural sites.
97. The human institutions (agencies, governments, private sector, indigenous groups, clubs, communities, individuals) involved in conducting or supporting protected area management, and how they operate for or against the goal for which the protected area was created.
98. Cooperative governance, threat mitigation strategies and adaptive management – how adaptive can we afford to be?
99. Stakeholder perceptions of the protected area legislative paradigm and conservation mandates in South Africa.
100. How conservation agencies can achieve adaptive capacity while having to comply with burgeoning bureaucracy.

DISCUSSION

At a time of widespread biodiversity losses, land degradation, climate change and threats to human livelihoods (e.g., United Nations, 2017), the most frequently identified research needs are on understanding if, how and to what extent protected areas can help respond to these challenges. This is demonstrated clearly by the high interest shown in climate change and management effectiveness. These disparate threads also come together in the priorities relating to system design, another popular subject, particularly when it is noted that most priorities here looked at the role of protected areas in the wider landscape. Similarly, high importance is placed on understanding how people relate to protected areas,

both in terms of potential costs and benefits, and how protected areas can be better designed and managed. A harsher economic climate and government withdrawal from environmental issues (Watson et al., 2014) mean that many responses also looked at financing protected areas, both obliquely through a focus on ecosystem services and more directly looking at financing options.

In the 100 responses to the survey, environmental change was a mentioned 14 times and was the area where there was perhaps the most overlap between researchers and practitioners with many looking for information on how these new pressures can be integrated into day-to-day protected area management. The focus of attention ranged from the very broad to quite specific issues. Protected area effectiveness was also one of the most common issues overall and was referred to in 16 of the 100 responses, although admittedly this is also one of the broadest issues. When this block of responses was subdivided into four sub-categories – improving effectiveness, measuring effectiveness, monitoring and reporting, and demonstrating conservation outcomes – it revealed more frequent responses relating to measuring and demonstrating conservation effectiveness (16 responses) rather than on improving effectiveness (2 responses), perhaps indicating that people are focused first on understanding effectiveness before moving on to the use of this understanding to adapt management. This may also be influenced by an increasing pressure for protected areas to report against quantitative targets. Here, reporting against meaningful targets is especially important (Watson et al., 2014) and the responses relating to planning protected area systems (responses 1 - 8) are particularly relevant.

Some high-profile issues in current policy fora, such as Protected Area Downsizing, Degrading and Degazettement (PADDD, Mascia & Pailler, 2011; Cook et al., 2017) featured very little. This may be because topics like PADDD that involve changing the laws governing protected areas and the high-level policies of governments are outside the direct control of both managers and researchers. Encouragingly, 48 per cent of researchers showed a focus on integrating science into management of protected areas, indicating an interest in not just growing knowledge but also in making a real difference on the ground. The most frequently mentioned research needs that overlapped across main categories addressed issues at the intersection of ecological questions with management, with a focus on how ecological understanding can be translated into management actions. Interestingly there was little focus on the intersection of social and governance aspects of protected areas.

Comparison of the most frequently used words using NVivo word clouds in the full responses from researchers and practitioners (Figure 1) shows strong similarities along with some noticeable differences. Biodiversity featured prominently in both groups although species was more important for managers and comparatively unimportant amongst researchers. The latter mentioned governance and climate at around the same frequency as biodiversity; these were much less prominent amongst practitioners. Both groups highlighted social issues although in different ways, with managers mentioning local, private, public while researchers stressed human, social, and again local. Not surprisingly, researchers stressed concepts like evidence, outcomes, performance, effectiveness, and

Figure 1: The 30 most frequent words used in the responses from managers and researchers

practices; these words were largely or completely absent among practitioners.

Overall, while there was diversity of priorities for research, there are some clear trends and these can hopefully help refine and focus a research agenda for improving the use and effectiveness of protected areas. Further work is needed on refining the application of science to protected areas, as a major input to adaptive management and speeding up the learning curve. Working with key protected area agencies and partners to develop a more comprehensive global research programme might be a valuable next step.

CONCLUDING REMARKS

The academics and practitioners who participated in this study have outlined a series of important and timely research priorities for the protected area community. A series of responses are called for:

1. In several cases, the responses highlight the need for better dissemination of available information; some of the answers may already be at least partly available in the literature but are still not widely known: some of the priorities related to environmental change or monitoring techniques may fall into this category.

2. Others identify quite precise questions that could be the subject of doctoral, post-doctoral or other research projects and it is to be hoped that highlighting them here will stimulate their take-up. Examples include issues relating to turtle nesting and invasive species.

3. A third group of priorities are beyond the scope of a single research project, either because they identify a theme requiring a range of responses, such as better understanding of the costs and benefits of protected areas, or because they are on their own sufficiently complex and multidisciplinary to require a team effort, like the call for a biodiversity equivalent of a tonne of carbon sequestered as a measure of success.

4. Finally, the IUCN WCPA also has some clear obligations to update its own technical guidance; for example, much of the earlier best practice documents do not include climate change, and although specific guidance now exists (Gross et al., 2016), these and other issues need to be more fully integrated into the Commission's work.

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RESUMEN
Se identificaron cien prioridades de investigación que revisten importancia fundamental para el manejo de áreas protegidas mediante una encuesta dirigida a profesionales de la conservación, mitad investigadores y mitad practicantes. Los encuestados seleccionados representaban una gama de disciplinas, todos los continentes excepto la Antártida y aproximadamente el mismo número de hombres y mujeres. Los resultados fueron analizados por temas y agrupados como posibles temas de investigación tanto por los profesionales como por los investigadores. Las principales deficiencias en materia de investigación revelan un gran interés por demostrar el papel de las áreas protegidas dentro de una discusión más amplia sobre futuros sostenibles y si las áreas protegidas pueden abordar de manera eficaz una serie de desafíos socio-económicos y de conservación, y de qué forma. El artículo enumera las cien prioridades estructuradas bajo amplios encabezados de gestión, ecología, gobernanza y cuestiones sociales (incluyendo asuntos políticos y económicos) y ayuda a contribuir al establecimiento de futuros programas de investigación.

RÉSUMÉ
Une enquête menée auprès de professionnels de la conservation, chercheurs et opérationnels, a mis en lumière une centaine de sujets d'étude qui sont d'importance cruciale pour la gestion des aires protégées. Les répondants ont été choisis de manière à représenter une gamme de disciplines, l'ensemble des continents sauf l'Antarctique et un nombre approximativement égal d'hommes et de femmes. Les résultats ont été analysés par thèmes et regroupés en sujets de recherche potentiels par les praticiens et les chercheurs. Les lacunes prioritaires constatées en matière de recherche démontrent l'importance d'examiner d'une part, le rôle des aires protégées dans un débat plus large sur l'avenir durable, et d'autre part, la manière dont les aires protégées peuvent aborder efficacement les défis socio-économiques et de conservation. Le document dresse une liste de cent priorités structurées sous des grandes rubriques telles la gestion, la gouvernance, l'écologie et le sociétal (qui comprend des questions politiques et économiques), et contribue ainsi à l'élaboration de futurs programmes de recherche.

EVALUATING COLLABORATIVE MANAGEMENT WITHIN THE NATIONAL PARKS AND WILDLIFE SANCTUARIES OF BANGLADESH

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ABSTRACT

The protected area system of Bangladesh in March 2017 comprised 17 national parks covering 45,740 hectares and 21 wildlife sanctuaries covering 394,053 hectares. The Government of Bangladesh introduced collaborative management in these reserves in three successive, expanding phases undertaken between 2003 up until the present time. During this period, the successive programmes introduced an elaborate collaborative management system. This paper evaluates this collaborative management system as well as the protected area management arrangements being promoted, comprising: (i) the Co-management Council, (ii) the Co-management Committee, (iii) the People's Forum, and (iv) sub-village institutional bodies including the Community Patrol Groups and the Forest User Groups (or the Village Conservation Forums). It assesses the management interventions and the effectiveness of the collaborative management system to implement an effective protected area programme. The review indicates that the current organisation and mandate of the protected area authorities precludes them from being effective partners in collaborative management, lacking dedicated staff in both the outreach and livelihood agendas, which severely undermines their participation in collaborative management. This paper recommends that the protected area authority needs to be strengthened and reorganised, in order to play a leading role in village engagement – and a key leading agency in the higher level collaborative management bodies.

Key words: Bangladesh, co-management, collaborative management, national park, protected area, wildlife sanctuary

INTRODUCTION

Various management terms – including joint management, shared governance and co-management – have been proposed as approaches for management of protected areas worldwide (Carlsson & Berkes, 2005; Rashid et al., 2013, 2015). Co-management has also been proposed to provide opportunities to share responsibilities, rights and duties between the government and local resource users (Berkes et al., 1991; World Bank, 1999; Carlsson & Berkes, 2005; Parr et al., 2013). However, in Asia, government conservation agencies across the region have often been awarded management responsibility over the past 30–50 years for the biologically rich tracts of natural habitats within their respective countries. With very few exceptions (e.g. Lao PDR and the Philippines), these conservation agencies have managed these sites for varying numbers of decades, without meaningful engagement of the local communities (De Koning et al., 2016). The transition from fortress-type management approaches to collaborative management approaches involves not only a policy change, but institutional organisational changes within the protected area bodies themselves managing the protected areas (Chowdhury et al., 2009). Collaborative management – and the gradual shift towards co-management – requires the training of field staff, from managers downwards, so that they actually have the necessary skill sets to engage in collaborative management with the district partner agencies and the villagers themselves; becoming co-management partners takes decades. Hence, we adopt the term "collaborative management" which takes account of the anticipated 20–30 year period for government conservation partners to engage, understand and accept villagers as (co-)management partners.

Monthly Co-Management Committee (CMC) meeting including Forest Department staff, community representatives, civil society and law enforcing agency staff © Md. Shama Uddin

The principles of collaborative management, like co-management, include the use of local people's knowledge in resources conservation. It incorporates traditional and scientific knowledge into protected area management, and integrates a variety of actors in a variety of roles in natural resource management. It promotes continuous consultation through a learning-by-doing approach, encouraging decentralisation of management power, biodiversity conservation and planning at the local level and participatory learning, (Berkes et al., 1991; Borrini-Feyerabend et al., 2004; Carlsson & Berkes, 2005; Arnold & Gimenez, 2007), which are the basis for the acceptance of collaborative management by protected area managers.

The establishment of the protected area system in Bangladesh was launched in the 1960s through the declaration of national parks and wildlife sanctuaries under the Forest Act (1927) and the Wildlife Preservation Act (1974) (Huda, 2006; Sharma et al., 2008; Chowdhury & Koike, 2010). As of 31 March 2017, Bangladesh had 38 protected areas comprising 17 national parks covering 45,740 hectares and 21 wildlife sanctuaries covering 394,053 hectares. These protected areas are valued for supporting the livelihoods of the dependent communities (Mukul et al., 2010) and indigenous communities (Mian et al., 2013). Bangladesh is a country facing high population density, resource scarcity and extreme pressures on its forests (Mukul et al., 2010; Sohel et al., 2014). Collectively, these factors result in high threat levels within the protected area system from local villagers, including cutting saplings for firewood, uncontrolled grazing, forest fire outbreaks, illegal selective logging, as well as conversion of lands into agriculture and housing (Rashid et al., 2013; Chowdhury et al., 2014; Palomo et al., 2014; Rahman & Vacik, 2015). Furthermore, due to changes in temperature and rainfall patterns, the overall health and condition of the protected areas are degrading (Pender, 2008).

In response to the prevailing situation, the Government of Bangladesh introduced collaborative management

into five protected areas through the Nishorgo Support Project (NSP) undertaken between 2003 and 2008 in order to develop a model which could be gradually replicated to other protected areas of the country (Quazi et al., 2008). This pilot initiative involved the sharing of management responsibilities with other stakeholders, including local villagers (Fox et al., 2007; Ferdous, 2015). In 2006, eight Co-management Committees were formed within the five sites, based upon the number of ranges found in the respective sites. The Forest Department developed the Nishorgo Vision 2010 to implement collaborative management. Subsequently, the Forest Department increased the collaborative management programme to a further 13 protected areas (as an overall total of 18 protected areas) involving a further 15 Co-management Committees through the Integrated Protected Area Co-management (IPAC) Project undertaken between 2008 and 2013, covering 185,088 hectares. Significantly, co-management was incorporated into the Wildlife Conservation and Security Act (Amendment, 2012). In 2013, the Forest Department expanded and strengthened the collaborative management programme, targeting a total of 22 protected areas and involving 27 Co-management Committees through the ongoing USAID-funded, Climate-Resilient Ecosystems and Livelihoods (CREL) Project.

During the 13 years of implementing collaborative management in Bangladesh, various challenges were recognised including the failure to establish the Forest Department as a leading partner with the local villagers within the key institutional bodies under the collaborative management system, the complexity of the institutional structures, the influence from local political parties, as well as project dependency and finances (Baldus, 2008; Cardinale et al., 2012; Rashid et al., 2013; Chowdhury et al., 2014). Despite these challenges, community participation in local forest management brought substantial positive impacts and collaborative management has gained popularity among people involved in the conservation and protection of biodiversity and ecosystem services of protected areas (Rashid et al., 2013; Mukul et al., 2015).

This paper investigates the challenges regarding the effectiveness of collaborative management within the protected areas of Bangladesh with the aim of generating alternative solutions, through:

1. A detailed analysis of the institutional arrangements of;
   (a) the protected area authorities, and
   (b) the governance mechanisms for their interactions with local stakeholders; and
2. Inferences from the institutional mapping analysis on the collaborative management issues and the current management responses.

METHODOLOGY

A systematic analysis of the collaborative management system was undertaken, involving the following steps:

1. The development of the collaborative management engagement of the protected area authorities with the local communities was assessed in the relevant legislation, including the prescribing of the institutional bodies involved in the collaborative management system.
2. The organisational arrangements of the protected area authorities of the national parks and wildlife sanctuaries were reviewed, to see how they are structured with regards to implementing collaborative management in the various technical fields of protected area management found in Asia.
3. The institutional bodies prescribed for implementing collaborative management were analysed to understand what their memberships, their functions and responsibilities were, the frequency of meetings and how they interacted within the multi-tiered collaborative management system; and
4. The field activities undertaken during the three successive phases of the collaborative management programme, namely the Nishorgo Support Project (NSP) (2003–2008), the Integrated Protected Area Co-management (IPAC) Project (2008–2013) and the Climate-Resilient Ecosystems and Livelihoods (CREL) Project (2013–2017), were reviewed.

RESULTS

Protected area management arrangements

The management authorities of the national parks and wildlife sanctuaries should be a core institutional body at the centre of the collaborative management system, and should be a primary partner in implementing collaborative management in and around the protected areas. The authors evaluated the management system and staffing levels for a typical national park and a typical wildlife sanctuary, which were deemed representative of the collaborative management system

and issues found more broadly within the protected area system of Bangladesh. In Himchari National Park, these staffing levels were approximately half the required staffing levels as prescribed in the Himchari National Park Management Plan (2016–2025). In Rema -Kalenga Wildlife Sanctuary, comprising 1,795 ha, staffing levels were also lower than the levels prescribed in the Rema-Kalenga Wildlife Sanctuary Management Plan (2016–2025).

In both reserves, the overwhelming number of staff are dedicated to law enforcement and forest protection (Table 1). Current staffing levels on enforcement were deemed inadequate in both reserves, so additional enforcement staff are proposed within both respective management plans. In sharp contrast, both reserves lack dedicated outreach and conservation awareness staff which are prerequisite to facilitating engagement with the villagers. Collaboration with the buffer zone communities was confined to promoting plantations, with extremely limited opportunities for meaningful engagement with individual villagers. These institutional staffing weaknesses found within these two randomly selected reserves are indicative of the field-level management arrangements found throughout the protected area system of Bangladesh. The low staffing levels contribute to the lack of staffing specialisation required for collaborative management.

Collaborative management institutional bodies at different levels

The collaborative management system in Bangladesh has four different levels. The two upper level institutional bodies are multi-stakeholder collaborative management bodies, while the lower two levels comprise institutional bodies comprising village representatives at the village level and sub-village level. These four tiers of the collaborative management system comprise (Figure 1):

1. the Co-management Council;
2. the Co-management Committee;
3. the People's Forum; and
4. sub-village bodies including the Community Patrol Groups and the Forest User Groups (or Village Conservation Forums).

The Co-management Council

Every forest protected area has one or more Co-management Councils, promoting effective participation of the local stakeholders living around the protected area. The Co-management Council is a general body for policy development, with a membership of 65 stakeholders. Members of the Co-management Council are appointed for four years. The Co-management Council meets at least two times a year.

The Co-management Committee

The Co-management Committee constitutes the key collaborative management body in Bangladesh. The Committee is elected for two years; any elected member shall not be a member more than two times consecutively. The Co-management Committee meets at least once a month.

The People's Forum

The General Committee of the People's Forums was constituted with elected representatives from the Village Conservation Forums in villages adjacent to the forest protected areas, consisting of 11 village members.

Table 1. Staffing levels in a typical national park and a typical wildlife sanctuary in 2015

Protected area	Area (hectares)	No. of Ranges[a]	No. of Beats[b]	Enforcement staff	Outreach staff	Livelihoods staff
Himchari National Park	1,727	1	5	21	None	None
Additional staff required				22		
Rema-Kalenga Wildlife	1,795	1	3	29	None	None
Additional staff required				15		

[a] A Range Office, composed of 3–5 beats depending on the area of the Range, is managed by a Range Officer. A Co-management Committee is usually based on the range jurisdiction with the Range Officer designated as the member secretary of the Co-management Committee.

[b] A Beat is the lowest administrative unit of the Forest Department. A Beat Officer is in charge of a Beat.

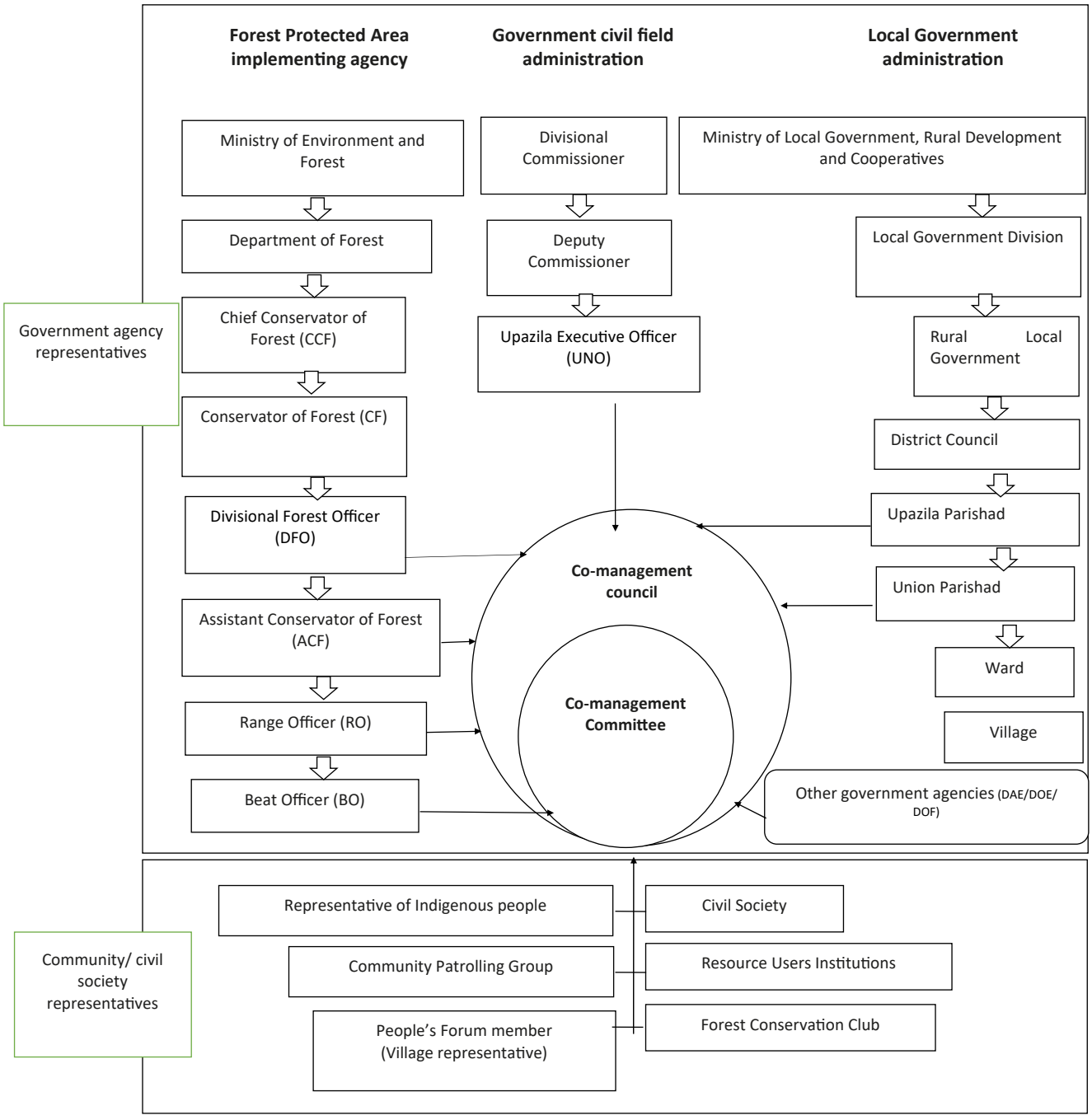

Figure 1. Two main co-management bodies – the Co-management Council and the Co-management Committee in relation to (i) the Forest Protected Area agency, (ii) the Government civil administration and (iii) the Local Government Administration.

Ecotourism facilities in protected areas provide income generation to sustain collaborative management in Bangladesh. © UN-REDD National Programmme

Sub-village institutional bodies

(a) Community Patrol Groups

A total of 75 Community Patrol Groups protect 43,974 hectares of protected areas in Bangladesh. Each month group members meet together to discuss threats, protection and the next course of action. Community patrolling work is mostly voluntary. They patrol for 6–8 days a month. Training has been provided on conservation, protection and the responsibilities of patrol group members. Of note, the patrol members have no land tenure relationship to the natural resources which they are protecting. Since the patrol groups began patrolling in 2006, three patrol members have been killed and a further 68 severely injured while on patrol.

(b) Forest User Groups

Forest user groups comprised those members of the local communities who were heavily dependent upon the natural resources from the protected areas. The members were selected by the village committee themselves. These Forest User Group members were given development assistance priority because of their heavy dependence on the natural resources. These Forest User Groups were replaced in 2006 by the Village Conservation Forums.

(c) Village Conservation Forums

The Village Conservation Forums were formed during the IPAC to promote conservation and sustainable development in each village around the protected areas. They comprise individual villagers who are interested in the conservation of the forest resources.

Initiatives promoting collaborative management

The Forest Department implemented three projects with financial assistance from USAID to introduce collaborative management in protected areas in Bangladesh since 2003. Additional details of projects are provided in Supplementary Online Material.

The Nishorgo Support Project (NSP) from 2003–2008

This project piloted collaborative management in five protected areas comprising Lawachara National Park, Sathchari National Park, Rema-Kalenga Wildlife

Sanctuary, Chunati Wildlife Sanctuary and Teknaf Wildlife Sanctuary. The project established eight Co-management Committees, as well as People's Forums, and Forest User Groups.

Integrated Protected Area Co-management (IPAC) Project from 2008–2013

The project expanded the collaborative management system into a further 13 protected areas (targeting an overall of 18 protected areas) involving the mobilisation and technical support to total of 23 Co-management Committees.

Climate Resilient Ecosystems and Livelihood (CREL) Project, from 2013–2017

Under this project the Forest Department expanded collaborative management in 22 protected areas with 27 Co-management Committees. The initiative facilitated the development of 14 protected area management plans and 27 long-term (10-year duration) co-management plans.

DISCUSSION

Rapid legal changes promoting collaborative management of protected areas

The mainstream forestry legislation (Forestry Act, 1927) in Bangladesh precluded access to local people, for almost 80 years; a period of sufficient duration to facilitate a strongly ingrained attitude among forestry officials regarding community participation in protected area management. After the Liberation War in 1971, the Government of Bangladesh included a section (18A) in the Constitution which states that the "State will conserve and develop the environment for people and will ensure conservation and security of forests, wildlife, wetlands, biodiversity and natural resources". Consequently, the Bangladesh Government enacted a number of new policies and instruments relating to promoting collaborative management in protected areas. The government notified a gazette on co-management in 2006 (amended in 2009) to introduce collaborative management within the five pilot co-managed protected areas. Collaborative management was also recognised by the Wildlife Preservation Act (Amendment, 2012), which stated that: "the government may introduce co-management system for proper utilization, conservation and management of natural resources of the sanctuary involving the Forest Department, minor ethnic-communities living in the forests or local communities on participatory basis to ensure active participation of all the parties therein".

General observations on the collaborative management system

The majority of the protected areas established before the 1980s followed exclusionary state-run approaches, restricting the customary user rights of the local communities (Mehta & Heinen, 2001). The challenge for the development of collaborative management has been to overcome the colonial legacy characterised by bureaucratic and revenue-oriented management, and widespread isolation of communities by ignoring their traditional rights, indigenous knowledge and resource use practices (Rashid et al., 2017). In this context, the collaborative management system in Bangladesh developed extremely rapidly. It was therefore somewhat optimistic to consolidate the identification of the two key institutional bodies for collaborative management – the Co-management Council and the Co-management Committee – based entirely upon the outcomes and recommendations of a single project initiative, the NSP (2003–2008), without trialling a range of collaborative management models, and evaluating their internal institutional and governance mechanics.

The system proposed and adopted comprises a multi-tiered governance system in which the two highest level multi-stakeholder institutional bodies discuss the full range of protected area issues. These two higher institutional bodies immediately link into the grassroots village forums, namely the People's Forums and the Forest User Groups (or Village Conservation Forums). The Bangladesh collaborative system contrasts strongly with the collaborative management arrangements found within other protected areas in Asia, which have committees dedicated to different technical areas of management, which have evolved over longer time frames. Mount Kitanglad Range Natural Park, mooted as one of the best protected area collaborative management systems in the Philippines, has no less than 13 committees operating under the Protected Area Management Board and Executive Protected Area Management Board, with each committee dedicated to focus on a particular protected area issue (Parr, 2017). Periyar Tiger Reserve also has a wide range of institutional bodies tackling various issues found in landscape protected area management (Parr, 2015).

This 'vertical' collaborative management phenomenon in protected area management in Bangladesh may have been induced by the lack of diversity of job roles and responsibilities awarded to the forestry staff, or by individuals who think that stakeholder dialogue forums alone promote effective co-management; without

training of the collaborative management partners, they almost certainly do not. It is unclear what role was envisaged for the Forest Department in the three successive collaborative management projects, and what training or technical expertise was added to its mandate. However, this may well account for the degree of ambiguity between the role and responsibilities of the Forest Department and the collaborative management bodies in field operations, as reported by Rashid et al. (2015). The lack of focus on discussing technical agendas, also leads to the predominance of elite groups in the collaborative management bodies. Quite simply, too few members have been appointed with technical knowledge, whilst too many members have been elected with their own agendas. Chowdhury et al. (2014) reported a lack of policy level integration in all 34 protected areas, and cited this as the biggest threat to biodiversity conservation in protected areas.

According to Haider and Kabir (2014), a number of stakeholders complained that the working body of the Co-management Committee was not always effective in engaging local people in decision-making. The stakeholders claimed that there is a communication gap between the Co-management Committee, the Village Conservation Forums and local villagers, which is sometimes responsible for the unsuccessful conservation approaches. Rashid et al. (2017) also recommend devising an appropriate governance mechanism recognising and supporting local rights, access and participation in protected area management. The Forest User Groups, which constitute a valuable institutional body for sustainable management of the protected areas, have had their mandates broadened into the Village Conservation Forums. It may be worth reconstituting the Forest User Groups, which could be targeted for development assistance, to mitigate threats to the protected areas. These groups should be linked into the government administrative system, through the Union Parishad and Wards.

Local political people are important stakeholders in collaborative management. However, sometimes politically influential individuals misuse their power by overshadowing the voices and interests of people at the grassroots (Jashimuddin & Inoue, 2012), and are themselves involved in illegal poaching and resource collection from the forest (Fox et al., 2007; Uddin & Foisal, 2007; Uddin & Mukul, 2007; Muhammed et al., 2008). On many occasions illegal logging and encroachment inside the protected areas benefitted and were supported by political leaders (Rashid et al., 2013; Ferdous, 2015).

Weak organisational arrangements of the protected area management authorities for village engagement

The organisational arrangements of Himchari National Park and Rema-Kalenga Wildlife Sanctuary, including the proposed staffing levels stated in their respective management plans, suggest that the Forest Department has been unable to restructure its management authorities to the extent required to effectively engage in collaborative management. In both reserves, the overwhelming number of staff are dedicated to forest protection, and there is an extremely limited mandate, and perhaps capacities, at the lowest management levels to collaborate with the buffer zone communities. Forestry staff were only appointed to promote plantations. There were no dedicated protected area staff in either reserve to promote outreach and conservation awareness – to change village attitudes and behaviour - and there are no dedicated staff to facilitate livelihood interventions, and ensure that they link to threat mitigation. According to Kolahi et al. (2013), failing to build connections with the local people is the main cause of the unsuccessful management approaches in the protected areas. This lack of connectivity might be a result of no Forest Department staff having been trained in (i) outreach and conservation awareness and (ii) facilitating livelihood development for conservation; two core requirements for meaningful engagement with local communities.

Such collaborative management arrangements were alluded to indirectly by Kopylova & Danilina (2011), proposed by Appleton et al. (2003), and elaborated by Parr et al. (2013). A good multi-level collaborative management system has been developed in Periyar Tiger Reserve in Southern India (Parr, 2015). In this regard, the piloting of village engagement crucially involves outreach and livelihoods agendas – and thence bringing about attitudinal changes among the Forest Department officials towards the shifting paradigm in protected area management.

Absence of coherent outreach programmes to villagers

All three collaborative management initiatives overlooked the need to establish dedicated outreach and conservation awareness staff in the targeted protected areas over the 14-year agenda of promoting collaborative management within the protected area system of Bangladesh. Under the NSP (2003–2008), the outreach and school programmes for conservation were implemented by the project staff. Key outreach activities under the IPAC Project (2008–2013) involved arranging a co-management congress, promoting responsible tourism campaigns, youth engagement in conservation, radio programmes, journalists' visits, cross-site visits, art competitions and local theatres, and participation in

different national and international events. In 2009, the sharing of entrance fees in protected areas with local communities was initiated in five protected areas through the Co-management Committees. More diverse outreach activities were undertaken under the CREL Project (2013–present), including youth engagement, cross-site visits, national and international day observance, signage, jungle walks, newsletters, leaflet flyers, journalists' visits to protected areas, community radio programmes, tourism promotion activities, and various capacity-building courses at home and abroad aimed at co-management and Forest Department staff.

Management of outreach is diffused across co-management bodies. Co-management Committees are mandated to arrange various meetings, training, workshops and public awareness programmes to increase the awareness of villagers on biodiversity conservation, with no lead agency specified. Both the People's Forums and the Village Conservation Forums are also mandated to promote outreach and conservation awareness among their village communities. However, no government capacities "on (i) raising awareness regarding the conservation of natural resources and wildlife, (ii) raising awareness about sustainable livelihoods, including sustainable utilisation of non-timber forest products, (iii) raising awareness among villagers regarding climate change and (iv) encouraging villagers to abide by the existing forestry conservation legislation", were envisaged in successive project designs.

To contest these mandates, Ferdous (2015) stated that most of the poor villagers have little or no idea about biodiversity conservation. He recommended that steps should be taken by the protected area agency itself to make villagers aware of species conservation as well as the links to deforestation, global warming, climate change and their consequences. Open dialogue and community engagement will foster stronger ties, and assist in alleviating various illegal practices including poaching and resources extraction (Abbasi & Khan, 2009; Steinmetz et al., 2014; Dhakal & Thapa, 2015). A number of authors also point to the importance of understanding local peoples' perceptions of protected areas (Lynam et al., 2007; Allendorf et al., 2012), which can guide management decisions (Parry & Campbell, 1992; Weladji et al., 2003). Parr et al. (2013) recommend that a defined community outreach section within the protected area management authority is required.

Sustainable utilisation of natural resources in protected areas

Traditional utilisation of non-timber forest products from the forest protected area system of Bangladesh

Educating school children during Protected Area visit © Climate-Resilient Ecosystems and Livelihoods project

appears widespread, and represents a significant proportion of livelihood income. It also represents a particularly vital source of income to landless villagers. In Satchari National Park, Mukul et al. (2012) discovered that local communities gather a substantial amount of non-timber forest products despite official restrictions. They found that 27 per cent of households living in close proximity to the protected area received at least some cash benefit from the collection, processing and selling of non-timber forest products, and non-timber forest products contribute to households' primary, supplementary and emergency sources of income. They also reported that non-timber forest products also constituted an estimated 19 per cent of households' net annual income, and were the primary occupation for about 18 per cent of the households. The forests provide food, fodder, fuel, medicines and building materials. To avoid conflict and promote the traditional livelihoods of the communities, there is a need to allow local people to harvest certain amounts of forest products to ensure ecological sustainability (Mukul et al., 2010, 2012).

There is a strong link between poverty and dependence upon the forest. In Kaptai National Park, Mian (2011) found that approximately 36 per cent of households in Bangchari and 57 per cent of households in Kamillachari have no agricultural land. The landless in both villages collect and sell fuel-wood and other non-timber forest products from neighbouring forests. In Madhupur National Park, 82 per cent of households in the village of Pirgacha engage in forestry activities inside the national park. Fuel-wood is collected from the park's forests by 75 per cent of households for daily consumption and also for sale (Mian, 2011). He found that 20 per cent of households collect wood and that 18 per cent collect fruits and leaves from forests. Approximately 36 per cent of households own land. In Telki Village, all the households collect fuel-wood from the national park both for household consumption and for sale (Mian, 2011). In addition, 84 per cent collect wood and 12 per cent collect fruit and leaves from the forest. In Telki, 32 per cent of respondents own land.

Given these realities, the three co-management initiatives overlooked an opportunity to conduct participatory research involving protected area staff and the villagers to enable the Forest Department staff to understand the social dynamics of natural resource utilisation. This in turn could have led to the piloting of village land use planning, and the subsequent zoning of the protected areas to facilitate sustainable natural resource extraction, linked to village rules. Instead, alternative livelihoods were promoted.

Livelihood development interventions linked to threat mitigation

The three successive programmes delivered a wide range of livelihood interventions, some directly linked to threat mitigation and some indirectly linked to threat mitigation. However, the protected area staff were not given a facilitator role in the delivery of these interventions, and hence again missed an opportunity to make the protected area staff a core co-management partner. Under the NSP (2003–2008), livelihood interventions activities were introduced by the Co-management Committees with support from the project staff; the protected area staff were not trained and designated as the collaborative management partners for implementing these activities, plantations aside. A total of 102 Forest Users Groups were established comprising 1,750 of the most forest dependent households, to reduce their forest dependence. Interventions included homestead tree plantations, bamboo management and improved cooking stoves, as well as linkages to micro finance institutions, handicrafts, tourist stalls and eco-cottages. The project provided households with training in cow fattening, nursery establishment, fish cultivation, fishing, pig rearing, poultry rearing, small trading, rickshaw-van pulling, manufacturing of improved cooking stoves, and eco tour guiding. Under the project, the Co-management Committees received development funding amounting to BDT 8,989,303 (US$ 113,788) to implement livelihoods and ecosystems improvement activities.

Through the IPAC Project: 2008–2013, the collaborative management systems received a further BDT 4,565,442 (US$ 57,790) to manage the forest ecosystems and promote livelihoods interventions. Important livelihoods activities comprised nursery establishment, bamboo handicrafts and weaving, homestead vegetable gardening, mushroom cultivation, poultry rearing, eco tour guiding, tailoring, and leveraging funds from other projects. All these livelihood interventions were facilitated by the project staff; the protected area staff were not trained and designated as the collaborative management partners for these activities. In stark contrast, in Periyar Tiger Reserve, the protected area authorities recruit a livelihoods development facilitator who leads on the delivery of the livelihood interventions, and promotes sustainable buffer zone livelihoods (Parr, 2015).

The CREL Project: 2013–2017 also developed 400 local service providers, 2,760 agriculture demonstration plots and engaged 3,900 women in export-oriented toy making. The project identified market-based livelihoods by providing market-based training, and linkage with

buyers and market actors, creating local service providers. The project also strengthened non-agricultural employment for natural resource users including the landless through private sector engagement. New economic opportunities through food processing and ecotourism for resource dependent people were created by the project. The project also introduced non-agriculture based livelihood activities included vocational training on souvenir making, jute/paper bag making, crop seed production, handicrafts production and crab fattening. Further, the project included 350 Financial Literacy and Entrepreneurship Development Centres targeting 6,200 beneficiaries, mostly women, who each received seven months of training.

Successful joint patrolling with villagers

All three development initiatives promoted the recruitment and employment of local villagers as community patrol staff, who have provided much needed additional human resources to implement the law enforcement activities within the protected areas. Under the NSP Project (2003–2008), community patrol teams, comprising 927 local villagers, undertook joint patrolling with local forest officials. They were provided minimum honoraria. The IPAC also supported this law enforcement approach, facilitating the establishment of community patrol groups comprising 643 village members. The CREL (2008–present) Project helped the Forest Department to recruit 185 community patrol members in the Sundarbans reserve forests. However, it remains unclear whether the strong law enforcement programmes endeared the protected area staff to their villagers who are their collaborative management partners.

Financial sustainability of collaborative management

All the protected areas in Bangladesh are facing an acute funding shortage, hampering the sustainability of forest protection and biodiversity conservation (Chowdhury et al., 2014). Bangladesh has extreme resource constraints, and its government cannot allocate sufficient funds from the public budget to the forestry sector owing to other priorities (Mulongoy et al., 2008). The long-term sustainability of the entire Co-management Committee system remains an issue. One observation is that all the institutional bodies prescribed in the current co-management system are project-derived institutional bodies, operating outside the existing administrative system of Bangladesh. Rashid et al. (2017) recommend that these issues need consideration in designing future protected area regimes, in the perceived absence of external aid support.

Ecotourism represents one of the most viable options for delivering benefits to the local communities in protected areas (Nagothu, 2001; Fox et al., 2007; Haider & Kabir, 2014). Revenue sharing from ecotourism will assist in

Joint patrolling at protected areas, community people and Forest Department staff © IPAC project

maintaining the financial sustainability of the collaborative management programme. However, the Forest Department collects entry fees from Himchari National Park and Bhawal National Park through open bidding, without sharing these benefits with the respective Co-management Committee. Increasing ecotourism facilities will increase opportunities for co-management financial sustainability. Khadimnagar National Park, Kaptai National Park, Dudpukuria-Dhopachari Wildlife Sanctuary, Hazarikhil Wildlife Sanctuary, Fasiakhaki Wildlife Sanctuary, Medhakacchapia National Park, Nijumdwip National Park and Inani Reserved Forest (proposed protected area) all show potential for developing ecotourism. Finally, co-management has the potential to collect revenue from non-timber forest products, further revenue from entry fees to protected areas, the introduction of payment for ecosystem services, REDD+, public private partnerships, access to donor funding and the Climate Trust and Resilience Fund of the Bangladesh Government.

CONCLUSIONS

Collaborative management has become an acceptable management strategy for the forested protected areas in Bangladesh, and appears to be strongly supported at policy level, with donor support. However, the potential benefits of collaborative management are yet to be seen in Bangladesh because of some extremely fundamental flaws in the institutional collaborative management arrangements. Most significantly, the protected area staff have not been organised, trained and mandated to be effective collaborative management partners with the villagers and district partners. No outreach and conservation awareness units or livelihood development for conservation units have been established, rendering the officials of the national parks and wildlife sanctuaries poor collaborative management partners.

As a direct consequence of the limited participation of the protected area authorities, the Co-management Committees, and to a lesser extent, the Co-management Councils, have become project forums to deliver project activities, with technical stop-gapping by the project staff substituting themselves and other district partners to guide the outreach and livelihood programmes. These institutional arrangements are highly unsustainable. Some very simple structural changes are required to bring in the Forest Department as the lead collaborative management partner, and as a leading partner in outreach and livelihood development linked to threat mitigation. An important natural resource issue is villager access to non-timber forest products. This activity still needs some evaluation through piloting in a couple of protected areas, involving international experts in forest and land use planning, and village forest management. Livelihood interventions need clear links to participatory threat mitigation.

The institutional arrangements for collaborative management need to bridge the technical programmes of the protected area authorities with the administrative agendas of government. These modifications should ensure the long-term sustainability and better forest governance of the protected areas in Bangladesh.

Recommendations

The entire collaborative management system revolves around stakeholder meetings being convened at the different levels. The membership and agendas of the Co-management Councils and Co-management Committees should be reviewed given the proposed role of protected area staff to lead outreach and conservation awareness programmes as well as livelihood development for conservation programmes within the neighbouring villages.

To assist the restructuring process of both the Co-management Councils and the Co-management Committees, research should be conducted to assess the effectiveness of both these institutions in supporting effective collaborative management interventions.

One or more selected protected areas, should pilot test a possible restructuring of the Co-management Committee into three specialised committees, focussed on (i) law enforcement; (ii) promoting sustainable livelihoods and capacity development, (iii) outreach. Efforts should be made to align these specialised Co-management committees with existing government administrative structures including the sub-districts (Upazilas/Thana), union councils (Union Parishads) and villages (Wards) to increase sustainability.

The Forest Department, assisted by donor support, should pilot the recruitment of rural development/ livelihood experts within the management structure of national parks or wildlife sanctuaries to facilitate sustainable livelihood and threat mitigation interventions in the buffer zone.

The Forest Department, assisted by donor support, should train selected forestry staff to facilitate outreach and conservation awareness programmes within buffer zones.

Piloting of law enforcement strategies, involving selected community patrol groups, protected area law enforcement staff and perhaps district police should be

promoted to provide a mobile higher level of enforcement inside the protected areas.

The Forest Department should promote a national level collaborative management working group, bringing together expertise from government agencies, academia, recognised experts and NGOs to supervise the development of collaborative management in protected areas in Bangladesh. Expertise should be sought to cover the full spectrum of protected area issues.

The Forest Department, in collaboration with the national level collaborative management working group, should investigate use of site level protected area trust funds to facilitate funding of collaborative management (e.g. contracts for livelihood development facilitators) in protected areas in Bangladesh, as implemented in Periyar Tiger Reserve, India.

SUPPLEMENTARY ONLINE MATERIAL

Appendix 1: Key institutional bodies in the Collaborative management system of Bangladesh, in 2016.
Appendix 2: Field projects promoting the collaborative management system in Bangladesh between 2003 and 2017

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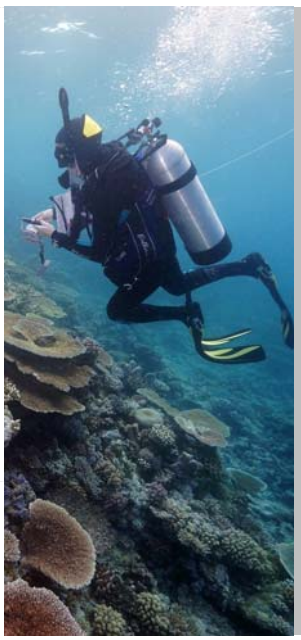
RESUMEN

El sistema de áreas protegidas de Bangladesh comprende 17 parques nacionales que abarcan 45.740 hectáreas y 21 santuarios de vida silvestre que cubren 394.053 hectáreas (a marzo de 2017). El Gobierno de Bangladesh introdujo la gestión participativa en estas reservas en tres etapas sucesivas y en expansión, emprendidas entre 2003 y hasta hoy día. Durante este período, los programas sucesivos introdujeron un elaborado sistema de gestión participativa. El presente artículo evalúa tanto el sistema de gestión participativa como los acuerdos de gestión de áreas protegidas que se promueven, los cuales incluyen: (i) el Consejo de cogestión, (ii) el Comité de cogestión, (iii) los Foros del pueblo y (iv) los órganos institucionales de subaldeas, incluidos los Comités de vigilancia participativa y los Grupos de usuarios de los bosques (o los Foros de conservación de las aldeas). Evalúa las intervenciones de gestión y la eficacia del sistema de gestión participativa para implementar un programa eficaz para la gestión de áreas protegidas. El examen indica que la organización y el mandato actual de las autoridades de áreas protegidas les impide ser socios eficaces en la gestión participativa, careciendo de personal dedicado tanto en términos de los programas de proyección como de medios de subsistencia, lo cual socava su participación en la gestión colaborativa. Este artículo recomienda el fortalecimiento y reorganización de las autoridades responsables de las áreas protegidas, para que desempeñen un papel preponderante en la participación a nivel de aldeas y que puedan actuar como organismo coordinador clave en los órganos de gestión participativa de más alto nivel.

RÉSUMÉ

Le système d'aires protégées du Bangladesh comprend 17 parcs nationaux qui s'étendent sur 45 740 hectares, et 21 réserves fauniques englobant un total de 394 053 hectares (en mars 2017). Le gouvernement du Bangladesh a mis en place la gestion collaborative dans ces réserves en trois phases successives et progressives, entreprises entre 2003 et aujourd'hui. Au cours de cette période, les programmes successifs ont mis en oeuvre un système de gestion collaboratif élaboré. Cet article évalue ce système de gestion collaboratif ainsi que les dispositions de gestion en cours d'implémentation dans les aires protégées, comprenant (i) le Conseil de Cogestion, (ii) le Comité de Cogestion, (iii) le Forum Populaire, et (iv) les organismes institutionnels des villages, y compris les groupes de patrouilles communautaires et les groupes d'usagers forestiers (ou les forums de conservation des villages). Il évalue le rôle des interventions administratives et de la gestion collaborative dans la mise en œuvre d'un programme efficace dans les aires protégées. Cet étude indique que l'organisation et le mandat actuel des autorités des aires protégées ne permet pas leur implication efficace dans la gestion collaborative, car ils manquent de personnel dédié aux programmes de sensibilisation et de subsistance, ce qui entrave sérieusement leur participation à la gestion collaborative. Ce document recommande que l'autorité des aires protégées soit renforcée et réorganisée, afin de leur permettre de jouer un rôle de premier plan dans l'engagement des villages - et d'occuper une position clé au sein des organes de gestion collaborative au plus haut niveau.



IS MY MARINE PARK ACHIEVING ITS CONSERVATION GOAL? A STRAIGHTFORWARD ANALYTICAL APPROACH TO HELP MANAGERS ADDRESS THIS QUESTION

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ABSTRACT

There is an increasing demand that managers of marine parks quantitatively demonstrate the achievement of their conservation goals. Monitoring is one tool that can help with this. One component of monitoring that is challenging for managers is the statistical treatment of monitoring data. Commonly used approaches, such as null hypothesis tests, are conceptually challenging and operationally complex, potentially leading to wrong conclusions and poor decisions. A more straightforward approach is parameter estimation with confidence intervals. Parameter estimation focuses on estimating the size of change or difference (an 'effect size') in a response variable and comparing this with a pre-defined effect size called a management threshold. Confidence intervals indicate the level of precision in estimates of change, which make for more balanced conclusions. Parameter estimation is also conducive to graphing, which can facilitate interpretation and communication to non-scientists. In this paper, I demonstrate three examples of parameter estimation and discuss their relative strengths and weaknesses. By presenting these examples, I hope to encourage managers to adopt statistical approaches that allow them to quantify environmental change in a way that will contribute to defensible conclusions, facilitate timely decision making and be understood by stakeholders.

Key words: Confidence interval, effect size, management threshold, marine park, monitoring, parameter estimation, statistical analysis

INTRODUCTION

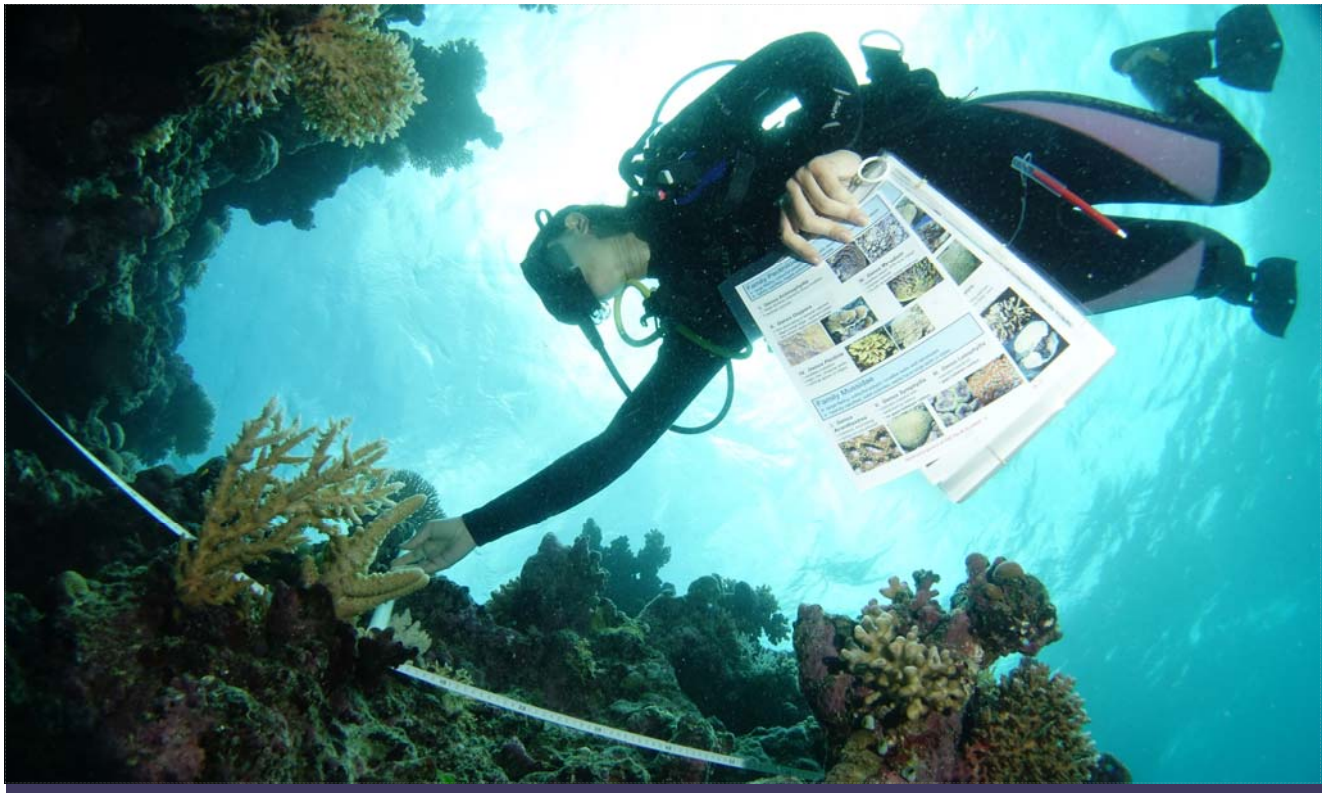
Most multiple-use marine parks (hereafter, 'marine parks') have several goals, including biodiversity conservation, facilitating tourism and supporting sustainable fisheries (Day et al., 2015). A zoning scheme and activity-specific regulations are among the management tools used to balance competing goals, but these are not always guaranteed to work. Therefore, monitoring is required to assess whether conservation goals are being achieved and to prompt changes in management strategies where there is evidence of an unacceptable level of environmental change (Addison et al., 2015a; Hockings et al., 2006; Pomeroy et al., 2004).

To directly compare monitoring data with a conservation goal, the latter needs to be quantitatively defined (Burgman et al., 2012). Quantitatively defining a conservation goal usually involves specifying a management threshold for the response variable of interest. A threshold is a value that if exceeded would trigger management intervention or further investigation. In some instances, a management threshold might be a fixed value, such as a water quality standard (ANZECC, 2001) or presented as a range of values called quantitative condition categories (Addison et al., 2015b). In other situations, a threshold can be defined in terms of a level of change or a mean difference, say between impact and control sites, which would be of management concern. Such change or difference, irrespective of its management importance, is also referred to as an 'effect size' (Cohen, 1990; Cumming, 2012). A management threshold can be considered a pre-defined effect size of management importance. A simple quantitative example of a threshold would be a 30 per cent decrease in the amount of live coral at a snorkel site relative to control sites. Another example could be when there is on average > 10 damaged coral colonies at a dive site compared to control sites.

Specifying a management threshold before the start of monitoring is important because it forces a manager to give due consideration to the level of environmental change that would be of ecological or social importance (Di Stefano, 2004). This is vital because it facilitates defensible conclusions and timely decision making. Also, from a philosophical perspective, specifying a management threshold before the start of monitoring lessens the risk of a monitoring programme deteriorating into a Baconian data gathering exercise (Underwood, 2000a).

Two other key components of monitoring are the approach to statistically treat data so these can be compared with a management threshold and the approach used to help interpret the cause of observed environmental change (Fabricius & De'ath, 2004). The latter relates to the monitoring design. Both factors are equally important, but it is probably the statistical treatment of data that often proves most challenging to managers of marine parks. This is because managers may not be trained in statistical methods, and some analytical approaches can be computationally and conceptually demanding (Walshe & Wintle, 2006). Such challenges may make it difficult for managers to successfully communicate or defend results to sceptical decision makers (e.g. politicians, funding agencies) and economic stakeholders (e.g. tourism operators).

It is the statistical treatment of data collected in a monitoring programme and how the outputs are compared to a management threshold that is the focus of this paper. I begin by highlighting some of the challenges for managers using null hypothesis tests and control charts to treat data. I then describe parameter estimation with confidence intervals (hereafter 'parameter estimation'), which offers a simple and practical alternative. To illustrate the utility of parameter estimation, I present three examples or variants of this analytical approach. The three vary in how an 'effect size' is quantified, how uncertainty about the effect size is interpreted and how the effect size is compared with a management threshold. Each example has its own strengths and weaknesses, which are all discussed. My intention is not to endorse one variant over another, nor do I recommend replacing superior analytical approaches if the technical expertise is available. Instead, I hope to encourage managers to adopt analytical approaches that allow environmental change to be quantified in a way that minimises misinterpretation, will contribute to defensible conclusions and will be understood by stakeholders who may not be scientists.



Monitoring is a critical element of MPA management © Commonwealth of Australia (GBRMPA)

NULL HYPOTHESIS TESTS AND CONTROL CHARTS

One of the most common approaches to statistically treat data is null hypothesis testing, typically using Analysis of Variance (ANOVA) or similar (e.g., Generalised Linear Models) (Benedetti-Cecchi, 2001; Downes et al., 2002; Green, 1979; Underwood, 2000a). This involves calculating a probability (p-value) indicating the strength of evidence against a null hypothesis (i.e. a hypothesis of no difference or change). Null hypothesis testing has a number of strengths for the assessment of environmental change (Underwood, 1997; Downes et al., 2002). It provides a logical basis for distinguishing between alternative hypotheses, such as whether a disturbance has or has not resulted in environmental change. When using ANOVA, objective decision rules can be used to reduce the risk of falsely concluding that there has been change (Type I error). When combined with power at the planning stage, the Type II error rate (risk of falsely concluding that there has not been a change) can also be predicted for the study (Mapstone, 1995).

Unfortunately, there are at least three reasons why null hypothesis testing may be unsuitable for managers of marine parks. First, a null hypothesis of no environmental change is usually, if not always, invalid when associated with activities permitted in marine parks. This is because the effects of tourists on benthic habitats (Marion & Rogers, 1994) and the effects of fishing (Young et al., 2014) cannot be mitigated entirely even with management. Therefore, the question to be addressed by monitoring in marine parks is not "has an activity caused environmental change?", but "what is the size of that change?", or, more pointedly, "how does the size of change relate to a management threshold?" Second, many managers are administrators, not scientists, and may lack the technical knowledge to use ANOVA or similar statistical tools. Consequently, they may struggle to accurately explain outputs such as p-values or recognise some of the assumptions that need to be considered when interpreting p-values (Stewart-Oaten, 1996; Walshe et al., 2007). Third, a p-value, when presented on its own, does not convey uncertainty in conclusions (Cumming, 2012; Cumming & Calin-Jageman, 2017).

Control charts have also been proposed as an alternative way to treat monitoring data (Burgman, 2005). Indeed, control charts share some advantages offered by parameter estimation. However, standard control charts do not normally illustrate uncertainty in the parameter being estimated and assume that the variable being monitored has little temporal variability (Morrison, 2008). Further, it is not straightforward to link management thresholds to control sites using standard control charts.

PARAMETER ESTIMATION

One analytical method that avoids some of the limitations mentioned above is parameter estimation (Di Stefano, 2004; Rouphael et al., 2011; Walshe & Wintle, 2006). Widely used in medicine and psychology (Altman et al., 2000; Cumming & Calin-Jageman, 2017), parameter estimation, especially in conjunction with management thresholds, appears to be largely ignored by managers of marine parks. This is unfortunate because parameter estimation focuses on the size of change, provides an intuitive way to quantify uncertainty in results, allows for a straightforward way to compare estimates of change or differences with management thresholds and, if summarised graphically, facilitates communication of results to laypersons. These issues are explored more fully below.

To quote Fowler et al. (1998, page 6), "the measures which describe a variable of a sample are called statistics. It is from the sample statistics that the parameters of a population are estimated". Thus the means, medians and effect sizes that are calculated from monitoring data are imprecise estimates of the true population parameters. Imprecision is captured using confidence intervals. More precisely, a confidence interval includes a single value estimate, such as a sample mean or effect size, and a range of values around an estimate that are also considered plausible for the population under investigation (Gardner & Altman, 2000).

Confidence intervals can be used like null hypothesis tests to derive dichotomous conclusions based on the degree of overlap between pairs of confidence intervals or whether a confidence interval includes zero (Tryon, 2001). However, like null hypothesis testing, deriving conclusions in this way is, in part, a function of sample size and does not take into consideration the size of the effect (Cumming, 2012; Di Stefano et al., 2005).

Although it is desirable to have sufficient replication to provide a definitive answer to the question of whether a mean or an effect size and their associated confidence intervals are entirely above or below a threshold, this will rarely be the case for managers. Typically, there will be too few resources to provide precise estimates and thus the associated confidence intervals will be wide and overlap thresholds. Consequently, conclusions derived from monitoring data will need to be tempered by the width of a confidence interval, how much a confidence

interval overlaps with a threshold and long-term trends in the variable being monitored (Masson & Loftus, 2003). Conclusions drawn in this way may be more subjective than those derived using null hypothesis tests. Nevertheless, this increased level of subjectivity may be acceptable for most stakeholders in the context of marine parks, especially if a precautionary approach is adopted where decisions favour environmental outcomes.

BACKGROUND TO THE VARIANTS

The three variants (or examples) of parameter estimation presented in this paper are modified versions from the literature. All examples relate to activities that are legally permitted in marine parks and, for the purposes of realism, to situations where a Before/After by Control/Impact (BACI) monitoring design is unattainable. More precisely, all relate to situations where a single impact site is monitored and compared with multiple control sites and where there are no baseline data. In terms of monitoring a single impact site, such a situation is not unrealistic in many marine parks. Managers are typically less concerned about an average effect among replicate management zones or sites, compared with understanding impacts to individual sites, especially those that are iconic, popular or unique. In terms of a baseline, legal activities within marine parks are often well established before the instigation of monitoring, rendering it impossible to obtain baseline data (Buckley et al., 2008). Nevertheless, managers should always attempt to incorporate baseline and other elements of experimental design into their monitoring design wherever possible (Underwood, 2000b).

Although I encourage the adoption of BACI style monitoring design where possible, the effect sizes and management thresholds illustrated in this paper represent spatial differences between impact and control sites rather than interactions. An interaction can be defined as "some pattern of difference from before to after a planned disturbance in the relationship between the mean of whatever variable is measured in the disturb location compared with that in the control" (Underwood, 1997). Although effect sizes and confidence intervals can be calculated for an interaction (Masson & Loftus, 2003), they are not straightforward to interpret (Di Stefano, 2004). However, the primary reason why effect sizes in this paper are based only on spatial differences is because of the absence of baseline data. When a statistical interaction cannot be used to evaluate whether there has been an impact, more caution is required when inferring the cause of change. A levels-of-evidence approach would be useful to help infer causation in such situations (Fabricius & De'ath, 2004).

Careful thought is required when choosing the appropriate source of variability to calculate confidence intervals especially if confidence intervals are to be compared between impact and control sites. When a monitoring design is characterised by replicate impact and control sites, it is reasonable to calculate confidence intervals for treatment means based on site level replication (i.e. variability among sites). However, when there is only one impact site there is no site level replication for the impact treatment. Instead, within-site level replication (e.g., transects or quadrats used to sub-sample an individual site) needs to be used to construct a confidence interval for the impact site in order to assess the precision of the mean estimate. For the control sites, there are two options to generate a confidence interval. The first is to generate a confidence interval using site level replication because there are multiple control sites. The second is to pool all within-site replicates from all control sites to generate a confidence interval, which has the advantage that confidence intervals are constructed for both the impact and control treatments using the same units. An issue with using within-site variability in this way is that one is making the assumption that there is no among site level variability. If this assumption is wrong, pooling replicates to generate a confidence interval in this way may lead to a misleadingly high level of precision for the mean of the control treatment. For this reason, when the impact mean is plotted on the same graph as the control mean, it is usually preferable that only the confidence interval for the control mean is shown. This is to avoid confusing different sources of variability used to construct the two confidence intervals, potentially resulting in misinterpretation. This is the approach illustrated in this paper. Nevertheless, there are at least two reasons why it is still helpful to plot the confidence interval of the impact site on a separate graph. First, it will allow managers to evaluate the level of precision for the mean used at the impact site. Second, change in variability at the impact site might be indicative of human disturbance and worthy of investigation (Warwick & Clarke, 1993).

Whatever approach is adopted to construct confidence intervals, the units used, the type of confidence interval (e.g. 90 per cent vs 95 per cent), degrees of freedom, assumptions and limitations need to be made explicit to stakeholders. The data should also be available to experts who might be required to undertake a more detailed assessment if uncertainty remains high and/or the results are challenged by stakeholders.

THE THREE VARIANTS

In the remaining section of this paper, I illustrate three variants or examples of parameter estimation. They differ in how the effect sizes are estimated and how confidence intervals are used to aid interpretation. Each variant presented is structured as follows: theory, scenario and strengths and weaknesses. The management thresholds used to illustrate the variants are fictional and thus have no ecological or social basis. In addition, the examples are based on hypothetical data chosen to help the reader better appreciate the application of parameter estimation.

All thresholds used in the examples are benchmarked against control sites, but parameter estimation is equally suitable using thresholds based on fixed values. Benchmarking thresholds to control sites is important when response variables being monitored are spatially and temporally dynamic even in the absence of human activities. This is usually the case with marine organisms and their habitats (Connell et al., 2004; Hatcher et al., 1989; Hughes et al., 1999). When linking a management threshold to control sites the following should be considered. That control sites are chosen to be as similar as possible to the impact site except for the presence of the activity (e.g. snorkelling) that is potentially contributing to change in the response variable (e.g. coral cover) being monitored (Downes et al., 2002). This is usually not a great challenge for activities with spatially discrete impact zones, such as snorkelling, scuba diving and reef walking. Another consideration is that control sites and impact sites are not already severely damaged as a result of a widespread disturbance event, such as declining water quality or increasing sea surface temperatures (Hughes, 1994). Under such circumstances, benchmarking a management threshold against control sites could be misleading. In this situation, linking a threshold to a restoration outcome might be more appropriate.

Variant 1: Effect size and its confidence interval compared with a threshold

Theory

The first variant illustrating how data from an impact site can be compared with control sites is based on an approach suggested by Rouphael et al. (2011) for managers of marine parks. They propose comparing the difference between the means of the impact and control sites (i.e., an 'effect size') and its confidence interval with a management threshold. In terms of calculating an effect size, Fowler et al. (1998) recommend subtracting the smaller mean (irrespective of whether it relates to the impact or control sites) from the larger mean to maintain positive differences. They also show how to calculate a confidence interval for an effect size, which involves pooling the two treatment sources of variance. In a situation when there is a single impact site but multiple control sites, Rouphael et al. (2011) suggest using the within-site sources of variances from each treatment to ensure the variances used to construct the confidence interval for the effect size are based on the same units. But as stated before, pooling subsamples (e.g. transects or quadrats) from all control sites would be valid only under the assumption that there is no among control site variability. An alternative would be to only use among control site variance and associated degrees of freedom to generate the confidence interval for the effect size. This is the approach taken in this example.

Fox (2001) and Di Stefano et al. (2005) graphically illustrate how the approach could be interpreted depending on where the effect size (± confidence interval) was in relation to the threshold. A modified version of their graphs is illustrated in Figure 1. Scenario 1 clearly indicates that the threshold is exceeded, which would trigger a site-specific investigation or management intervention. Scenario 2 is the opposite of Scenario 1 and would not require a response. Scenario 3 shows that the middle of the confidence interval is on the threshold and thus there is an equal chance that the threshold has or has not been exceeded. The broad width of the confidence interval suggests that the estimate is not very precise. Under such a scenario, a manager could immediately undertake a new survey, if resources were available, or instigate management as a

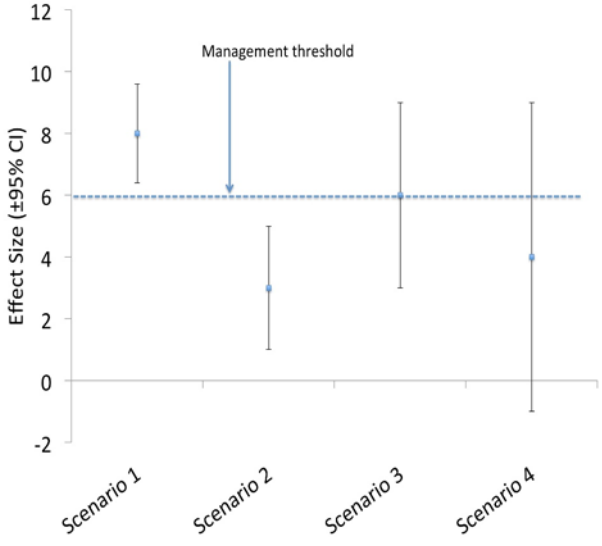


Figure 1: Four potential scenarios or outcomes following a survey that differ in terms of where the effect size lies in relation to the threshold and the width of the 95 per cent confidence interval (refer to text for interpretation).

precaution. In Scenario 4, the middle of the confidence interval is below the threshold, but the upper length of the confidence interval intercepts the threshold. In Scenario 4, the confidence interval is so wide that there is no sensible way to interpret the data. A confidence interval, such as that shown in Scenario 4, needs to be reduced in width through increased replication.

With this variant, the monitoring data are summarised using two figures. One figure is used to determine if the effect size (± confidence interval) is above or below the threshold and to indicate the level of precision of the effect size via the widths of the confidence intervals. The other figure is used to show the means for the impact and control sites separately, thus indicating which had the larger mean at the time of sampling. This figure would also be used to illustrate temporal trends, which is helpful when interpreting data. An example is illustrated below.

Scenario

In this scenario, a manager is concerned about the level of browsing by domestic animals in a mangrove stand (the 'impact site') situated in a resource-use zone of a marine park. The conservation goal for this zone is to maintain the structural integrity of the stand, while still permitting livestock access to feed. However, rangers have reported dead seedlings in the mangrove stand and are concerned about recruitment failure. Nevertheless, they have also observed dead seedlings in mangrove stands in other areas of the marine park where livestock and other human activities are not permitted. It is therefore apparent that seedling mortality may occur as a result of natural processes. Rather than prohibiting livestock in the resource-use zone, the manager decides to monitor seedling mortality to ensure the level of mortality there does not greatly exceed an average level observed among three control stands (i.e. the control sites). To operationalise the conservation goal, the manager links it to a quantitative management threshold. If the threshold is exceeded the manager will implement management to reduce the risk of further seedling mortality. The manager suggests that, on average, more than six dead seedlings (per 50 m^2) in the mangrove stand in the resource-use zone, relative to the average number in the unbrowsed stands, would be worthy of management concern. Obviously, seedling mortality is not the only variable that could be used to monitor the structure of a mangrove stand, but a single variable is used here for illustrative purposes only.

Hypothetical data, representing four consecutive surveys, are graphically summarised in two ways to aid interpretation. The two ways are shown in Figures 2 and 3. Figure 2 illustrates the effect size and its 95 per cent confidence interval for each survey. Each of the four effect sizes and confidence intervals are also shown in relation to the management threshold. To reiterate, in this example, the effect size is the difference between the

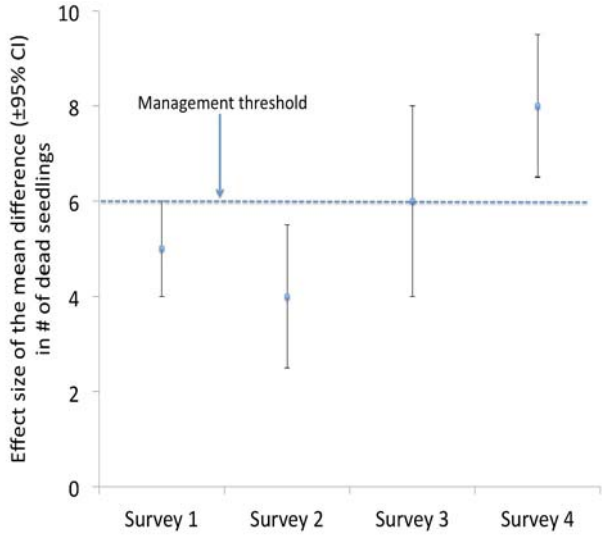


Figure 2: Shows the effect sizes and the associated 95 per cent confidence intervals for the number of dead mangrove seedlings over four surveys. These are shown in relation to a management threshold. See text for detail.

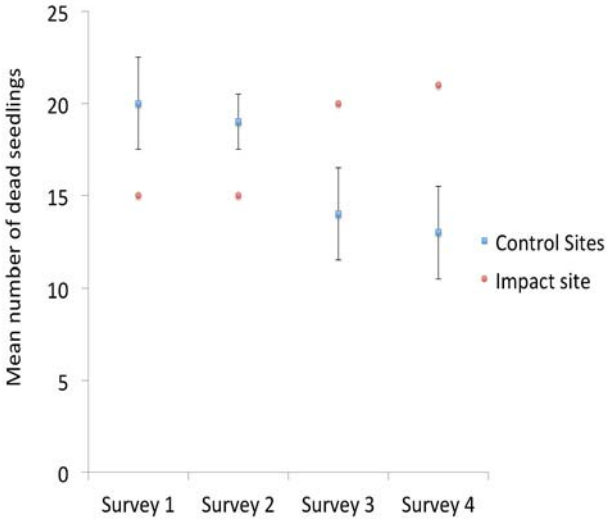


Figure 3: Means of the impact and control sites for four surveys. Note that this figure is used to complement the previous figure by illustrating which mean is larger at each survey and shows trends over time. Also note there are no confidence intervals for the impact means or a threshold in this figure (refer to text for details).

mean of the single impact site and the mean of the control sites. The middle value of a confidence interval is the most plausible estimate of the effect size while values at the extremities of the confidence interval are less plausible. Recall that the confidence intervals for the effect sizes in Figure 2 are based only on among site variability for the control treatment because there is no site level variability for the impact treatment. Figure 3 illustrates the same data, but shows the impact and control site means individually. Note that the mean number of dead seedlings at the control sites had fallen following Survey 2. As stated earlier, most environmental variables that will be monitored in a marine park will vary naturally through time independent of human influence. Note also that there is no confidence interval for the impact site in Figure 3 for reasons explained earlier. But on a separate graph (not illustrated) it would be desirable to calculate a confidence interval for the impact site to assess the level of precision and how the width of the confidence interval changes through time.

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Figure 2 indicates that at the time of Survey 3 the threshold may have been exceeded while at Survey 4 the threshold is clearly exceeded. Figure 3 confirms that during Survey 3 and Survey 4 the mean number of dead seedlings is higher at the impact site compared with the control sites. This suggests that browsing, rather than natural processes is the cause of the increased number of dead seedlings at the impact site. In Figure 2, Survey 3 shows that the threshold is potentially exceeded because a large proportion of the confidence interval overlaps the threshold. Such a result might prompt the manager to increase replication to reduce uncertainty or to instigate management as a precaution. Survey 4 is unambiguous in terms of exceeding the threshold because the entire confidence interval is above the threshold (Figure 2). This result would warrant management action.

Strengths and weaknesses

A strength of this variant is that a confidence interval is generated for the actual effect size, not just the individual mean estimates. When an effect size is combined with a confidence interval, as shown in Figure 2, a manager can intuitively assess how likely a monitoring programme is able to clearly distinguish whether a threshold has been exceeded (Walshe & Wintle, 2006; Walshe et al., 2007). For instance, a wide confidence interval overlapping a threshold makes it difficult to derive clear-cut conclusions; in this case, managers should consider increasing the level of replication. Andrew and Mapstone (1987) and Green (1979) show how precision of an effect size can be quantified objectively. Andrew and Mapstone (1987), Di Stefano et al. (2005) and Cumming (2012) also show how to determine the sample size for a desired level of precision.

One challenge with this and the other variants of parameter estimation described in this paper is the need to minimise subjectivity when drawing conclusions about whether a threshold has been exceeded or not. Subjectivity will be high when a large amount of the confidence interval overlaps the threshold making it impossible to conclusively state whether the threshold has or has not been exceeded. Reducing the width of the confidence interval by increasing replication is the most direct way to reduce uncertainty, but this may be impossible if managers have limited resources. Consequently, in some situations, it might be prudent to assume that a threshold has been reached even if the most plausible estimate of the effect size (i.e., the middle value of the confidence interval) is below it, but a large amount of the confidence interval overlaps the threshold. As this could have costly ramifications, managers and stakeholders should agree beforehand on the type of action to be triggered in such a scenario.

Although the focus of this paper is on data analysis, it is important to reiterate the weaknesses of the monitoring design illustrated in this and the other examples. The weaknesses are the absence of baseline data and only having one impact site. A sub-optimal design such as this can limit the ability to reliably infer causation (Downes et al., 2002; Green, 1979; Underwood, 2000a).

That is, one cannot state categorically that the threshold was exceeded due to livestock browsing, as opposed to natural processes acting at that site. In this hypothetical example, the lack of a baseline and having only a single impact site was unavoidable because livestock browsing was occurring before monitoring was initiated and only one mangrove stand, in the resource-use zone, was exposed to browsing by livestock. When a monitoring design is sub-optimal, other tools, such as levels-of-evidence approach, should be used to facilitate inference (Downes et al., 2002; Fabricius & De'ath, 2004; Rouphael et al., 2011).

Variant 2: Difference between extremities of confidence intervals compared with thresholds

Theory

Variant 2 is based on an approach proposed by Walshe and Wintle (2006) who show how an effect size can be quantified by comparing the difference between the extremities of confidence intervals rather than between the means of impact and control treatments. Their approach is useful when a more conservative effect size estimate is preferred. However, assessing uncertainty is not as straightforward as in the previous variant because there is no single confidence interval generated for an effect size.

The Walshe and Wintle (2006) approach is modified here in two ways. First, a management threshold is stated before the start of monitoring. Second, in the absence of site level variability for the impact treatment, the effect size is calculated as the difference between the mean of the impact site and an extremity of the confidence interval for the control treatment. The reason why the confidence interval for the impact site is not used for estimating the effect size in this situation is explained in the section 'Background to Variants'.

Scenario

Variant 2 is based on a scenario where a manager of a marine park is concerned about the effect of resort guests walking on seagrasses on a reef flat in a tourism-use zone. The conservation goal for seagrass meadows is to maintain their structural integrity, defined in part by the density (i.e. number per unit area) of seagrass stems. An environmental awareness campaign at the resort has greatly reduced the number of guests walking on the reef flat. The manager believes the current intensity of walking on the reef flat should not cause seagrass stem density to drop below a level of management concern. The manager recognises that stem density changes seasonally and that a management threshold should be linked to the control condition. The manager proposes that if seagrass stem density at the reef flat (hereafter 'impact site') is less than the control sites by an absolute value of 10 or more stems per m^2, then further investigation would be required. To reiterate, the effect size is measured as the difference between the mean of the impact site and the upper confidence interval of the control treatment. As in the previous example, there was no baseline period and only one impact site.

Figure 4 shows hypothetical data for four consecutive surveys. For each survey, stem density data from the impact site and control sites are collected and their means and 95 per cent confidence intervals plotted. Note that the confidence intervals for the impact site are not shown in Figure 4. Although a confidence interval can be generated for the impact site based on within level variability, this should not be compared directly with the confidence intervals for the control treatment, which are based on site level variability.

The first three surveys suggest that the management threshold has not been exceeded. However, Survey 4 indicates the mean density of stems is less at the impact site and that the difference in the density of seagrass stems between the mean of the impact site and the upper confidence interval of the control treatment is greater than 10 stems. Based on this result the management threshold has been exceeded (Figure 4). As with all examples given in this paper, interpretation focuses on effect sizes, not on whether the means are statistically different.

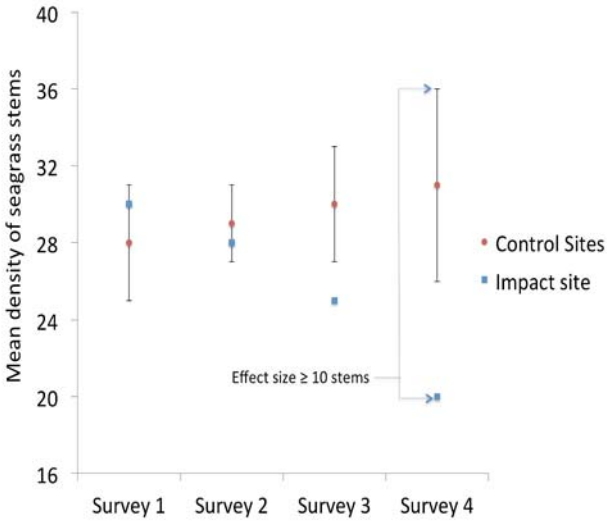
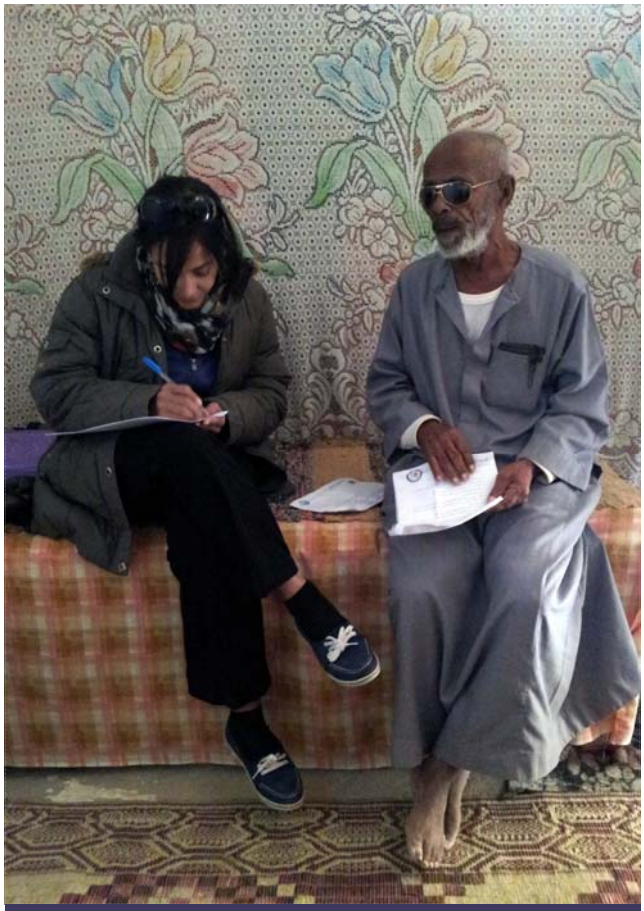


Figure 4: At each survey an effect size is calculated as the difference between the upper 95 per cent confidence interval of the control treatment and the mean for the impact site. In Survey 4, the effect size is greater than 10 stems and thus exceeds the management threshold.



Parameter estimation techniques can be used to summarise social data. Here Dr. Salwa Elhalawani collects data from a fisher to understand fishing intensity and the level of dugong bycatch in Elba National Park © Dr. S Elhalawani

Strengths and weaknesses

When using this variant, it is worth noting a second definition of a confidence interval that states that the central value of a confidence interval is about seven times more plausible than values at the limits (Cumming, 2012). Therefore, using the extremity of a confidence interval to define a parameter of interest, as opposed to the central value, might be considered conservative. Another strength of this approach is that it is straightforward to quantify effect sizes and to compare these with a management threshold.

One weakness of this variant is that a confidence interval is not generated for the effect size, as it was in the previous example. Instead, examining the confidence interval for each mean assesses precision. Therefore, the ability to determine how well the monitoring programme is capable of assessing whether a threshold has been reached is not as clear-cut as in the previous example.

Variant 3: Comparing percentiles between impact and control sites

Theory

A third variant of parameter estimation that can be used to compare data from an impact site with a control site is based on that proposed by ANZECC (2001) and Fox (2001). This approach was proposed for water quality monitoring, but has application for monitoring other variables. This approach is not as straightforward as the previous two variants, but has some advantages when data are counts and highly skewed, and when stakeholders cannot initially agree on a threshold in terms of absolute values.

With this approach, the median, or 50th-percentile (50thP), of the data from an impact site is compared with the 80th-percentile (80thP) of the control treatment. A median is the middle value of a data set, while an 80thP represents a value that partitions a data set into 80 per cent and 20 per cent of all values, respectively. The choice of using a median, rather than a mean, is often desirable when a data set does not conform to a normal distribution or when outliers have a disproportionate influence on a measure of central tendency.

Rouphael and Hanafy (2007) show how the ANZECC (2001) approach can be simplified in order to monitor change in the amount of broken coral at a dive site. Instead of using a 'rolling' percentile, Rouphael and Hanafy (2007) propose estimating the median and the 80thP based only on the most recent survey data. This is unavoidable when baseline data are absent. They also discuss the advantages of this approach for managers of marine parks who lack the technical skills to use more complex statistical approaches. Walshe and Wintle (2006) expand on ANZECC (2001) by recommending that confidence intervals be placed on the median and 80thP. Although ANZECC (2001) describes its approach as a 'process control chart', I refer to the version presented here as parameter estimation because confidence intervals are estimated for the median and 80thP, and because a rolling percentile is not used to calculate the 80thP. Instead, the median and 80thP are calculated and compared based only on the most recent survey data. For reasons given in the previous example, a confidence interval is not shown for the impact site median when it is juxtaposed with the median and confidence interval for the 80thP.

Scenario

In the following scenario, a manager is concerned about a temporary decline in water quality associated with the deepening of a marina adjacent to her marine park. The marine environment adjacent to the marina is zoned general-use, which permits a range of human activities, such as shipping. Given that the general-use zone borders the marina, the manager acknowledges that a temporary decline in water quality near the marina is acceptable provided it does not lead to long-term and widespread environmental damage.

The manager learns that over the next six months, excavators will remove sediment from the marina. This will result in the re-suspension of sediment, leading to turbid water plumes moving down current from the marina to a bay that supports coral assemblages. The manager is concerned that excessive levels of sediment in the water column may lead to an unacceptable level of impact to the assemblages.

The marina authority agrees to limit the frequency of plumes contacting coral assemblages in the bay by controlling the intensity of excavation and the timing in relation to tidal cycles. The marine park manager is still concerned that plumes from the marina will increase turbidity to a point where sediment may lead to coral colony mortality. Consequently, the marina authority instigates water quality monitoring in the bay to ascertain when the amount of sediment in the water column is regularly exceeding background level. However, the manager and the marina authority cannot agree on a threshold expressed in absolute values above background level nor is there a suitable water quality standard because the marine environment is naturally turbid anyway. As a compromise, they decide that if the median (50thP) suspended sediment concentration (SSC) in the bay was above the 80thP of the control sites for three consecutive daily surveys, then they would assess the condition of the coral assemblages directly. The water quality control sites are located well away from the plumes. Figure 5 shows hypothetical data for seven water quality surveys following the start of excavation. It also shows that the median values of SSC at the bay (i.e. the impact site) for the last three surveys are above the 80thP threshold for the control sites. Indeed, since Survey 3, the median SSC for the bay has steadily increased relative to the 80thP, providing additional evidence that the threshold was not exceeded due to a random natural event.

Strengths and weaknesses

An advantage with this approach is its flexibility. For instance, in this example, the 80thP is used as the threshold, but there is no reason why another percentile could not have been chosen. Similarly, a different number of consecutive times the 80thP was exceeded could also have been chosen. This would depend, in part, on how frequently monitoring could be undertaken and on an improved understanding of the relationship between levels of SSC and coral colony mortality.

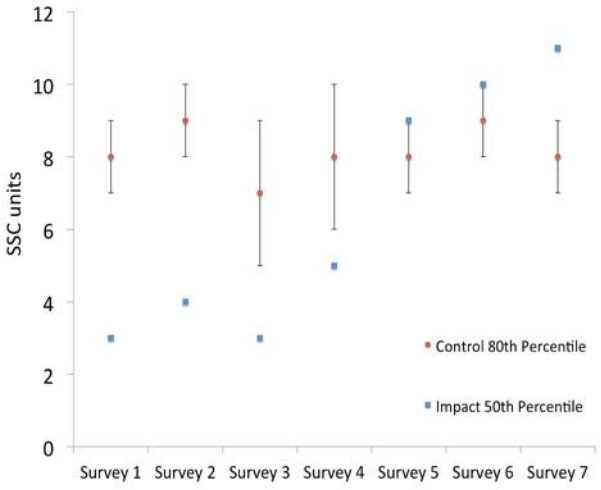


Figure 5: With this approach, the 50thP SSC value from the bay (the impact site) is compared with the 80thP value (±95 per cent confidence interval) from all control sites. The 50thP has exceeded the 80thP in three consecutive surveys (Surveys 5, 6 and 7), which is the trigger for action.

Another advantage of this approach is that it avoids the need to state a management threshold defined in terms of an absolute value (ANZECC, 2001). This is helpful when water quality standards are unavailable for the area of interest or where stakeholders cannot immediately agree on a threshold defined in terms of absolute values. Other advantages of this approach include the ease of interpretation and the flexibility in terms of statistical assumptions (ANZECC, 2001).

Fox (2001) highlighted one limitation. He warned against assuming that a shift from the 50thP to the 80thP represented an ecologically significant effect. Thus, although a threshold in absolute values need not be defined up-front, at some stage, the manager will need to assess the ecological relevance of this threshold.

CONCLUSION

There is an increasing demand for managers of marine parks to demonstrate the achievement of conservation goals, often defined in terms of quantitative management thresholds. However, analysing monitoring data and comparing these with a

Eye on the Reef diver assessing impact of Tropical Cyclone Ita © Commonwealth of Australia (GBRMPA)

management threshold is not straightforward for laypersons. Some statistical approaches are complicated or may be invalid in the context of marine parks. Further, stakeholders easily misunderstand the outputs of some approaches. Parameter estimation offers a number of advantages for managers of marine parks, but there are few practical examples of how the approach could be applied in this context. In this paper, three variants of parameter estimation are presented. All three variants focus on the size of environmental change that is compared with an a-priori defined management threshold. However, the variants differ in how effect sizes and associated confidence intervals are estimated. The first variant calculates an effect size as the difference between the mean of the impact site and mean of the control sites. A confidence interval for the effect size is also calculated. The second compares the difference between the mean of the impact site and the upper confidence for the mean of the control sites. The degree of uncertainty is ascertained by examining the confidence for the mean of the control treatment. The third variant compares the median value of the impact site with the 80thP of the control sites. For this variant, confidence intervals are also generated for the 80thP. Each variant has its relative strengths and weaknesses that need to be considered carefully prior to adoption.

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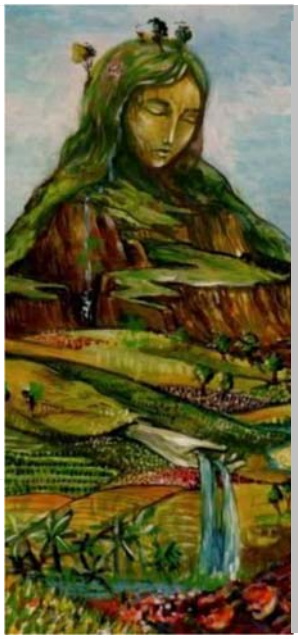
RESUMEN

Cada vez es más importante que los administradores de los parques marinos demuestren cuantitativamente el logro de sus objetivos de conservación. El monitoreo es una herramienta de gran utilidad para ello. Un componente del monitoreo que resulta complejo para los administradores es el tratamiento estadístico de los datos de monitoreo. Los enfoques comúnmente utilizados, tales como las pruebas de hipótesis nulas, son conceptualmente desafiantes y operacionalmente complejas, lo que puede llevar a conclusiones erróneas y malas decisiones. Un enfoque más directo es la estimación de parámetros con intervalos de confianza. La estimación de parámetros se centra en la estimación del tamaño del cambio o diferencia (un "tamaño de efecto") en una variable de respuesta y la comparación de esta con un tamaño de efecto predefinido denominado umbral de gestión. Los intervalos de confianza indican el nivel de precisión en las estimaciones de los cambios, lo que se traduce en conclusiones más equilibradas. La estimación de parámetros también es propicia para la representación gráfica, que puede facilitar la interpretación y la comunicación para un público no científico. En este artículo, se demuestran tres ejemplos de estimación de parámetros y se analizan sus fortalezas y debilidades relativas, con lo que se espera alentar a los administradores a adoptar enfoques estadísticos que les permitan cuantificar el cambio ambiental de una manera que contribuya a conclusiones defendibles y a facilitar la toma de decisiones oportunas y de fácil comprensión para los interesados.

RÉSUMÉ

Il y a une exigence accrue auprès des gestionnaires de parcs marins pour qu'ils fournissent une évaluation quantitative de la réalisation de leurs objectifs de conservation. La surveillance est un outil qui peut leur venir en aide dans ce processus. Cependant, le traitement statistique des données de surveillance constitue l'une des difficultés de cette méthode. Les approches couramment utilisées, telles les tests d'hypothèse nulle, sont conceptuellement exigeantes et complexes sur le plan opérationnel, et peuvent ainsi mener à des conclusions erronées et à de mauvaises décisions. L'estimation des paramètres avec des intervalles de confiance constitue une approche plus directe. L'estimation des paramètres consiste à estimer la taille du changement ou de la différence (une «taille d'effet») dans une variable-réponse, puis à la comparer avec une taille d'effet prédéfinie appelée seuil de gestion. Les intervalles de confiance indiquent le niveau de précision des estimations de changement, ce qui permet d'obtenir des conclusions plus équilibrées. L'estimation des paramètres est également adaptée à la représentation graphique, ce qui peut faciliter l'interprétation et la communication aux non-scientifiques. Dans cet article, je présente trois exemples d'estimation des paramètres et passe en revue leurs forces et faiblesses relatives. En présentant ces exemples, j'espère encourager les gestionnaires à adopter des approches statistiques qui leur permettent de quantifier les changements environnementaux de manière à soutenir efficacement leurs conclusions, à faciliter la prise de décision en temps opportun et à être compris par les intervenants.



JURISTIC PERSONHOOD FOR SACRED NATURAL SITES: A POTENTIAL MEANS FOR PROTECTING NATURE

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ABSTRACT

The recognition that 'other-than-human' persons can be legal subjects has previously been adopted in forms of customary law but has been denied in most modern jurisdictions until recently. The legal concept of juristic personhood is rooted in *jus gentium* of Imperial Rome, which was also the basis of 'public trusts'. Juristic personhood has been expanded in some jurisdictions to include other 'legal subjects' with specific rights and obligations. Judges in India, for example, have recognised enspirited idols as having legal status with the same legal rights as human beings ever since the nineteenth century. Recently, several additional jurisdictions have recognised certain spiritual-natural entities as legal persons, making sacred rivers and mountains 'juristic persons'. In this article we review a number of recent cases from around the world that highlight this evolution of jurisprudence over time. The legal regime of juristic personhood may be an effective tactic for safeguarding enspirited sacred natural sites, because it conceptually resonates with the animistic world-view and relational ontologies of many Indigenous peoples. Further study (and litigation) is required for such an approach to become widely recognised, but it could become an effective tool for conservation of nature within community-conserved areas and protected areas.

Keywords: juristic personhood, sacred natural sites, protected areas, other-than-human persons, numina, ecocentrism, panentheism, spiritual governance, ICCA, OECM

INTRODUCTION

With the realisation that loss of biodiversity and ecosystem services have become global crises (Ceballos et al., 2015; Ripple et al., 2017), there has been a recognition of the need to vastly increase the area of most landscapes and ecosystems under conservation management (Venter et al., 2014; Butchart et al., 2015; Wilson, 2016). Butchart et al. (2015) and others have pointed out that this will require approaches that go beyond conventional Western conservation frameworks, and have particularly advocated community-based management. Community-conserved areas have considerable potential as another form of area-based conservation, which could be enhanced and better secured for the long-term if they could also be endowed with legal recognition. Indeed, the 11th Aichi Target in the Strategic Plan for Biodiversity 2011–2020, drafted under the Convention on Biological Diversity, mentions "other effective area-based conservation measures" (OECM) as a basis for achieving 2020 targets of protection for ecologically representative areas (CBD, 2010, p. 9). Jonas et al. (2014) have suggested that these OECMs should include Indigenous Peoples' and Community Conserved Territories and Areas (ICCAs) that effectively conserve nature, even if that conservation is an ancillary outcome, not a primary objective, and only if the governance authority wants them to be recognised as such.

Many sacred natural sites (SNS) include biodiverse habitats or refugia that benefit from ritual protection in the context of animistic beliefs as distinct from protection motivated by a 'conservation ethic' (Kopnina, 2012) or legal prescriptions. While this may not apply to most SNS of mainstream religions, these SNS are often still important for biodiversity conservation. As far as many Indigenous peoples and local communities are concerned, the 'spirits of place' or *numina* that enspirit[1] most SNS are endowed with certain rights –'juristic persons', in all but name – and these communities

regularly invoke the *numina* enabling them to engage in 'spiritual governance' (Studley & Awang, 2016; Studley & Horsley, 2018).

SNS would be most effective as conservation areas if legal recognition was given to complement community-based customary ritual protection that is already in place. One possible nascent approach is to bestow *juristic personhood* on selected landscapes. Most conservation initiatives aimed at the legal protection of the environment are undertaken by *Homo sapiens* acting as the plaintiff (e.g. a person who brings a case against another in a court of law) and beneficiary. Under the aegis of juristic personhood, the *numina* that inhabit the SNS are themselves granted standing as plaintiffs in the defence of their domain, represented by a guardian, agent or 'next friend'.

Historically most European-based legal systems have "denied legal personhood to natural-spiritual entities" (Jonas pers. comm. 29/6/2017). This article highlights recent cases and trends in legislation that seem to be reversing that denial, based on notions of juristic personhood or nature rights. It can be argued that conceptually juristic personhood falls under the rubric of animism predicated on a posthuman world-view and ecocentric 'rights of nature' under the aegis of a pan(en)theistic world-view (Berry, 1988; Berry, 1996; McDermott, 2012; Nash, 1989; Zaleha, 2008).

CONCEPTUAL UNDERPINNINGS

Animism is the most ancient, geographically widespread and diverse of all belief systems, adhered to today by some 300 million Indigenous people. It is predicated on the assumption that biophysical entities such as mountains, forests and rocks are typically enspirited by spirits or *numina* (Sponsel, 2007) or 'spirits of place' (ICOMOS, 2008).

A *numen* is a 'spirit of place' or genius loci that is present within an object or place (mountain, forest, spring, idol). *Numina* were very common in ancient Rome (Mehta-Jones, 2005), and the same concept continues to be widespread among Indigenous people throughout the world. In Tibet, for example, they are known as *gzhi bdag* (Tucci, 1980), and in the Andes they are known as *huacas* (Bunker, 2006), exemplified by *Pachamama*.

The posthuman represents a return to animism and constitutes a qualitative shift in thinking addressing the basic unit of common reference for our species, our polity and our relationship to the other non-human inhabitants of the planet (Clarke & Rossini, 2016).

Ecocentrism, in contrast, is a philosophy or perspective that places intrinsic value on all living organisms and their natural environment, regardless of their perceived usefulness or importance to human beings. It recognises that human beings have responsibility towards the ecosphere and moral sentiments that are increasingly expressed in the language of 'rights'. O'Riordan (1981) has suggested that Gaia has emerged as a popular symbol of ecocentrism primarily because it has come to be associated with the belief that humankind is not the most important species and human consciousness is not the only means through which nature should be judged and interpreted.

Panentheism, all is **in** God, is a related concept predicated on an intrinsic connection between all living things and the physical universe which accord with natural laws[2]. It assumes, however, that there is a separate and greater divine reality outside the material world. Panentheism is part of a gnostic mystic experiential tradition that is informed by Plato, Pierre Teilhard de Chardin and Thomas Berry by which all things are united under the world soul. Berry's mystic panentheism inspired movements for Earth Jurisprudence, Wild Law and Earth Law, although Berry himself emphasised the physical universe rather than the Earth (Berry, 1988).

LEGAL FOUNDATION OF JURISTIC PERSONHOOD

Roman law recognised both *persona natura* (natural persons) and *persona ficta* (fictional persons) which were later known as 'juristic persons' (Gierke, 1954). 'Natural persons' is the term used to refer to human beings who have certain legal rights automatically upon birth, which expand as a child becomes an adult. A legal or juristic person refers generally to a 'legal subject' as an entity capable of holding rights, duties and capacities and includes both juristic and natural persons. This is not a human being, but one which society has decided to recognise as a 'subject of rights' and obligations (Shelton, 2015). These 'rights, duties and obligations' may include the capacity to sue or be sued, own or dispose of property, seek judicial relief, receive legacies, gifts and inheritances, incur debt, enter into contracts and comply with the laws of the state (de Vos, 2006). Perhaps the most familiar example of juristic personhood is the process of incorporating a business or trust, giving it many of the rights of a human being under the law, including certain protections and the right to sue in court.

The legal concept of personhood resonates with indigenous worldviews. In indigenous societies 'persons'

are not "a small select group of rational-minded individuals" (Oriel, 2014) but rather personhood is ascribed to a vast range of diverse human and non-human entities. From many indigenous perspectives human beings are not in a position to demarcate personhood, for they are just one element of a matrix of reciprocating persons that includes other-than-human persons (OTHP) such as *numina*.

This article aims to contribute to conservation practice by identifying legal tools (laws and rights) and legal regimes (juristic personhood and spiritual governance) that can safeguard SNS and protected areas. While it is important to avoid the mistake of valuing Indigenous peoples' and local communities' worldviews only if they contribute to conservation outcomes (Jonas et al., 2017), juristic personhood could create an interface and legal basis to bolster the effectiveness and endurance of OECM as sites for biodiversity conservation.

RESILIENCE, EFFECTIVENESS AND SCOPE

There may be a temptation to ignore the potential of unconventional legal regimes such as juristic personhood to underpin conservation in enspirited SNS on the basis of an assumption that the underlying beliefs will not survive threats from globalisation and secularisation or that they are too limited in effectiveness or scale. We believe that this would be an error. Indigenous people have shown remarkable resilience and aptitude in recalibrating their cultures, and animism has not died (Tippett, 1973) or been replaced by secularism. Indeed, it has expanded and the communication tools of globalisation have allowed threatened Indigenous people groups to network with each other (e.g. Carlson, 2017). Tibetan lay people, for example, repeatedly have had to find ways of recovering their ancient culture within the space provided by official discourses (Studley & Awang, 2016). When China relaxed its religious policies in the 1980s, Tibetans and many other ethnic groups took full advantage. Many ethnic traditions were revitalised and celebrated and a profound nativisation of culture took place across the Tibetan Plateau. The revival of the *gzhi bdag* cult enabled lay Tibetans to reclaim their SNS as 'Tibetan' (Kolas, 2004) and it provided a means of defiance and ritual protest against oppression (Studley, 2005) Similarly, resurgent indigenous groups (often with a political agenda) have provided the impetus in New Zealand, India and Bolivia that has resulted in these countries granting juristic personhood to enspirited bio-physical entities.

The protection of SNS by most Indigenous people is not predicated on a conservation ethic but on ritual compliance enjoined by the *numina* that inhabits the SNS. The *numina* traditionally determine what constitutes 'good' and 'bad' behaviour within their jurisdiction – i.e. the SNS they inhabit (Studley, 2016). This phenomenon of *numina* acting as law-givers has been termed 'spiritual governance' (Bellezza, 1997, p. 41). Many SNS are actively patrolled by self-organised community protectors (Studley, 2016), who in some cases have been given legal authority even without designation of juristic personhood for the SNS.

Spiritual governance of SNS is also large in geographic scale, being a characteristic behavioural practice by which many of the world's Indigenous people ritually protect much of the world's biodiversity in SNS outside formal protected areas (Lynch & Alcorn, 1993). SNS are globally distributed and when aggregated may constitute 12 million km² or at least 8 per cent of the world's land surface (Bhagwat & Palmer, 2009). On the Tibetan Plateau alone, SNS have been estimated to cover 25 per cent of the territory (Buckley, 2007), or twice the size of Germany. Furthermore, SNS are nodes in a much larger ecological network and an integral part of the social fabric that permeates the whole landscape or territory.

Juristic personhood and spiritual governance can be important socio-cultural mechanisms that explain the extent of the spiritual dimension in the context of the wider landscape. Legal protection for SNS could complement spiritual governance and norm-based conservation with regulatory and judicial protections to make conservation more effective.

LEGISLATIVE CHRONOLOGY OF JURISTIC PERSONHOOD AND 'NATURE RIGHTS' BASED ON EMBLEMATIC CASES

The granting of legal status to other-than-human entities has its origins in the Roman doctrine of public trusts which surfaced again during the 19th century in Colonial India. It has only been in the last twenty years that there has been a nascent trend to grant legal status and rights to spiritual-natural entities. These have been articulated in courts and legislatures under the aegis of legal rights for 'Mother Earth' in Ecuador and Bolivia, juristic personhood in New Zealand, India and Colombia, and the recognition of sacred natural sites in Africa. They are presented here in this order.

The doctrine of public trusts

The doctrine of public trusts, which is well established in many countries, seems fit to provide an important staging post on the road to legal personhood (Shelton, 2015). The ancient laws of *jus gentium* referred to the rules and laws that were common in the nations within the Roman Empire, as formulated by the Byzantine

Emperor Justinian and later developed into the 'public trust' doctrine (Sandars, 1917) which held that the sea, the shores of the sea, the air and running water were common to everyone. This principle became the law in England, which distinguishes between private property capable of being owned by individuals and certain common resources that the monarch holds in inalienable trust for present and future generations.

Many common law courts have adopted and applied public trust law (Shelton, 2015). These laws confer trusteeship or guardianship on the government, with an initial focus on fishing rights and access to the shore, navigable waters and the lands beneath them. After the publication of an influential law review article by Joseph Sax (1970), courts in the United States began to expand the doctrine of public trusts and apply it to other resources, including wildlife and public lands (e.g. *Wade v Kramer*, 1984). This is included in the constitutions of Pennsylvania, Hawaii, Rhode Island and Alaska (Shelton, 2015). Public trusts, however, like corporations, are normally constituted only for the benefit of human beings. A more far reaching measure is required to confer juristic personhood and direct rights on other-than-human persons (OTHP) (Hallowell, 2002).

The granting of legal status to other-than-human people

Various attempts have been made in modern times to accord legal status to OTHP. In 1925 colonial judges in India conferred juristic personhood on temples, idols and deities (e.g. *Mullick v Mullick*, 1925) contingent upon the enspiriting of an idol and Salmond's definition of 'person' (1913). Importantly, an idol (or a temple) does not develop into a juristic person until it is enspirited during a *Pran Pratishtha* ceremony

An enspirited idol of Radha Shyamsunderji (similar to the one above) was recognized as a "juristic person" in 1925 (Mullick v Mullick), Privy Council, Bombay High Court. With permission of Rrahul Yadav www.yadavhistory.com

An idol of Khrishna and Radha being enspirited at a pran pratisha ceremony at Sri Sri Radha Madhava Mandir, Kanpur, UP, India. In India enspiriting is required before the idol can legally become a "juristic person". Permission from ISKCON desiretree

(Mukherjea & Sen, 2013). Salmond defined 'person' (1913, p. 82) in the following way:

> So far as legal theory is concerned, a person is any being whom the law regards as capable of 'rights and duties'. Any being that is so capable is a person, whether a human being or not, and no being that is not so capable is a person even though he be a man.

In a seminal article, 'Should Trees Have Standing?', Stone (1972) argued that the granting of legal personality should not be limited to corporations and ships but should include animals, trees, rivers and the environment. Stone's innovation was to propose that the interests of nature should be represented in court by a guardian and that the burden of proof should rest upon the party that had allegedly compromised the integrity of the ecosystem or organism. Stone's comments echoed remarks made by US Supreme Court Justice William O. Douglas, who in a dissenting opinion argued in a landmark environmental law case (*Sierra Club v. Morton*, 1972) that environmental objects should have standing to sue in court.

In the years since Stone's and Douglas's comments, various innovations in law (outlined below in chronological order) have allowed for 'nature rights' to be recognised in Ecuador and Bolivia, 'juristic personhood' to be granted to biophysical entities in New Zealand, India and Colombia, and for SNS to be recognised in Africa.

The case of recognising Mother Earth as a legal entity

In 2008, Ecuador became the first country in the world to declare in its constitution that nature is a legal entity. More specifically, nature was identified as *Pachamama*, an earth-goddess (mother goddess), who is a *huaca* or *numen* who may adopt the persona of the Virgin Mary (Derks, 2009). Both earth-goddesses and *numina* are world-wide phenomena which date from the Neolithic era. Under Articles 10 and 71–74, the Constitution (Republic of Ecuador, 2008) recognises the inalienable rights of ecosystems; gives individuals the authority to petition on behalf of ecosystems, and requires the government to remedy violations of *Pachamama* or

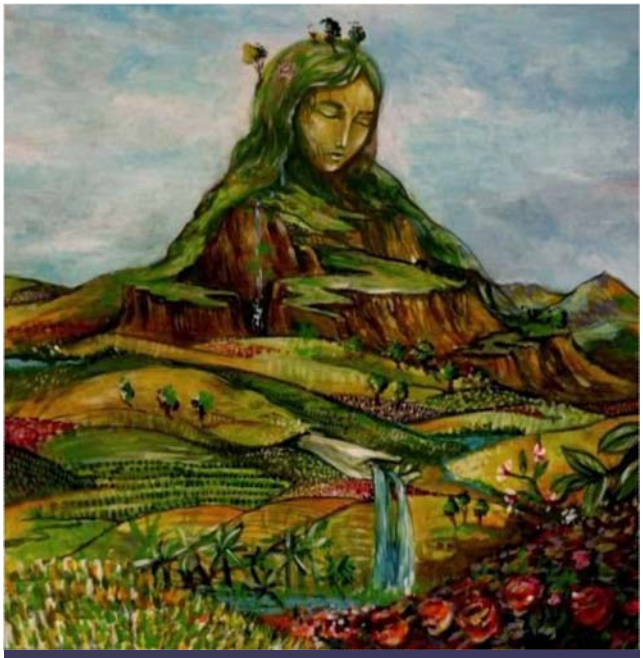
nature's rights. It states that: "Nature or PachaMama … has the right to exist, persist, maintain and regenerate its vital cycles, structure, functions and its processes in evolution" (Republic of Ecuador, 2008, Article 71).

On 21 May 2009, indigenous churches issued a joint declaration at the UN Permanent Forum on Indigenous Issues recommending that the forum recognise Mother Earth as a legal subject (World Council of Churches, 2009)

Bolivia followed Ecuador's example by similarly amending its constitution to give protection to natural ecosystems (Plurinational State of Bolivia, 2010). The amendments redefined the country's mineral deposits as 'blessings' and established new 'rights for nature', namely:

> …the right to life and to exist; the right to continue vital cycles and processes free from human alteration; the right to pure water and clean air; the right to ecological balance; the right to the effective and opportune restoration of life systems affected by direct or indirect human activities, and the right for preservation of Mother Earth and any of its components with regards to toxic and radioactive waste generated by human activities (Plurinational State of Bolivia, 2010, Article 7).

Furthermore, the government appointed an ombudsman to defend or represent Mother Earth.



Bolivia enshrined natural world's rights with equal status for Pachamama in 2010. Permission from F Kemp http://shatfordcentre.com/osa/

The constitutional changes made by Bolivia and Ecuador both resulted from and have given new momentum to a 'Pachamama movement' (Weston & Bollier, 2013, p. 60) that has spread to sub-Saharan Africa, Australia, Canada, India, Nepal, New Zealand, United Kingdom and the United States. It has had a deep influence on *Harmony with Nature* resolutions in the United Nations (United Nations General Assembly, 2009; United Nations General Assembly, 2015; United Nations General Assembly, 2016). Efforts have also been made to secure a *Universal Declaration of the Rights of Mother Earth* at the UN, but these have not been forthcoming to date.

The cases of *Te Urewera* and *Te Awa Tupua*, New Zealand

Although the foundations for 'ecosystems' to become juristic persons were first laid down by Stone and Douglas in the USA, the New Zealand government translated rhetoric into practice, when it introduced legislation that covered ecosystems.

In 2014, New Zealand was the first nation on Earth to give up formal ownership of a National Park, regulated through the Te Urewera Act (The New Zealand Parliamentary Counsel Office, 2014). The area known by the local *Tuhoe* as *Te Urewera* was declared a legal person with "all the rights, powers, duties and liabilities of a legal person" (The New Zealand Parliamentary Counsel Office, 2014, Clause 14(1)).

Personhood means that lawsuits to protect the land of *Te Urewera* can be brought on behalf of the land itself, obviating the need to show harm to a human being. The new legal entity is now administered by the Te Urewera Board which comprises joint *Tuhoe* and Crown membership who are empowered to file lawsuits on behalf of *Te Urewera* and "to act on behalf of, and in the name of, Te Urewera" and "to provide governance for Te Urewera" (The New Zealand Parliamentary Counsel Office, 2014, Schedule 6, Part 2, clauses 17a and 17b). *Tuhoe* spirituality is directly provided for in Board decision-making, whereby in performing its functions, the Board may consider and give expression to *Tuhoe tanga* (*Tuhoe* identity and culture) and the *Tuhoe* concepts that underpin nurturance, namely: *mana* (authority, identity), *mauri* (life-force), *kaitiaki* (spiritual guardians), *tikanga* (traditional custom), *ture* (societal guidelines), *tohu* (signs and signals), *tapu* (sacredness), *muru* (social deterrent) and *rahui* (temporary bans).

Three years later, the New Zealand House of Representatives passed the *Te Awa Tupua* (Whanganui River Claims Settlement) Bill (The New Zealand

The Whanganui River, New Zealand – declared a juristic person in 2017 © Geoff Cloake www.geoffcloake.co.nz

Parliamentary Counsel Office, 2016) at its third reading on 15 March 2017 (Scoop News, 2017), declaring that the Whanganui River was a legal person after 170 years of litigation by the Maori. The legislation established a new legal framework for the Whanganui River (or *Te Awa Tupua*) whereby "Te Awa Tupua is a legal person and has all the rights, powers, duties and liabilities of a legal person" (The New Zealand Parliamentary Counsel Office, 2016, Clause 14 (1)) predicated on a set of overarching 'intrinsic values', or *Tupuate Kawa*. The legislation makes provision for two *Te Pou Tupua* or guardians appointed jointly from nominations made by *iwi* (Maori confederation of tribes) with interests in the Whanganui River and the Crown. Their role is to: "act and speak on behalf of the Te Awa Tupua … and protect the health and wellbeing of the river" (Clause 19 a and b). The *Te Pou Tupua* is 'supported' by a *Te Karewao*, or advisory committee comprising representatives of Whanganui *iwi*, other *iwi* with interests in the River and local authorities. The *Te Pou Tupua* enter into relationships with relevant agencies, local government and the *iwi* and *hapu* (sub-tribe) of the river[3].

Furthermore in a 'statement of significance' (schedule 8) recognition is also given to the *numina* or *kaitiaki* that inhabit each of the 240 plus rapids (*ripo*) on the Whanganui River and are each associated with a distinct *hapu*:

> The kaitiaki provide insight, guidance, and premonition in relation to matters affecting the Whanganui River, its resources and life in general and the hapu invoke (karakia) the kaitiaki for guidance in times of joy, despair, or uncertainty for the guidance and insight they can provide. (Schedule 8 (3)).

The cases of the Ganga River and Uttarakhand Himalaya, India

On the 20 March 2017, the High Court of Uttarakhand in India (S*alim v State of Uttarakhand and Others*, 2017) declared that the: "Ganga and Yamuna Rivers and all their (115) tributaries and streams…. are juristic persons with all the corresponding rights duties and liabilities of a living person" (Clause 19).The court appointed three officials to act as legal custodians responsible for conserving and protecting the rivers and their tributaries and ordered a management board be established within three months. The court's decision was necessary because both rivers are "losing their very existence" (Clause 10) and both "are sacred and revered and presided over by goddesses" (Clause 11).

On 30 March 2017, the High Court of Uttarakhand re-examined a previous (failed) petition (*Miglani v State of Uttarakhand and Others*) and declared that:

> We, by invoking our *parens patriae*[4] jurisdiction, declare glaciers including Gangotri & Yamunotri, rivers, streams, rivulets, lakes, air, meadows, dales, jungles, forests, wetlands, grasslands, springs and waterfalls, legal entity/ legal person/juristic person/juridical person/ moral person/artificial person having the status of a legal person, with all corresponding rights, duties and liabilities of a living person, in order to preserve and conserve them. They are also accorded the rights akin to fundamental rights/ legal rights (Clause 2).

In contrast to the earlier judgment, the court recognised the role of other riparian states (under the aegis of an inter-state council), community participation and the importance of extending juristic personhood to the Himalayan ecosystem. It appointed six government officials to act as persons in *loco parentis*[5] of the geographic features in the State of Uttarakhand and permitted the co-option of seven local representatives. The judgment quotes repeatedly from *Secret Abode of Fireflies* (Singh, 2009), which underlines the sacredness of mountains (as the abode of deities) and of certain Indian trees and plants, and emphasises the 'rights for nature'.

On 7 July 2017, in an apparent setback, The Supreme Court of India (*State of Uttarakhand v Salim*) 'stayed' the landmark judgment of 20 March (*Salim v State of Uttarakhand and Others*, 2017) that granted juristic personhood to the Ganga and Yamuna Rivers (and their tributaries). A stay is a suspension of a case or a suspension of a particular proceeding within a case. However, this stay resulted not from a challenge to juristic personhood, which was accepted by the Supreme Court, but as a result of ambiguity regarding accountability of damage done to the rivers (Times of India, 2017).

The case of the Atrato River Basin, Colombia

On the 2 May 2017, it was publically announced in the national newspaper of Columbia, *El Tiempo* that the constitutional court had declared the Atrato River Basin a 'subject of rights' meriting special constitutional protection (ABColombia, 2017). The court called on the state to protect and revive the river and its tributaries and the Chocó. The state was given six months to eradicate illegal mining and to begin to decontaminate the river and reforest areas affected by illegal mining (some 44,000 ha). The court also ordered the national government to exercise legal guardianship and representation of the rights of the river (through an institution designated by the President of the Republic), together with the indigenous ethnic communities (mostly Emberas) that live in the Atrato River Basin in Chocó. The legislation may allow the Emberas to secure standing and protection for some of their *jaikatuma* or spirit mountains (Justicia y Pas, 2009) and defend their *Sitios Sagrados Naturales* or SNS (Organización Indígena de Antioquia) (OIA, undated, CRIC, undated).

The Ganges River, India, and its 115 tributaries declared as multiple juristic persons in 2017 by the Uttarakhand High Court, Nanital, Kumaon Region, Uttarakhand State, India. Permission from Richard Haley http://www.himalayamasala.com/

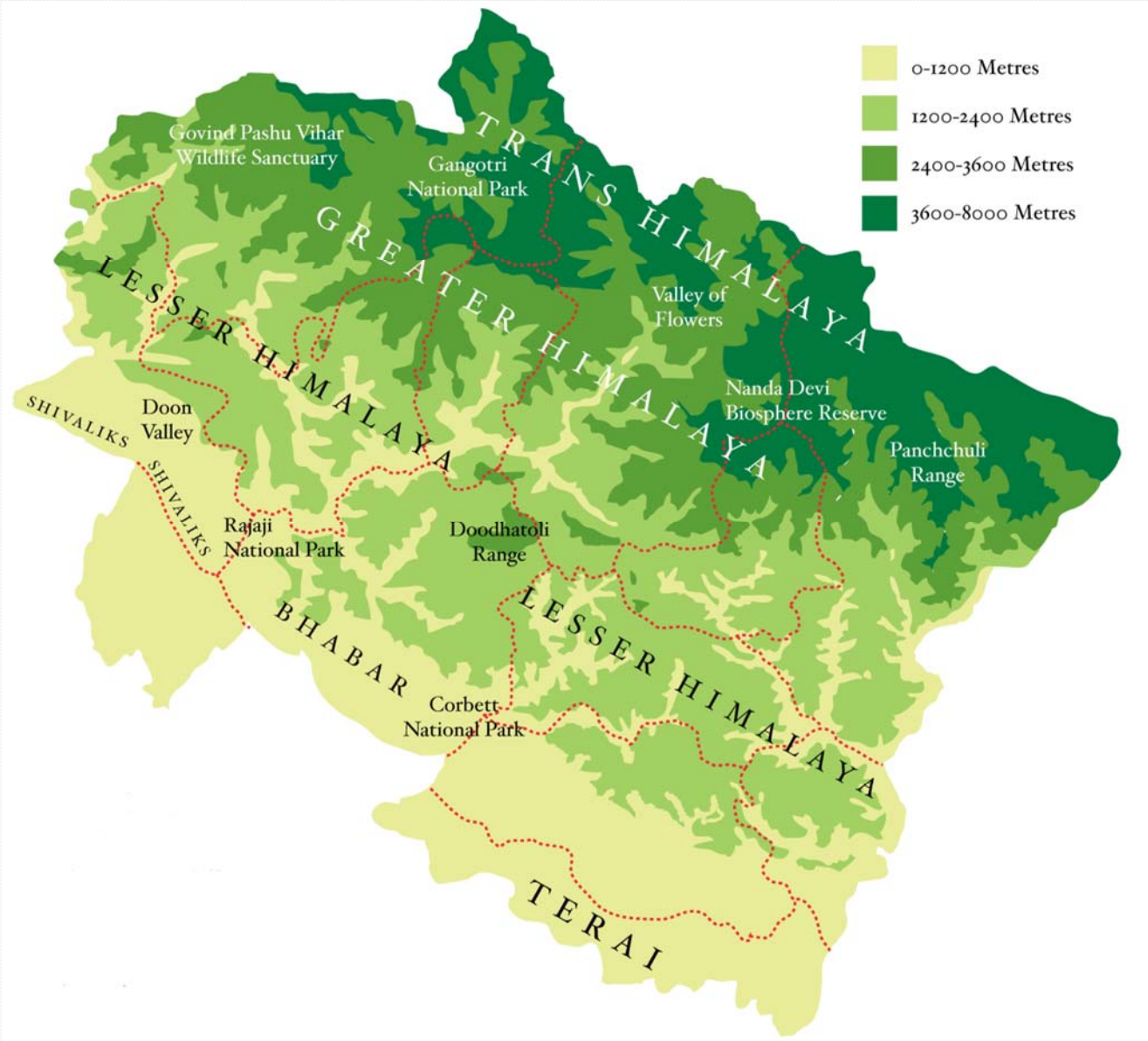
The case of the African Commission on Human and Peoples' Rights

The African Commission on Human and Peoples' Rights resolved in May 2017 to "protect Sacred Natural Sites and Territories" (Clause 44 (iv)). This was in response to a submission from the African Biodiversity Network (ABN) and Gaia Foundation of *A Call for Legal Recognition of SNS and Territories and their Customary Governance Systems* (ABN, 2016, p. 1), which was predicated on Gaian panentheism.

LITIGATION BASED ON NON-HUMAN LEGAL PERSONHOOD

There is evidence that constitutional and legal provisions are beginning to give rise to litigation and enforcement based on the legal personhood of nature. In Ecuador there have been two cases:

The first lawsuit (*Wheeler v DPGEL*, 2011) was filed against the local government near Rio Vilcabamba in March 2011, which was responsible for a road expansion project that dumped debris into the river, narrowing its width and thereby doubling its speed. The project was also done without the completion of an environmental impact assessment or consent of the local residents. The



The Himalayan Ecosystem of Uttarakhand (India)– was declared as multiple juristic persons in 2017 by the Uttarakhand High Court, Nanital, Kumaon Region, Uttarakhand State, India. Permission from Rajiv Rawat ©1997-2010 http://uttarakhand.org

case was filed by two residents, citing the violation of the Rights of Nature, rather than property rights, by the damage done to the river. The case was especially important because the court stated that the rights of nature would prevail over other constitutional rights if they were in conflict with each other, setting an important precedent. The proceedings also confirmed that the burden of proof to show there is no damage lies with the defendant. Though the plaintiffs were granted a victory in court, the enforcement of the ruling has been lacking, as the local government has been slow to comply with the mandated reparations (Daly, 2012).

In a second case (REANCBRN, 2011) on June 2011 the government of Ecuador filed a case against illegal gold mining operations in northern Ecuador in the remote districts of San Lorenzo and Eloy Alfaro. The prosecution argued that the rights of nature were violated by the mining operations, which were polluting the nearby rivers. This case was different from the previous case in that it was the government addressing the violation of the rights of nature. The court's decision was also swiftly enforced, as a military operation to destroy the machinery used for illegal mining was ordered and implemented (Daly, 2012)

DISCUSSION

Matching indigenous beliefs with modern jurisprudence

Both anthropologists and lawyers recognise that there are major differences and tensions between indigenous beliefs and modern jurisprudence and have suggested alternatives to 'juristic personhood'. Bohannan (1957) has suggested that 'juristic' entities should be locally defined rather than by the court or government and Petrazycki (2011, p. 189–190) has suggested "legal relationships with animated entities" which resonates with animistic relational ontologies. Given the complexities and disparate nature of local definitions and norms it might be easier for enspirited SNS to be "integrated into the circle of 'legal subjects' in order to survive" (Stavru, 2016) and for the concept of juristic personhood to be infused with indigenous meaning (Cajete, 2000).

Clearly more research is required in order to address legal systems that do not appear to be fit for purpose and, under the aegis of legal pluralism and a sui generis framework, to identify legal systems predicated on ethno-jurisprudence and customary law.

Congruence with animism

Juristic personhood resonates with the beliefs underpinning most sacred natural sites. SNS are typically enspirited by a unique geospecific spirit with a unique personhood capable of spiritual governance. This is predicated on a pluriversal animistic tradition which does not resonate well with ecocentrism, panentheism or pantheism. Ecocentrism is monistic and the concept of 'rights' is a construction from outside an indigenous animistic context (Solon, undated). Panentheism assumes an intrinsic connection between all living things and the physical world and focuses on gnostic mystic advancement in order to merge with the world soul, which is an alien approach for animists. Pantheism is popular in some conservation circles (Harrison, 2004). It does not recognise deities who are personal and anthropogenic and the approach robs particular life forms of their own measure of significance and agency (Plumwood, 1993) and discounts "the particularity of place and ecosystem and the diversity of life" (Northcott, 1996, p. 113).

Legal acceptance

Colonial judges in India (*Mullick v Mullick*, 1925) were able to employ "the great legal freedom to personify, almost it would seem on a whim" (Naffine, 2009, p. 166) allowing them to infer juristic personhood on an idol and operating on the assumption that an enspirited idol certainly had standing. The colonial judges employed a line of reasoning that mirrors a key element of the argument in favour of legal standing for other OTHP; the directly affected parties deserve the courts' consideration of their interests, and may also require the courts to appoint appropriate legal representatives to argue their case for them (Totten, 2015). In this context, it appears perverse that dissenting justices in North America could only enquire about standing for natural entities in two cases (*Sierra Club v Morton*, 1972; *Reece v Edmonton City*, 2011).

Some scholars have suggested that extensive legislative change would be necessary to recognise legal standing for OTHP. A case such as *Reece v Edmonton City* (2011), however, suggests that it is already within the power of the judiciary to consider these issues. As Chief Justice Fraser (dissenting) asserted, unusual cases such as *Reece*[6] offer a fertile ground for the growth of law in a changing society. It appears that the judiciary already has at its disposal the legal tools necessary to accommodate standing for SNS and protected areas, and judges need only to make use of them (Totten, 2015).

There appears to be no reason why 'juristic personhood' cannot be used as part of a legal regime to ensure standing for protected areas (Sobrevila, 2008) and particularly for enspirited SNS. If *numina* or SNS are granted legal status as juristic persons they have standing as a plaintiff. If their bio-cultural integrity is compromised (if for example a SNS is threatened with clear felling), then they can seek redress in court through a guardian, and the burden of proof lies with the offending party/parties.

The question of guardians

Although juristic persons have standing, they are also perpetual minors and require guardians to represent their interests (especially in court) ideally under the aegis of a local 'community of believers' (Marsilius of Padua 1324 in Emerton, 2015, p. 72). Marsilius embraced a form of democracy that views the people, or the 'community of believers', as the only legitimate source of political authority. He argued that sovereignty lies with the people, and that citizens should elect, correct, and, if necessary, depose their political leaders. In the context of Tibetan SNS, for example, appropriate guardians might be the hereditary village leader, or a trance medium, or a divination master that will establish the wishes and demands of the *numina*. There are a number of judicial options if minors are not represented. Under the aegis of Western jurisprudence, judges are able to appoint, by court order, a guardian a*d litum*[7] for the duration of the legal action or a state

guardian *parens patriae*[8] on a longer-term basis. In a Hawaiian court case (MKAH v BLNR, 2013), for example, a descendent of the *Kanaka Maoli* (native Hawaiians) wrote an *affidavit* (accepted by the court) that granted him power of attorney to act and speak on behalf of a spirit named *Mo'oinanea* that inhabits mount *Mauna Kea*.

Scaling-up

Most enspirited SNS are small, such as those in SW China, and typically average 250 ha (Studley, 2016) and are therefore ritually protected by a small group of local people, which could represent the SNS in court. Challenges arise however in terms of standing for larger natural entities such as the Great Barrier Reef or the Mekong River. The Great Barrier Reef, an important cultural site for many Aboriginal and Torres Strait Islander peoples, is being degraded as a result of global carbon emissions (Marshall & Johnson, 2007), but who will represent it in court and who can be sued? The Mekong is especially sacred to Buddhist and animistic communities who live along its banks in the seven nations (Tibet, China, Myanmar, Lao PDR, Thailand, Cambodia and Viet Nam) through which it flows. It presents different problems because it crosses multiple borders and jurisdictions. As a result, appointing guardian(s) would require transnational regional cooperation, and enforcement would require several countries working together with several sets of national legislation.

Future priorities

Given the current threatened status of SNS in many parts of the world and their lack of recognition, it would appear that the granting of juristic personhood to those SNS that are outside of recognised protected areas is more of a priority than those already under the aegis of conservation designations. Furthermore, juristic personhood is augmented by customary laws, *sui generis* frameworks and ritual protection of SNS that are often extant in indigenous societies. Although as a legal term 'juristic personhood' or its cross cultural equivalent does not exist in lay Tibetan and may not appear in the lexicons of many Indigenous people, as a concept it resonates with animist worldviews and ontologies (Studley, 2016).

Although SNS "occur in all IUCN categories of protected area" (Dudley, 2008) it is apparent that their extent, distribution and spiritual governance is largely unknown, and even less is known about SNS in the homelands of Indigenous people (Studley, 2016). It is vitally important especially when establishing or expanding protected areas to identify and map SNS and to record the expectations of the *numina* who inhabit the SNS and any customary laws that might affect conservation outcomes, positively or negatively.

CONCLUSIONS

Recent legislation has provided conservationists with new ecocentric legal tools: 'nature rights' and 'earth law' and legal regimes; 'juristic personhood' and 'spiritual governance' to safeguard SNS and ecosystems. There is no reason why the legal regime of juristic personhood and ecocentric legal tools cannot both be used to safeguard protected areas and OECM, especially given the use of the latter in litigation in Ecuador (Daly, 2012) and the recent recognition of SNS in Africa (ACHPR, 2017) and elsewhere. The legal regime of juristic personhood and spiritual governance mediated by *numina* may be the optimal choice for safeguarding enspirited SNS because, unlike ecocentrism or panentheism, it conceptually resonates with the animistic worldview and relational ontologies of many Indigenous peoples.

Although the semantics vary, most of the Indigenous people who live closest to most SNS accept other-than-human personhood and experience culturally specific legal relationships with entities who are *de facto* juristic persons. These relationships are predicated on contractual reciprocity between local people and the *numina*, which provide protection and blessing providing they are honoured, appeased and empowered to exercise spiritual governance and custodianship over their domain.

Currently, many enspirited SNS in the homelands of Indigenous people are seemingly rendered 'invisible' or discursively excluded because they are owned and governed by other-than-human persons. This would seem to be a lost opportunity for conservation, as well as a disservice to Indigenous people. Recognition of enspirited SNS as juristic persons with legal standing should lead to their recognition by IUCN as a governance sub-type of ICCA and OECM under the aegis of a spiritual governance type. The result could lead to the safeguarding of SNS under national law and recognition internationally, a benefit for both Indigenous people and nature conservation. The concept of juristic personhood for rivers, glaciers and mountains could be a significant and effective addition to the tool-box available to conservationists and protected area managers.

ENDNOTES

[1]Enspiriting is an animistic ritual (and sometimes liturgical) process whereby a spirit or numina is 'called down' or invoked by animistic humankind and invited to inhabit a biophysical entity (mountain, forest, rock, idol) which becomes enspirited permanently providing the spirit is honoured and appeased on a regular basis.

[2]Natural law is a philosophy asserting that certain rights are inherent by virtue of human nature, endowed by nature and that these can be understood universally through human reason.

[3]Most recently, the New Zealand government announced that it would grant 'legal personality' to a third site, Mount Taranaki, with the government and eight local Maori tribes acting jointly as guardians (Aigne Roy, 2017).

[4](parents of the nation) is a public policy power of the state to intervene as legal guardian of an entity in need of protection.

[5](in place of a parent) refers to the legal requirement of a person (or persons) to take on the responsibilities of a parent for another entity.

[6]The Queen's Bench of Edmonton Court decided on 20/8/2010 that the City of Edmonton had not violated the Animal Protection Act by keeping Lucy the Elephant in Valley Zoo. The application was brought forward by a number of organisations concerned for the health and welfare of Lucy, a lone Asian elephant kept at the zoo. In dismissing the appeal, the majority of the court upheld the finding below that the application for a declaration was an abuse of process. Leave to appeal to the SCC was refused [2011] SCCA No 447.

[7](guardian appointed by a court) is someone appointed by the court to represent a client for the duration of a particular legal action.

[8](parents of the nation) is a public policy power of the state to intervene as legal guardian of an entity in need of protection.

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RESUMEN

El reconocimiento de que personas "que no son humanas" pueden ser sujetos de derecho había sido acogido anteriormente en formas de derecho consuetudinario, pero hasta hace poco había sido negado en la mayoría de las jurisdicciones modernas. El concepto legal de condición de persona está arraigado en el jus gentium de la Roma imperial, que también sirvió de base para los "fideicomisos públicos". La condición de persona ha sido ampliada en algunas jurisdicciones para incluir otros “sujetos de derecho” con derechos y obligaciones específicos. Tal es el caso, por ejemplo, de los magistrados en India, que desde el siglo XIX han reconocido a ciertos ídolos inspiradores como poseedores de una condición jurídica con los mismos derechos legales que los seres humanos. Recientemente, otras jurisdicciones han reconocido ciertas entidades naturales-espirituales como personas jurídicas, atribuyendo a ríos y montañas sagradas la condición de "persona jurídica". En este artículo, revisamos una serie de casos recientes de todo el mundo que destacan la evolución de esta jurisprudencia a través del tiempo. El régimen legal de la personalidad jurídica puede ser una táctica eficaz para salvaguardar los sitios naturales sagrados, porque resuena conceptualmente con la visión animista del mundo y las ontologías relacionales de muchos pueblos indígenas. Aunque se necesitan estudios (y litigios) adicionales para que este enfoque sea ampliamente reconocido, bien podría convertirse en un mecanismo eficaz para la conservación de la naturaleza dentro de áreas protegidas y áreas conservadas por la comunidad.

RÉSUMÉ

La reconnaissance que des entités «autres que l'homme» peuvent être considérées comme des sujets de droit a déjà été adoptée sous forme de droit coutumier, mais elle a été refusée jusqu'à récemment dans la plupart de juridictions modernes. Le concept légal de personnalité juridique est enraciné dans le jus gentium de la Rome impériale, qui était aussi la base des «trusts publics». La personnalité juridique a été élargie dans certaines juridictions de façon à inclure d'autres «sujets juridiques» avec des droits et obligations spécifiques. Les juges en Inde, par exemple, ont reconnu depuis le XIXe siècle que les idoles des esprits avaient un statut légal et les mêmes droits légaux que les êtres humains. Récemment, plusieurs autres juridictions ont reconnu certaines entités spirituelles-naturelles comme des personnes morales, faisant des rivières et des montagnes sacrées des «personnes morales». Dans cet article, nous passons en revue un certain nombre de cas récents à travers le monde qui mettent en évidence cette évolution de la jurisprudence au fil du temps. Le régime légal de la personnalité juridique pourrait constituer une technique efficace pour sauvegarder les sites naturels sacrés, car il résonne sur le plan conceptuel avec les ontologies animistes et relationnelles de nombreux peuples autochtones. Des études complémentaires (et des procédures judiciaires) seront nécessaires pour qu'une telle approche devienne largement reconnue, mais elle a le potentiel de devenir un outil efficace pour la conservation de la nature dans les aires de conservation communautaires et les aires protégées.

PARTICIPATORY THREAT ASSESSMENT OF TWO MAJOR WILDLIFE CORRIDORS IN THE TERAI ARC LANDSCAPE

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ABSTRACT

Threats within the Basanta and Laljhadi-Mohana wildlife corridors that connect protected areas in the Terai Arc Landscape were assessed in 2012 and 2014. The threat ranking employed a participatory and multi-stakeholder process with members of government agencies and the community. The team used two different methodologies in 2012 and 2014. In the first assessment in 2012, biodiversity targets and direct threats were identified in a conceptual model of the corridors, and absolute threat ranking was conducted using Miradi software. In 2014, direct threats in the corridors were identified and evaluated using a pairwise ranking approach. Both processes identified the type and level of direct threats in each corridor at each time period. The extent and intensity of direct threats were found to vary between wildlife corridors, between different landscapes and between the two time-periods. In the Basanta corridor, some threats identified in 2012 disappeared or were not prioritised (e.g. use of diclofenac) in 2014 while new threats emerged (e.g. infrastructure development) in the intervening years. In the Laljhadi-Mohana corridor, the level of threats varied (e.g., encroachment was a 'low' threat in 2012, whereas it was a 'high' threat in 2014). Both approaches provided simple ways of identifying and ranking direct threats in planning biodiversity conservation in a wildlife corridor or landscape.

Keywords: wildlife corridor, Terai Arc Landscape, direct threat, absolute threat ranking, pairwise ranking, Miradi

INTRODUCTION

The Terai Arc Landscape (TAL) is a vast conservation landscape of approximately 49,500 sq km, stretching from Nepal's Bagmati River in the east to India's Yamuna River in the west (MoFSC, 2004). It incorporates 13 protected areas and forest corridors stretching from Parsa Wildlife Reserve in Nepal to Rajaji National Park in India. The TAL includes the Terai-Duar savanna and grassland, a Global 200 Ecoregion, which is categorised as critical/endangered (Olson & Dinerstein, 2002). The landscape is home to some of Asia's largest mammals – Bengal tiger (Panthera tigris), Asian elephant (Elephas maximus), greater one-horned rhinoceros (Rhinoceros unicornis), gaur (Bos gaurus) and swamp deer (Cervus duvaucelii). The Terai Arc Landscape (Western Terai Complex) was identified as one of 17 priority conservation landscapes in a 2001 ecoregional assessment (WWF & ICIMOD, 2001). The Terai Arc Landscape – Nepal (TAL-Nepal) extends over an area of 23,199 sq km (Figure 1).

The Terai Arc Landscape was based on the concept of Tiger Conservation Units, a conservation tool developed by WWF, in collaboration with the Wildlife Conservation Society (WCS), and with support from Save the Tiger Fund (Terai Arc Landscape Program, A Retrospective, 2001-2008, 2008). TAL – Nepal represents two Level-1 Tiger Conservation Units (MoFSC, 2004). The TAL concept was developed around delineation of 'wildlife corridors', as defined by a tiger dispersal model using the tiger as umbrella species. Forest corridors are natural habitat areas that contain the ecological conditions necessary for potential wildlife movement. Usually, forest corridors link protected areas providing refuge for wildlife populations (MoFSC, 2006).

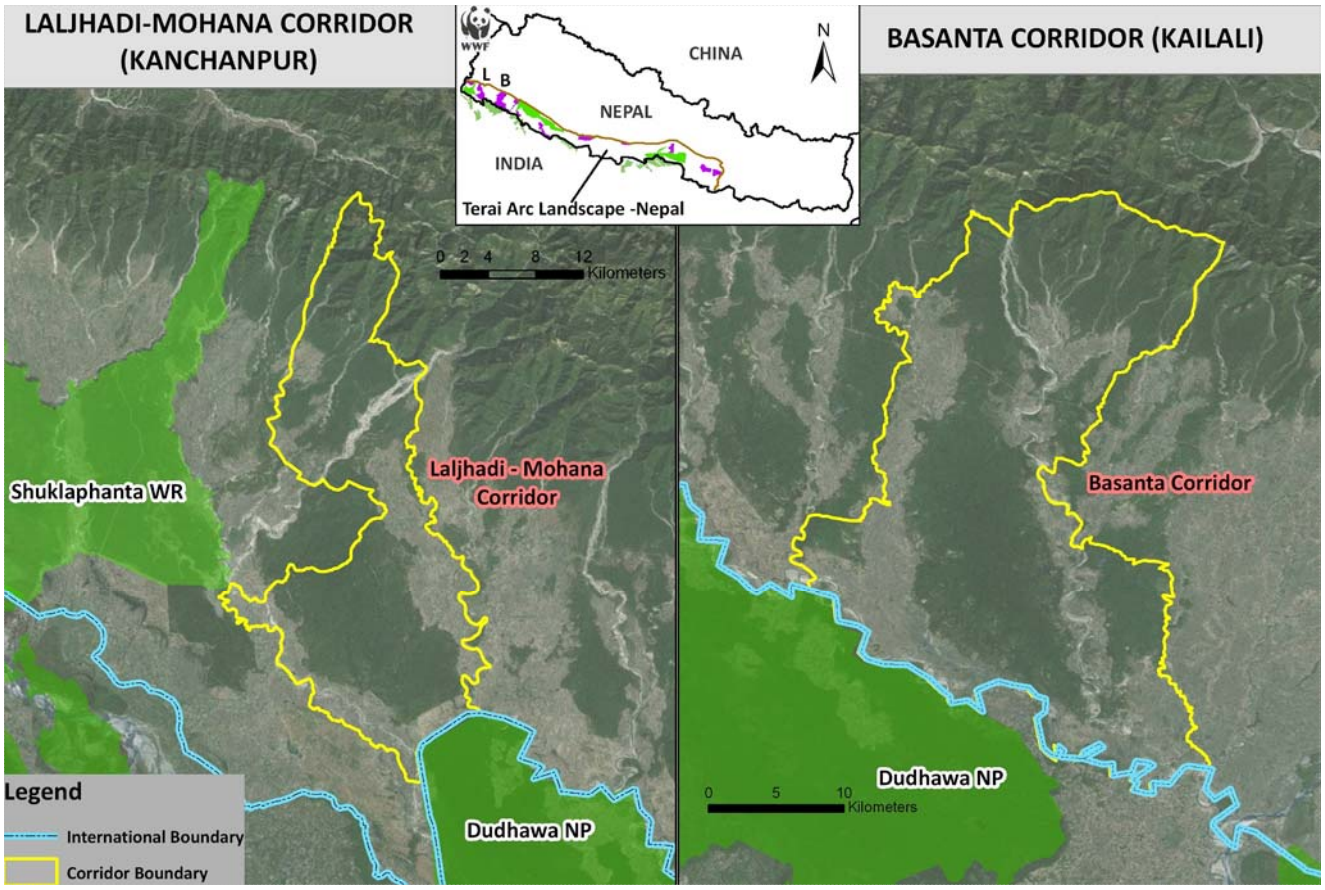

Figure 1. Protected areas and wildlife corridors in Terai Arc Landscape (TAL) – Nepal (and some protected areas in TAL India)

Three transboundary corridors were delineated in 2001: Basanta corridor, Brahamadev-Bardia-Chitwan corridor and Khata corridor. The Basanta corridor (Figure 1, labelled 'B' on the inset map of TAL) encompasses an area of 65,500 ha, connecting Suklaphanta Wildlife Reserve and Bardia National Park in Nepal with Dudhwa National Park in India through the forests of the Churia foothills (WWF Nepal, 2008). The corridor is used by tiger and rhinoceros, but encroachment in the forest area is high (TAL CBRP, 2015).

Within the Brahamadev-Bardia-Chitwan corridor a bottleneck was identified where a narrowing of the corridor had resulted from external threats (MoFSC, 2006). This bottleneck lies at the border of Kailali and Kanchanpur districts, and links Suklaphanta Wildlife Reserve with Bardia National Park through the Siwalik foothills (WWF Nepal, 2008). The degraded forest area has been gradually restored. It was identified that the southern part of the bottleneck had the potential to link to the Dudhwa National Park, India on the south. The area was then expanded as 'Laljhadi-Mohana corridor' in 2005 (Figure 1, shown as 'L' on the inset map of TAL). This corridor links Dudhwa National Park in India with the Churia forests in Nepal and lies in Kanchanpur district and east of Suklaphanta Wildlife Reserve. It covers an area of 35,400 ha. The corridor is frequently used by elephants and tigers (TAL CBRP, 2015). The government of Nepal declared parts of the Basanta corridor (40,782 ha) and the Laljhadi-Mohana corridor (24,664 ha) as protected forest areas in 2010.

ASSESSMENT OF THREATS IN THE TERAI ARC LANDSCAPE

The direct threats of biodiversity loss and environmental degradation in TAL-Nepal were identified in 2001 as forest conversion, uncontrolled grazing in forests, unsustainable timber harvesting, unsustainable fuelwood extraction, forest fires, Churia watershed degradation, and wildlife poaching and human wildlife conflict (MoFSC, 2004). The type and level of direct threat varied from one corridor to another and one protected area to another in TAL-Nepal. As part of more detailed conservation planning for projects in the Basanta and Laljhadi-Mohana corridors, WWF conducted threat assessments at a more local level in 2012 and 2014. Methods of threat analysis include (a) absolute rating systems like that used in the Open

Standards methodology and Miradi software (see https://www.miradi.org/), and (b) approaches that use pairwise comparisons of threats (Russell, 1997).
This paper reports on the results from applying both these approaches as part of a conservation project in the Terai Arc in Nepal. A WWF conservation team used absolute threat ranking in the analysis in 2012 (required as part of its USAID-supported programme) and used a pairwise ranking method, which included consultation with the surrounding communities in 2014.

METHODS AND METHODOLOGY

The conservation team used the absolute threat ranking methodology in 2012 with technical support from WWF Nepal who were facilitating the process. Absolute ranking of threats is done separately for each individual conservation target such as a species or particular ecosystem, and the rankings are rolled up to determine each threat's overall effect on the site. Thus, for each target, the team needs to look at all the threats that affect it and rank the degree to which each threat affects the target. The team used three criteria to evaluate each direct threat: scope, severity and irreversibility with each assessed on a four-point scale (very high, high, medium and low) as used in the Miradi software (WWF, 2012; see Supplementary Online Material 1 for details). The steps followed in threat ranking are outlined in Supplementary Online Material 2.

In the discussion of the Basanta corridor, key stakeholders such as members of the community forest coordination committee, community forest user groups, district forest office and the field staff of WWF Nepal participated in the team. The team held discussions and, after achieving a consensus, presented their results. Similarly, the team of stakeholders for Laljhadi-Mohana corridor included members of Suklaphanta Wildlife Reserve, the community forest coordination committee, community forest user groups, district forest office, local non-governmental organisations and field staff of WWF Nepal. There were 20 members in each team, made up of the organisations or institutions involved in biodiversity conservation in the corridors.

In 2014, the teams again conducted threat ranking of the same two wildlife corridors. Instead of using the

Indigenous Tharu community in Basanta corridor © WWF Nepal

absolute threat rating approach used previously in 2012, on advice and with the support of technical support staff, the teams used a pairwise ranking approach. In pairwise ranking, each item on a list is compared in a systematic way with every other item (Russell, 1997). In a table, each threat/problem is compared in turn with each of the other threats/ problems. The most important threat amongst the two is placed in the cell in the table. This is repeated until all threats are compared with the first threat. The same process is repeated for the second threat. The process is repeated for all threats until all possible comparisons are made and the matrix is completed (see Supplementary Online Material 2).

In the discussion of the Basanta corridor, the participants comprised members of the community forest coordination committee, community forest user groups, sector forest office, and field staff of WWF Nepal. In the discussion of Laljhadi-Mohana corridor, the participants comprised members of Laljhadi-Mohana protected forest, sector forest office, community forest coordination committee, community forest user groups, and field staff of WWF Nepal. There were 30 participants in each team made up of the organisations and institutions involved in biodiversity conservation in the corridors.

In 2012, the exercises were carried out in the district headquarters of Kailali district of the Terai Arc Landscape. Kailali district incorporates Basanta corridor, whereas its adjoining district in the west, Kanchanpur district incorporates Laljhadi-Mohana corridor. In 2014, the exercises were carried out in their respective corridors, one in Basanta corridor and the other in Laljhadi-Mohana corridor. So, the number of participants was higher in 2014 as there was greater representation from the community forest coordination committee and community forest user groups of the respective corridors. The officer of the sector forest office joined the meeting in 2014. Almost 40 per cent of the participants meeting in 2014 had previously participated in 2012.

RESULTS

Basanta Corridor

In 2012, 12 biodiversity targets and 10 direct threats for Basanta corridor were identified using absolute threat ranking (Supplementary Online Material 3 -– Basanta conceptual model and threat ranking). Flood and erosion/ sedimentation, poisoning (fishing) and excessive grazing were ranked as 'high' threats, whereas the remaining threats were ranked 'medium'. The overall project threat rating was 'high' (Table 1).

In 2014, the team conducted the threat ranking of Basanta corridor using pairwise ranking methodology (Supplementary Online Material 4 – Pairwise threat ranking, Basanta, 2014). The team identified nine threats. Two direct threats, encroachment and large infrastructure development were ranked 'very high'. Overgrazing and Chure degradation were ranked 'high'. Forest fire, river-bank cutting and wetland/habitat loss were ranked 'medium'. Poaching and illegal timber smuggling were ranked 'low' (Table 2).

Laljhadi-Mohana corridor

Similarly, in 2012, the team identified 15 biodiversity targets and nine direct threats for Laljhadi-Mohana corridor using absolute threat ranking (Supplementary Online Material 5 – Laljhadi-Mohana conceptual model and threat ranking).

Illegal grazing, poaching and uncontrolled forest fire were ranked as 'very high' threats, whereas lack of food and shelter, use of poison in river, river bank erosion and siltation and illegal extraction of fuelwood were ranked as 'high' threats. Timber smuggling was ranked 'medium' and encroachment was ranked as 'low' threat (Table 3). The overall project threat rating was 'very high'.

In 2014, the team conducted the threat ranking of Laljhadi-Mohana corridor using pairwise ranking methodology (Supplementary Online Material 6 – Pairwise threat ranking, Laljhadi-Mohana, 2014). The team identified 10 threats.

Illegal fuelwood collection was ranked as a 'very high' threat. Encroachment, river-bank cutting and flooding and open grazing were ranked as 'high' threats (Table 4). Poaching, forest fire, habitat loss and boulder/sand

Laljhadi Mohana corridor © WWF Nepal

Table 1: Summary of threat rankings of Basanta corridor in 2012 using absolute threat ranking

Very High	High	Medium	Low
	Flood, erosion and sedimentation	Use of diclofenac	
	Poisoning (fishing)	Illegal logging	
	Excessive grazing	Uncontrolled forest fire	
		Poaching	
		Excessive firewood extraction	
		Encroachment	
		Invasive species	
Overall Project Rating			**High**

Table 2: Summary of threat rankings of Basanta corridor in 2014 using pairwise comparison

Very High	High	Medium	Low
Encroachment	Overgrazing	Forest fire	Poaching
Infrastructure development	Chure degradation	Riverbank cutting	Illegal timber smuggling
		Wetland/habitat loss	

Table 3: Summary of threat rankings of Laljhadi-Mohana corridor in 2012 using absolute threat ranking

Very High	High	Medium	Low
Illegal grazing	Lack of food and shelter	Timber smuggling	Encroachment
Poaching	Use of poison in river		
Uncontrolled forest fire	Riverbank erosion and siltation		
	Illegal extraction of fuelwood		
Overall Project Rating			**Very high**

Table 4: Summary of threat rankings of Basant corridor in 2012

Very High	High	Medium	Low
Illegal fuelwood collection	Encroachment	Poaching	Poisoning
	Riverbank cutting and flooding	Forest fire	Human-wildlife conflict
	Open grazing	Habitat loss	
		Boulder/sand extraction	

extraction were ranked as 'medium' threats. Poisoning and human-wildlife conflict were ranked as 'low' threats.

Comparison of results

Comparing the results between the two methodologies over the two periods of time 2012 and 2014, indicates that new threats have emerged or become prioritised and some existing threats have receded or were not prioritised. Possible explanations are apparent for at least some, but not all, of these changes.

In the Basanta corridor, four threats from 2012 were not similarly identified or prioritised in 2014 (invasive species, poisoning (fishing), use of diclofenac, and excessive firewood extraction) while a number of new threats were identified at the later time (infrastructure development, Chure degradation, river-bank cutting and wetland/habitat loss). The governments of India, Nepal and Pakistan banned veterinary use of the painkiller diclofenac in 2006 because of its lethal effects on vultures that feed on the carcasses of cattle and buffaloes that have been treated with the drug shortly

before they died (Bird Conservation Nepal, 2014). Seven districts, including Kailali district which includes the Basanta corridor, were declared diclofenac-free in 2010/2011 (Bird Conservation Nepal, 2015) and may be the reason why use of diclofenac was seen as a threat in 2012 but not in 2014. Also, in the Kailali district, around half of households use fuelwood for cooking (Alternative Energy Promotion Centre, 2014) although fuelwood is being progressively replaced by technologies such as domestic solar, biogas and improved cook stoves (ICS). WWF Nepal, the Biogas Sector Partnership – Nepal, Alternative Energy Promotion Centre and other organisations are providing support to biogas and ICS in the district. WWF Nepal chiefly focuses on the corridor areas within the districts, and its programme supported the installation of 606 biogas plants and 345 ICS in the corridors in 2014 alone (TAL CBRP, 2014), which could explain why excessive firewood extraction was not seen as a threat in 2014.

The government of Nepal allocated a budget for national pride projects in 2013 (Ekantipur, 2013) including the postal highway project which passes through Basanta corridor. The government of Nepal also funded the Rani-Jamara-Kulriya irrigation project which passes through the Basanta corridor. These projects could have led to the identification of infrastructure development as a new priority threat. Chure degradation and river-bank cutting identified in 2014 closely relate to 'flood, erosion and sedimentation' which was identified in 2012. The Basanta corridor is connected to the Chure hills in the north which are geologically young, structurally weak and lie in a zone of high volume precipitation (MoFSC, 2008). In the monsoon season, the heavy rain in areas of forest degradation causes erosion and landslides and the increased run-off leads to flood and river-bank cutting in the lowland. The Kailali district is rated as 'moderate' in terms of flood vulnerability index (Ministry of Environment, 2010). So, 'flood, erosion and sedimentation' and/or 'river-bank cutting' were manifested as a threat in the Basanta corridor in Kailali district.

All but one (timber smuggling) of the threats identified in the Laljhadi-Mohana corridor in 2012 were also recorded in 2014, while three new threats were recorded at the later time (habitat loss, boulder/sand extraction and human-wildlife conflict). In 2014, a herd of elephants killed a farmer and destroyed several huts (TAL CBRP, 2015) and thus, exacerbated human-wildlife conflict while development pressures and weak governance lead to exacerbation of habitat destruction and exacerbation of resource extraction activities.

Members of community forest user groups in Laljhadi-Mohana corridor © WWF Nepal

Table 5: Strengths and weaknesses of the two methodologies

	Absolute threat ranking	Pair-wise ranking
Strengths	Threat is measured target-by-target basis.	Threat is measured considering the overall site or area.
	It is efficient and more scientific as it incorporates set criteria or parameters and their categories for rating – very high, high, medium and low. It thus allows sound comparison of the results over time.	It is a simple method that does not require a highly trained facilitator, nor the usage of software.
	The assessment of threats lends itself to the design of a target-driven activity or programme-based responses based upon the target-by-target analysis of the threat ranking.	It is less costly in terms of the requirement for a trained facilitator and is easier to understand for community members. It takes less time to conduct the exercise in the group.
	The method calculates an overall threat rating for the area or project.	
Weaknesses	It requires a trained facilitator who can guide the group through absolute threat ranking (best done using Miradi). So, it can be relatively costly and such a trained facilitator may not be available at the community level.	It requires another set of group work to identify a target-driven activity or programme.
	It is harder to understand by community members in the beginning of the group exercise as it is more technical in its procedure and it also takes longer for the whole exercise.	It does not show the overall threat rating for the area or project.

Relative strengths and weaknesses of the threat assessment approaches

Based on a discussion of the core team involved in managing both assessments, we assessed the strengths and weaknesses of the absolute threat ranking and pairwise threat ranking based upon our experience of the two exercises in 2012 and 2014 (Table 5). In the absolute threat ranking, the threat was analysed target-by-target based on scope, severity and irreversibility. The threat rating was then rolled up in the summary threat rating that shows the impact of the direct threat to the overall site. Pairwise ranking did not include the target-by-target analysis of threats and hence provided less detailed information. While the absolute ranking approach provided much more detailed results, conducting this assessment required the assistance of a trained facilitator who was able to use the Miradi software, and was hence more costly. We also observed that it was less easily understood by community participants than the pairwise ranking although it was easily understood by scientists and other technically trained participants.

DISCUSSION

The process and results presented here are examples of two different threat assessment methodologies applied at the project/programme scale and used to help guide the design and implementation of two conservation corridors. The threat assessment of the two corridors helped to design and prioritise activities in the planning process of the organisations involved in biodiversity conservation in the wildlife corridors at the two points in time. The organisations allocated more resources to addressing 'excessive grazing', 'flood, erosion and sedimentation' and 'poisoning' in Basanta corridor in 2012 whereas more resources were allocated to addressing 'encroachment', 'infrastructure development', 'overgrazing' and 'Chure degradation' in

Basanta corridor in 2014. WWF Nepal strengthened its efforts in sustainable grazing management (stall feeding practices, education of herders, etc.) in the Basanta corridor in 2014. Recently, WWF Nepal drafted a 'guideline for eco-friendly linear infrastructures' that can help address issues such as that seen within the Basanta corridor. Similarly, WWF Nepal strengthened its efforts in livestock management in Laljhadi-Mohana corridor to help control 'illegal grazing'. Some of the sites were declared as 'zero grazing sites' in 2014 in Laljhadi-Mohana corridor. WWF Nepal supported a bamboo plantation along the river bank in 2015 in Laljhadi-Mohana corridor to help address erosion issues. The threat analysis results have been used as an adaptive management tool in these projects and programmes.

This paper conveys the findings of two methodologies, aimed at identifying the type and level of direct threats in the two wildlife corridors. A group of practitioners and stakeholders could choose either of these two methodologies based upon the available resources and context. Based on our experiences, we recommend using absolute threat ranking and Miradi software in threat analysis as it is more technical and detailed in its content and procedure. Pairwise ranking can provide a rapid assessment when resources are limited and community members do not understand the technical terms and terminologies of the Open Standards.

SUPPLEMENTARY ONLINE MATERIAL

Supplementary Online Material 1. Threat Rating Criteria

Supplementary Online Material 2. Absolute threat ranking and Pairwise threat ranking processes

Supplementary Online Material 3 Basanta conceptual model and threat ranking, 2012

Supplementary Online Material 4 Pairwise threat ranking, Basanta, 2014

Supplementary Online Material 5 Laljhadi-Mohana conceptual model and threat ranking, 2012

Supplementary Online Material 6 Pairwise threat ranking, Laljhadi -Mohana, 2014

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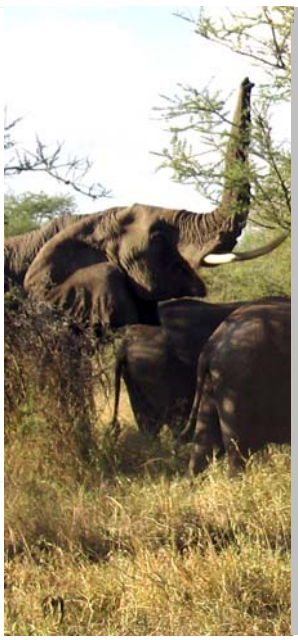
RESUMEN

Las amenazas dentro de los corredores de vida silvestre de Basanta y Laljhadi-Mohana que conectan las áreas protegidas en el Arco de Terai fueron evaluadas en 2012 y 2014. Para la clasificación de las amenazas se empleó un proceso participativo y de múltiples partes interesadas con miembros de las agencias gubernamentales y la comunidad. El equipo utilizó dos metodologías diferentes en 2012 y 2014. En la primera evaluación en 2012, los objetivos de biodiversidad y las amenazas directas fueron identificados en un modelo conceptual de los corredores, y la clasificación de amenaza absoluta se realizó utilizando el software Miradi. En 2014, las amenazas directas en los corredores fueron identificadas y evaluadas mediante un enfoque de clasificación por pares. Ambos procesos identificaron el tipo y el nivel de amenazas directas en cada corredor y en cada período de tiempo. El alcance y la intensidad de las amenazas directas varían entre los corredores de vida silvestre, entre los diferentes paisajes y entre los dos períodos de tiempo. En el corredor de Basanta, algunas amenazas identificadas en 2012 desaparecieron –o no se les asignó prioridad (por ejemplo, el uso de diclofenaco) en 2014, en tanto que nuevas amenazas (por ejemplo, desarrollo de infraestructura) surgieron en el ínterin. En el corredor de Laljhadi-Mohana, el nivel de amenazas varió (por ejemplo, la invasión representó un nivel "bajo" de amenaza en 2012, mientras que en 2014 constituyó un nivel “alto” de amenaza). Ambos enfoques proporcionaron formas sencillas para identificar y clasificar las amenazas directas en la planificación de la conservación de la biodiversidad en un corredor o paisaje de vida silvestre.

RÉSUMÉ

Les menaces dans les corridors fauniques de Basanta et de Laljhadi-Mohana, qui relient les aires protégées dans le paysage du Terai Arc, ont été évaluées en 2012 et 2014. Le classement des menaces a été établi grâce à un processus participatif et multipartite comprenant des membres des agences gouvernementales et de la communauté. L'équipe a employé deux méthodologies différentes en 2012 et 2014. Lors de la première évaluation en 2012, des cibles de biodiversité et des menaces directes ont été identifiées dans un modèle conceptuel des corridors, et un classement absolu des menaces a été réalisé à l'aide du logiciel Miradi. En 2014, les menaces directes dans les corridors ont été identifiées et évaluées en utilisant une approche de classement par paires. Les deux processus ont identifié le type et le niveau des menaces directes dans chaque corridor à chaque période. L'étendue et l'intensité des menaces directes varient entre les corridors fauniques, entre les différents paysages et entre les deux périodes. Dans le corridor de Basanta, certaines menaces identifiées en 2012 ont disparu ou n'ont pas été classées par ordre de priorité en 2014 (par exemple l'utilisation du diclofénac) alors que de nouvelles menaces ont émergé (par exemple le développement des infrastructures) dans les années intermédiaires. Dans le corridor Laljhadi-Mohana, le niveau de menaces variait (par exemple, l'empiètement était une menace «faible» en 2012, alors qu'il s'agissait d'une menace «élevée» en 2014). Les deux approches ont fourni des moyens simples d'identifier et de classer les menaces directes dans la planification de la conservation de la biodiversité dans un corridor ou un paysage faunique.



WILDLIFE DAMAGE IN VILLAGES SURROUNDING THE SERENGETI ECOSYSTEM

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ABSTRACT

Human–wildlife conflict is one of the biggest challenges facing conservation in Tanzania and throughout the world. In this study, human–wildlife conflict was examined through the assessment of wildlife damage in villages surrounding the Serengeti ecosystem. Data were obtained through analysis of reports available at the Zonal Anti-Poaching Unit of Serengeti and key informant interviews. A total of 110 reports were reviewed. Most damage was from crop destruction (66 percent) while less damage resulted from livestock depredation (4 percent). Elephants (*Loxodonta africana*) were responsible for most damage (57.4 percent) that occurred between 2011 and 2014 with little damage (0.8 percent) caused by leopards (*Panthera pardus*). The crops most frequently destroyed by wild animals were maize and sorghum (with 153 hectares and 116 hectares destroyed respectively during the study period. High monetary loss was sustained from tomato cropping, TZS 176,004,825 (ca. USD 88,002.4), which was attributed to its high yields (12.41 tonnes/ha) and high market prices (1,550 TZS/kg). Wildlife officers used several methods to control problem animals including scaring and killing. Inadequate resources were identified as a key challenge to problem animal control. Other challenges were political interference and inadequate collaboration amongst staff from wildlife conservation agencies.

Keywords: human–wildlife conflicts, problem (damage-causing) animals, Serengeti ecosystem

INTRODUCTION

Wildlife plays a significant role in the development of rural local communities. Through wildlife-based enterprises such as tourism, local communities benefit from employment, improvement in social infrastructure and income generation (Hahn & Kaggi, 2001; Masinda & Rathore, 2011). Despite these observable benefits to local communities, wildlife still negatively affects locals through crop damage (and the threat to food security), human injuries and deaths, livestock depredation and property damage (Malugu et al., 2011; KWS, 2013).

Despite the fact that human–wildlife conflicts are a worldwide phenomenon they are predominantly common and well documented in areas adjacent to protected areas (Gillingham & Lee, 2003; Le Bel et al., 2011). In Tanzania, for example, local communities living adjacent to protected areas were found to have a negative attitude and feelings towards wildlife largely as a result of the damage they sustain (Gillingham & Lee, 2003). It is claimed that in some places in Tanzania wildlife account for up to 90% of crop damage (Saru, 1997; Kideghesho, 2008). For example, up to 90% of the crops in Rombo District were destroyed by elephants (Kideghesho, 2008). The undocumented risk of injury or death to farmers who guard their crops at night should also be noted. Apart from crop destruction, livestock predation ranks as the second major damage inflicted by wildlife in Tanzania (Holmern et al., 2007; Kideghesho, 2008). For example, Holmern et al. (2007) reported that 708 livestock valued at USD 12,846 were killed by wild predators including lion, leopard and spotted hyena in seven villages adjacent to the Serengeti National Park in 2003.

The negative impacts of wildlife on human communities have been found to foster negative attitudes of

communities towards wildlife. These impacts need immediate attention as they may result in adverse impacts to both humans and wildlife (Madden, 2004; Distefano, 2005). It is this realisation that has prompted many studies in human–wildlife conflicts in different areas of Tanzania. These studies include Loibooki et al. (2002) and Kideghesho (2008) in areas surrounding the Serengeti National Park; Gillingham and Lee (2003), adjacent to the Selous Game Reserve, and Le Bel et al. (2011) in the villages adjacent to Tarangire National Park. However, most studies on HWC in Tanzania have focused on local community perspectives with few studies paying attention to wildlife damage. Therefore, the current study assesses the damage inflicted by wildlife.

This study assessed wildlife damages in the areas surrounding the Serengeti ecosystem through the use of both primary and secondary data from the Wildlife Division, Zonal Anti-Poaching Unit in Serengeti (APU-Bunda). Specifically, the study focused on identifying the wild animals involved in damage, the types of damage inflicted by wildlife, the cost of the damages and the measures taken to control the wildlife damage in the study area.

METHODS

Study area

This study was conducted in villages surrounding the Serengeti ecosystem within the jurisdiction of APU-Bunda (Figure 1). This ecosystem is located in northern Tanzania covering over 30,000 km2. The wildlife damage incidences occurred in villages adjacent to the Serengeti National Park and Ikorongo, Grumeti, Maswa and Kijereshi Game Reserves. The Anti-Poaching Unit jurisdiction area was selected because it is the only government entity in the area which has powers for wildlife law-enforcement inside and outside the protected areas. APU-Bunda, in conjunction with other stakeholders, is responsible for problem animals in all the villages within the Mara, Simiyu and Shinyanga regions where the western Serengeti National Park falls. From past studies, these areas experience a high degree

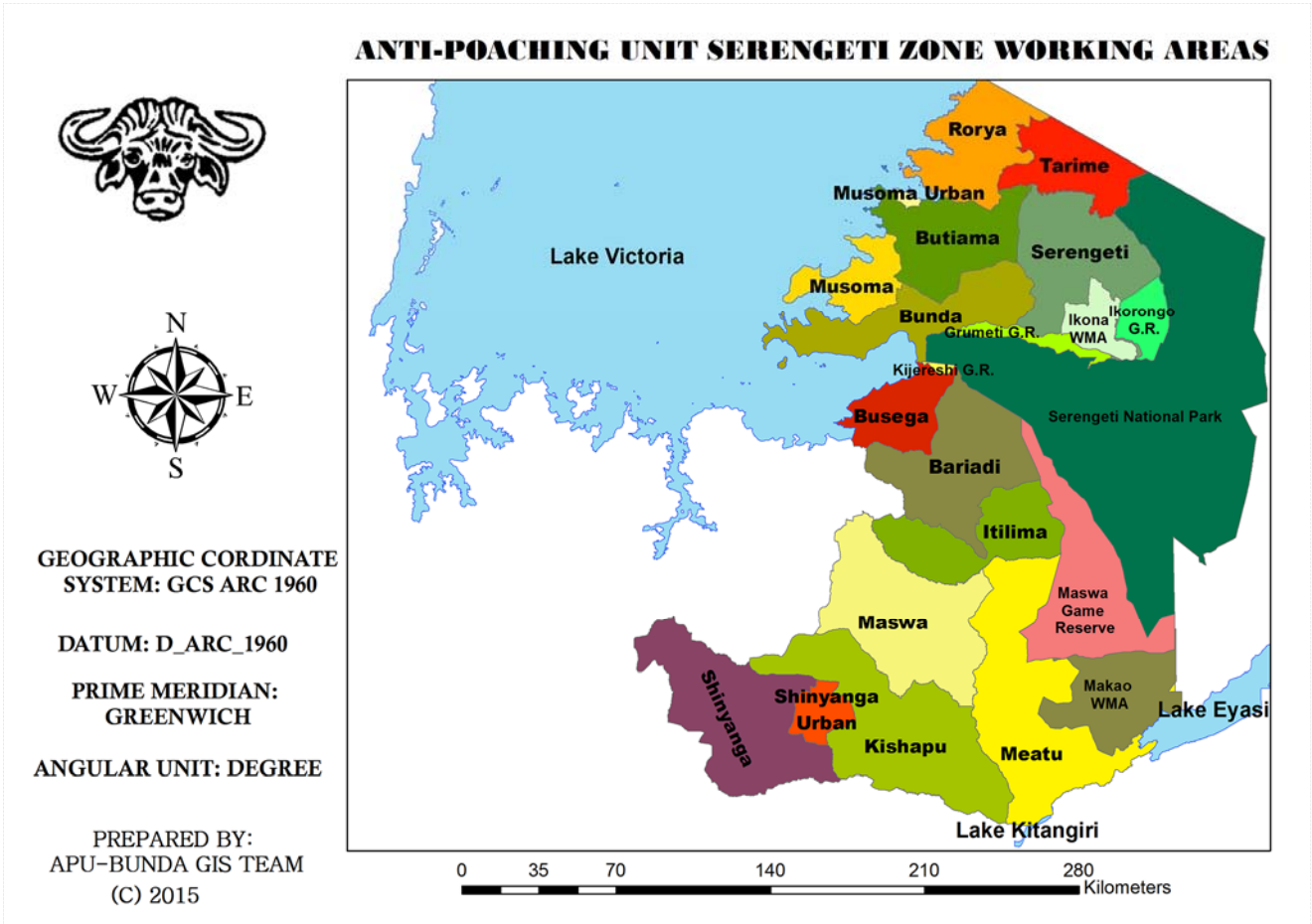

Figure 1: Map showing protected and non-protected areas under the jurisdiction of APU-Bunda (Source: APU-Bunda, 2016).

Local people, APU-Bunda and village leaders assessing a crop destroyed by Elephant for consolation payments © Alex Kisingo

of human–wildlife conflict (see Kideghesho, 2008). The human population in the Serengeti ecosystem is reported to have increased in recent years resulting in high pressure on natural resources (Estes et al., 2012). This has intensified human-wildlife conflict in the area (Estes et al., 2012).

Data collection

Data for this study were collected by analysing documents and conducting interviews. Document analysis involved the review of reports, letters and other information related to wildlife damages stored at the APU-Bunda office from the year 2010 to 2015. All information documented with regard to wildlife damages was reviewed by the researchers including but not limited to the villages affected, wild animal species involved, type of damage sustained, cost of damage (number of livestock killed, acres of crops destroyed, number of people injured, etc.), persons who acted to control the damage, control method applied, resources used (number of game rangers, vehicles, firearms, etc.) and challenges encountered during problem animal control exercises. There was no clear method established before data collection to measure if the control methods were a success or failure.

Key informant interviews were conducted to obtain information on the challenges faced by game rangers in controlling problem animals. These were important for gathering information on challenges as they were less documented in the reviewed documents. Interviews were guided by pre-designed questions to provoke discussions. Key informants were drawn from APU-Bunda staff with long experience in problem animal control and from experienced people from villages that had recorded high incidences of wildlife damage. The selection of key informants was guided by the reviewed reports that contained the names of staff members involved in controlling human–wildlife conflict incidents. A total of 12 game wardens (50% of all APU-

Bunda staff in August 2015) were interviewed. In addition, key informants were selected from 30 villages with high incidences of wildlife damage. The interviews were conducted mostly with Village Chairpersons or Village Executive Officers to understand the magnitude of the costs inflicted by wildlife damage to their respective local communities. For the purpose of this research, problem animal refers to a wild animal which causes negative damaging impact to humans and/or properties.

Data analysis

The secondary data collected from the document review were carefully examined and assessed before being summarised and coded in a spreadsheet and used to calculate frequencies and percentages of wildlife damage incidences. Pearson Chi-square test ($\chi 2$) was used to determine if there was a significant difference in the number of wild animals involved in wildlife damages and the types of wildlife damages that occurred across the years (2011–2014). The years 2010 and 2015 were excluded from the analysis as information was missing for some months. One sample t-test (t-test) was used to test for significant differences in acres lost across various crop types.

For estimating the monetary loss from wild animals, the formula employed by Pittiglio (2010) was applied. The cost incurred by the government was estimated by calculating the consolation fees which will be paid to local people who were affected by wildlife damage as per the Tanzanian Wildlife Conservation (Dangerous Animals Damage Consolation) Regulations of 2011. A 5 km distance from the protected area was observed in estimating the consolation payment rate for crop damage, and for human injuries the rates for permanent disability as stipulated in the fourth schedule of the Tanzanian Wildlife Conservation (Dangerous Animals Damage Consolation) Regulations of 2011 were used. The qualitative information collected from the key informant interviews was summarised focusing on key issues.

RESULTS

A total of 168 wildlife damage incidents from 110 reports, letters and other documents stored in the KDU-Bunda Vermin Control file were identified and recorded

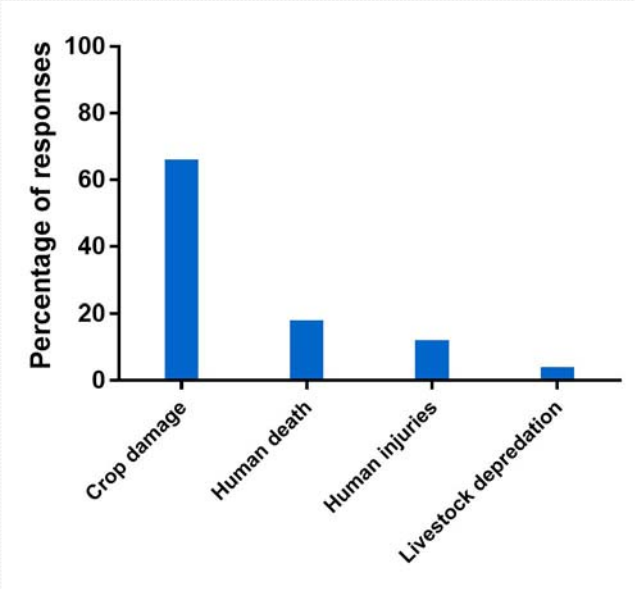

Figure 3: Wildlife damage identified between the years 2011 and 2014

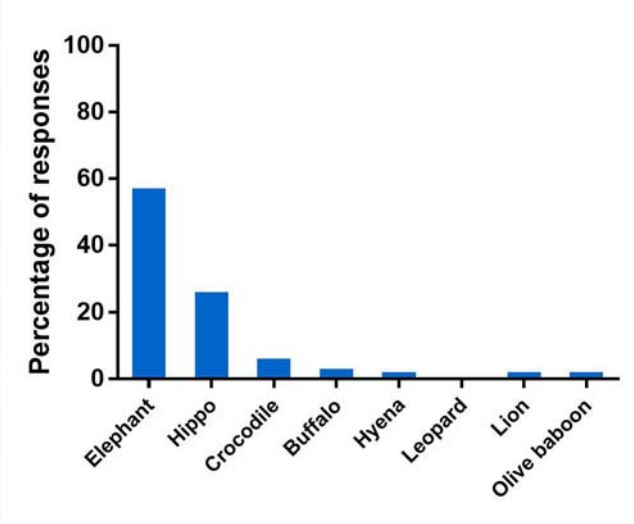

Figure 2: Wildlife species involved in wildlife damages between 2011 and 2014 (n=122).

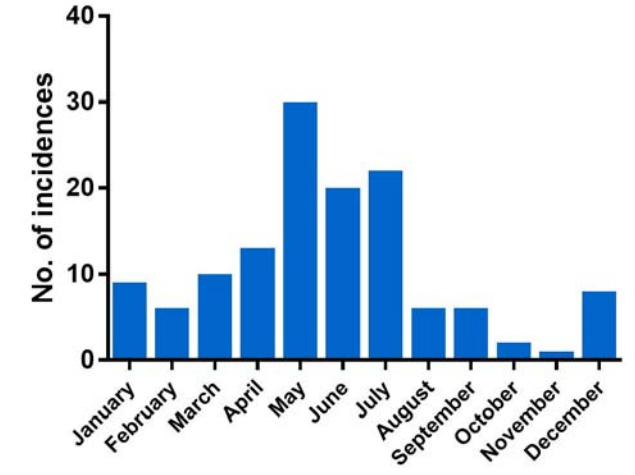

Figure 4: Number of wildlife damage incidences recorded per month from 2011 to 2014

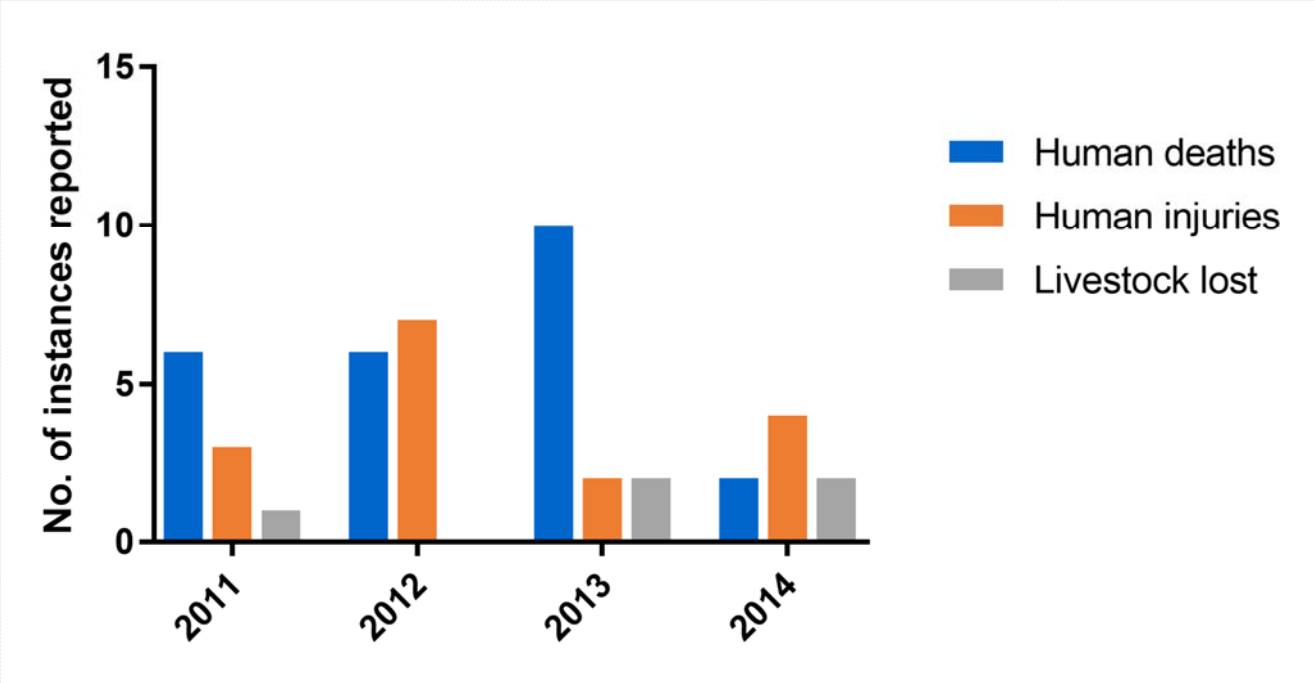

Figure 5: Wildlife damage incidences recorded between 2011 and 2014 in western Serengeti

from July 2010 to June 2015. Wildlife damage was recorded from 108 villages in 10 districts. Most incidents were reported from Bunda district (43.1%) followed by Busega (21.1%), Bariadi (17.9%), Rorya (5.0%), Butiama (4.1%), Musoma Rural (3.7%) and Tarime (2.3%), while fewer wildlife damage incidents were reported from Serengeti (0.9%), Musoma Urban (0.9%) and Itilima districts (0.9%). From these results, Mara region accounted for 60.1% and Simiyu 39.9% of all incidences reported. Most often game rangers used firearms and vehicles in controlling the problem animals by scaring and sometimes killing the animal involved. Most of the key informants suggested that inadequate resources such as personnel, equipment including vehicles, spotlights, scaring bullets and money were the major challenges encountered by game rangers when controlling problem animals.

Wild animal species involved in wildlife damages from 2011 to 2014

Eight species were involved in wildlife damage. Elephant (Loxodonta africana) was responsible for the highest number of incidences (57%) while the least frequent was leopard (Panthera pardus) which contributed to 1% of all damage recorded (Figure 2). The frequency of involvement in wildlife damage incidences from 2011 to 2014 differed significantly between wildlife species ($\chi 221,122 = 44.059$, $p= 0.0023$).

Types of damage caused by wildlife

Crop destruction occurred more frequently than other types of wildlife damage (66%) identified and recorded in the four years (2011–2014), followed by human deaths (18%) and human injuries (12%), while livestock killing was the least frequent damage recorded (4%) (Figure 3). The difference in these damage types across the four years (2011–2014) was statistically significant ($\chi 29, 131= 19.332$, $p= 0.023$).

Over the four years (2011 to 2014), wildlife damage incidences differed between months; increasing in March and peaking in May, while fewer incidences were recorded from August to February (Figure 4). This extent of damage differed significantly across months of the year ($\chi 233,133 = 69.04$, $p< 0.01$).

Cost of the damage caused by wildlife from 2011 to 2014

The extent and cost of damage caused by wildlife across Bunda, Serengeti, Musoma Urban, Musoma Rural, Tarime, Rorya, Butiama, Bariadi, Busega and Itilima districts between 2011 and 2014 were determined (Figure 5 and Table 1). Under the Wildlife Conservation (Dangerous Animal Damage Consolation) Regulations of 2011, the amounts that the Tanzanian government should pay in consolation are human deaths 24 million Tanzanian shillings (TZS) (≈ USD 12,000), human injuries 8 million TZS (≈ USD 4,000), and loss of

Table 1: Crop damage costs estimated in acres from 10 districts recorded by APU-Bunda between 2011 and 2014

Crop	Hectares Lost	Yield* (tonnes/ha)	Yield Lost (tonnes/ha)	Mean Price** (TZS/tonne)	Monetary Loss	
					TZS	USD1
Maize	152.87	1.33	203.32	500,000	101,658,550	50,829.3
Sorghum	116.04	0.97	112.56	650,000	73,163,220	36,581.6
Mixed crops	104.46	-	-	-	-	-
Cotton	108.15	0.82	88.68	-	-	-
Tomatoes	9.15	12.41	113.56	1,550,000	176,004,825	88,002.4
Paddy	8.70	1.59	13.83	1,050,000	14,524,650	7,262.3
Sugarcane	5.77	-	-	-	-	-
Cassava	5.58	1.85	10.32	-	-	-
Sweet potato	3.74	2.04	7.63	-	-	-
Cabbage	3.64	8.08	29.41	-	-	-
Beans	0.81	0.76	0.62	1,550,000	954,180	477.1
Finger Millet	0.81	0.77	0.62	1,350,000	841,995	421.0
Watermelon	0.81	5.67	4.59	-	-	-
Banana	0.40	-	-	-	-	-
Sisal	0.40	-	-	-	-	-
Cucumber	0.24	3.36	0.81	-	-	-
TOTAL	521.57		585.95		367,147,420	183,573.7

Sources: *CountrySTAT United Republic of Tanzania (URT) (2015); **Dullonet Tanzania (2015); - No clear data found; 11 USD ≈ 2,000 TZS

livestock (cattle) TZS 250,000 (≈ USD 125). Human deaths and injuries were reported from crocodile, hyena, hippo and elephant.

A total of 16 crop types were identified as being farmed in the area, out of which only 12 had reliable yield rates recorded for Tanzania (Table 1). Analysis of the losses from these 12 crops found that a total of 1,298.75 acres (521.57 ha) were lost costing TZS 367,147,420 (USD 183,573.7). Under the Tanzanian Wildlife Conservation (Dangerous Animals Damage Consolation) Regulations of 2011, the government should pay about TZS 5,860,000 in consolation for these damaged crop acreages. Maize crops (377.75 acres ≈ 152.87 ha) were the most commonly destroyed costing TZS 101,658,550 (USD 50,829.3). High economic losses were sustained from tomatoes with 22.6 acres lost (9.15 ha) costing TZS 176,004,825 (USD 88,002.4). Cucumbers sustained the least damage from wild animals (0.6 acres ≈ 0.24 ha) with 0.81 tonnes/ha, however the economic loss was not quantified due to lack of information. The area lost over the four years differed significantly across crops ($t_{15} = 2.446$, $p = 0.027$).

Four major costs to the local community associated with wildlife damage were indicated in key informant interviews with local government leaders (Figure 6).

Measures taken to control problem animals and the challenges faced

The work of controlling problem animals was primarily undertaken by game wardens (76.7%) with local community members carrying out the remaining work (23.3%). Game wardens scared (46.5%) and killed (30.2%) the problem animals with guns while local people used traditional methods like noise making when guarding their crops and properties (Figure 7). Mostly, the control of problem animals was carried out during the hours of darkness (evening, night and early morning). According to the key informant interviews, inadequate resources (human, material and financial)

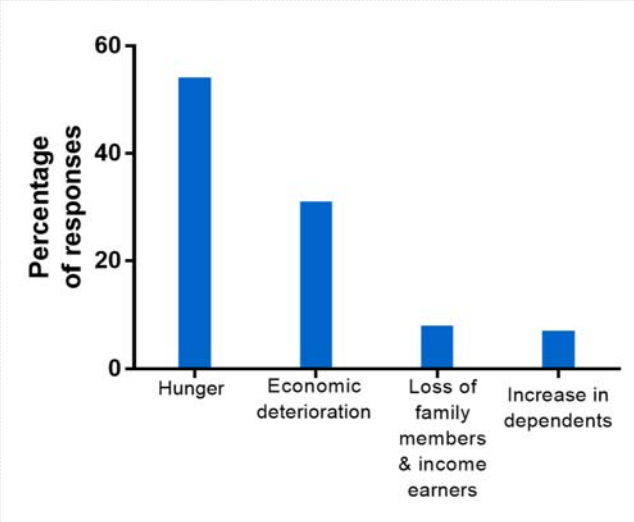

Figure 6. Costs associated with wildlife damage to the local community

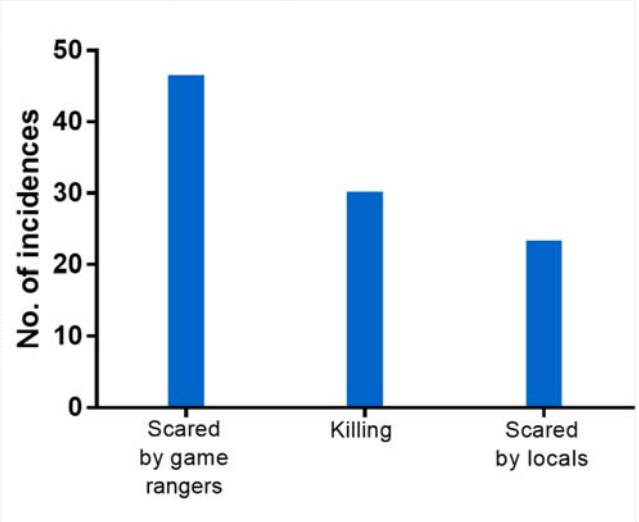

Figure 7. Measures taken to control problem animals by both game rangers and locals

were among the challenges faced by game wardens during the process of controlling problem animals, while political interference with some local leaders making false elephant presence calls, large areas to cover and inadequate collaboration of protected area staff with the nearby villages were other challenges encountered when controlling problem animals (Box 1).

No pro-active conflict prevention techniques such as the use of chili ropes or bricks, beehive fencing, lion lights and other similar techniques were identified during the survey.

Box 1. Challenges encountered by game rangers during control of problem animals

Resource scarcity: insufficient funds, personnel, vehicles, lack of spotlights and barriers to accomplish problem animal control tasks.

Political interference: Local government leaders give false information to game rangers in order to show their voters that they work very hard.

Coverage: APU-Bunda covers three regions (Mara, Shinyanga and Simiyu) with more than 10 districts, therefore this is a large area compared to the resources available of only 24 members of staff with only two field vehicles.

Collaboration: collaboration from the protected area staff is not sufficient because most of the incidences occur near to the protected area boundaries. Game rangers appreciate the collaboration they receive from District Game Officers (DGO) and local communities.

DISCUSSION

Wildlife species responsible for wildlife damage

The high frequency of damage by African elephant might be attributable to increases in both human activities around protected areas and/or increases in the elephant population. For example, the human population in Bunda and Serengeti districts is reported to have increased from 258,930 in 2002 to 335,051 in 2012 and 176,057 in 2002 to 249,420 in 2012 respectively (Brinkhoff, 2017). This increase in human population is linked to increased anthropogenic activities close to protected areas and thus more likelihood of wild animals coming into contact with human beings and their properties. This phenomenon was explained by Estes et al. (2012), who found a conversion rate to agriculture of 1.6% to 2% for land area close to protected areas in western Serengeti. With regard to increased wildlife populations, there are reports of an increase in the number of elephants in the Serengeti ecosystem by 0.78% to 3,680 in the year 2009, the highest population recorded in the past 23 years (TAWIRI, 2010). Reports for 2014 indicate a total of 7,535 elephants in the Serengeti-Mara ecosystem with 6,087 elephants in the southern area (Tanzanian protected areas) (Mduma et al., 2014). This increase in the number of elephants in protected areas might be associated with an increase in frequency of damage in nearby villages. Elephants are known to have a tendency of moving out of protected areas in search of food and water (Malugu et al., 2011).

Similar accounts of elephants as problem animals have been reported in other parts of Tanzania. In villages surrounding Arusha National Park and in Rombo district bordering Kilimanjaro National Park, elephants

were reported as the most destructive wild animal (Kideghesho, 2008). Likewise, in villages adjacent to Selous Game Reserve, African elephant was ranked as the most frequently reported problem animal (Newmark et al., 1994). That Leopard was less commonly reported as responsible for wildlife damage this might be due to their shy behaviour (hence difficult to spot the animal) or factors such as night enclosure of livestock, guardian dogs or other pro-active livestock protection measures. In the Serengeti ecosystem, leopards are difficult to find due to their elusive behaviour (TAWIRI, 2009).

Types of damages caused by wildlife

The high incidences of crop damage relative to other types of damage might be attributable to the proximity of farms to protected area boundaries and increase in human population as most Tanzanians depend on farming for food and income. Crop damage incidences are highly influenced by the distance between farms and the boundaries of protected areas (Newmark et al., 1994; Naughton-Treves, 1998; Holmern et al., 2007; Malugu et al., 2011). People living close to protected areas experience more losses from wildlife with up to 90% of damage from crop raiding (Naughton-Treves, 1998; Kideghesho, 2008). Fewer incidences of livestock killings observed in the area could be the result of the extra protection accorded to livestock. Most livestock are kept in well fenced enclosures and others guard them with local weapons (Mwakatobe et al., 2013).

Temporal pattern of wildlife damages distribution accelerated from March, peaked in May, and started to drop from August with less incidences recorded in October and November. This pattern corresponds to observations that damages correlate with the availability of mature crops which are palatable to wild animals, as advanced by Pittiglio (2010) and Malugu et al. (2011).

Cost of the damages caused by wildlife

Human injuries and deaths from wildlife are not a new issue in Tanzania (Kideghesho, 2008). In this study, human deaths occurred more frequently than human injuries. Human injuries and deaths inflict not only a heavy human and financial cost to families, many losing their main income earner, but also to the community and government through loss of productive workers.
Killing of livestock by wildlife was rarely encountered in the four-year period with only 5 livestock losses reported, principally caused by lion, crocodile and leopard. Most of the livestock attacked were cattle being the predominant livestock species kept by communities surrounding the Serengeti ecosystem.

Maize destroyed b elephants © Alex Kisingo

Maize was the most commonly destroyed crop while high economic loss was sustained from damage to tomatoes. The high monetary loss from tomatoes as compared to other crops was attributed to its higher yields and higher market prices. Sorghum was another frequently destroyed crop. These results correspond to those by Malugu et al. (2011) on types of crops damaged by elephants from 2006 to 2008 in villages surrounding the Ikorongo and Grumeti Game Reserves. According to Kideghesho (2008), maize and sorghum are widely grown and are staple crops for communities in the western Serengeti ecosystem.

The costs borne by the Tanzanian government in paying consolation for human deaths (TZS 24 million), human injuries (TZS 8 million), crop damage (TZS 5,860,000) and livestock (cattle) losses (TZS 250,000) are also worth noting. Even with these payments, the local community complained that the rates for consolation were very low.

Measures taken and challenges in controlling problem animals

Nearly a quarter of the measures taken to control problem animals were carried out by local communities themselves, mostly farmers guarding their farms at night. While scaring was the major method used by game wardens to control problem animals, killing was used when the animal became more dangerous, and was considered a lethal risk to humans.
The game wardens from APU-Bunda, identified a number of challenges in their work. Insufficient resources including lack of personnel and vehicles to cover more than 10 districts over 3 regions was the

Elephants in Serengeti National Park © Marc Hockings

biggest challenge. Lack of equipment such as spotlights was also mentioned as much of the work was carried out in the hours of darkness. Political interference was another challenge encountered by game wardens where some local government leaders called the game wardens even if there was no problem wild animal in their village, in order to show their voters how active they were, but they were not held accountable for wasting resources. Collaboration between protected area staff and other stakeholders is essential in controlling wildlife damages (Curtis et al., 2005). However, it was noted from this study that game wardens from APU-Bunda were hampered by inadequate collaboration with other protected area staff near to the wildlife damage incidences mainly due to inadequate coordination between them.

Human–wildlife conflict management

Currently, APU-Bunda in collaboration with the Grumeti Fund has stationed a human–wildlife conflict mitigation unit at Hunyari village, Bunda district, adjacent to Ikorongo-Grumeti Game Reserves in order to respond quickly to wildlife damage calls. Also, conservation authorities in collaboration with other stakeholders are providing conservation education to the local people living adjacent to protected areas. The education programme focuses on many issues, including the need to avoid cultivation in the proximity of protected area boundaries, the use of bee fences, cultivating unpalatable crops to elephant such as chili around their farms and other mitigation approaches. There have been trials on the use of drones to deter elephants in western Serengeti (Hahn et al., 2017), but, even though they have been effective, the cost of the project is not sustainable as farmers cannot afford to buy them. Furthermore, land use plans are not successfully implemented in the area. Even though the Wildlife Conservation Act prohibits human activities within 500 m of protected area boundaries, this requirement is not enforced and villagers still cultivate

crops within this zone. This also explains some complaints about the lack of compensation for wildlife damage to some communities as the law only allows payment of consolation for crop damage when it occurs at least 500 m from the protected area boundary (United Republic of Tanzania (URT), 2011). Meanwhile, although conservation stakeholders such as TAWA and TANAPA implement benefit sharing projects, more is needed so as to increase the local people's tolerance of wildlife damage. There is no single approach that can be fully effective in mitigating human–wildlife conflicts, and that there is a need to involve multi-stakeholders from conservation, local communities, land use planners, the agricultural sector, policy makers, law enforcement organs and many more to develop and implement holistic solutions to the human–wildlife conflict problem.

CONCLUSION

Wildlife damage in areas surrounding the Serengeti ecosystem is mostly caused by elephants to crops, while lions cause damage to livestock. High costs were sustained from crop damage with many acres lost for maize and sorghum while tomatoes led to higher monetary loss due to their high yields and higher market prices. Insufficient resources, political interference, inadequate collaboration with protected area staff and larger areas to cover by problem animal control staff were identified as drawbacks to problem animal control activities. Pro-active prevention of conflict using night enclosures, lion lights and growing unpalatable crops could also minimise human–wildlife conflicts. To minimise the problem of wildlife damage requires an approach where stakeholders are involved from the planning to execution phases of conservation projects. Furthermore, conservation management authorities such as the Tanzania Wildlife Management Authority, Tanzania National Parks, Ngorongoro Conservation Area Authority and Wildlife Division should improve the availability of resources to game wardens and rangers for efficient control of problem animals. Participatory land use planning and conservation education for the local community are necessary to reduce the proximity of people to protected area boundaries, thus minimising interactions between wildlife and local communities. This should be done in accordance with the Tanzania National Land Use Policy of 1997 which directs local governments to allocate land for farming, livestock grazing, settlements and conservation.

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RESUMEN

Los conflictos hombre-vida silvestre son uno de los mayores desafíos que enfrenta la conservación en Tanzania y en todo el mundo. En este estudio, se examinó el conflicto entre el hombre y la vida silvestre a través de la evaluación de los daños a la vida silvestre en las aldeas que rodean el ecosistema del Serengueti. Los datos se obtuvieron mediante el análisis de informes disponibles en la Unidad de la Zona contra la caza furtiva del Serengueti y entrevistas con informantes clave. Se revisó un total de 110 informes. La mayoría de los daños se debió a la destrucción de cultivos (66 por ciento), mientras que la depredación de ganado provocó menos daños (4 por ciento). Los elefantes (Loxodonta africana) fueron responsables de la mayoría de los daños (57,4 por ciento) que ocurrieron entre 2011 y 2014 con pocos daños (0,8 por ciento) causados por leopardos (Panthera pardus). Los cultivos más frecuentemente destruidos por los animales salvajes fueron el maíz (Zea mays) y el sorgo (Sorghum vulgare) con 153 hectáreas y 116 hectáreas destruidas, respectivamente, durante el período del estudio. La producción de tomates (Lycopersicon esculentum) sufrió cuantiosas pérdidas monetarias potenciales: TZS 176.004.825 (alrededor de USD 88.002), lo cual se atribuyó a sus elevados rendimientos (12,41 toneladas/ha) y a los altos precios de mercado (1550 TZS/kg). Los funcionarios de vida silvestre utilizaron varios métodos para controlar los animales problemáticos, incluyendo la práctica de asustar y matar. La escasez de recursos fue identificada como un problema muy importante para el control de animales problemáticos. Otros problemas fueron la interferencia política y la colaboración insuficiente entre el personal de las agencias de conservación de vida silvestre.

RÉSUMÉ

Le conflit entre l’homme et la faune est l'un des plus grands défis auxquels fait face la conservation en Tanzanie et à travers le monde. Dans cette étude, le conflit homme-faune a été examiné à travers l'évaluation des dommages causés par la faune dans les villages entourant l'écosystème du Serengeti. Les données ont été obtenues grâce à l'analyse des rapports mis à disposition par l'Unité Anti-Braconnage du Serengeti et à des entretiens directs avec des témoins clés. Au total, 110 rapports ont été examinés. La plupart des dommages proviennent de la destruction des récoltes (66%), tandis que les dommages causés par la déprédation du bétail sont moindres (4%). Les éléphants (Loxodonta africana) sont responsables de la plupart des dommages (57,4%) survenus entre 2011 et 2014, avec une part infiniment plus petite (0,8%) causée par les léopards (Panthera pardus). Les récoltes les plus fréquemment détruites par les animaux sauvages sont le maïs (Zea mays) et le sorgho (Sorghum vulgare) avec 153 hectares et 116 hectares détruits respectivement au cours de la période d'étude. Des pertes monétaires considérables sont causées par le pillage des tomates (Lycopersicon esculentum), TZS 176 004 825 (environ 88 002,4 USD), dont la culture est associée à des rendements élevés (12,41 tonnes/ha) et à des prix de marché élevés (1 550 TZS/kg). Les agents de la faune ont utilisé plusieurs méthodes pour contrôler les animaux à problèmes, de l'effarouchement à la mise à mort. Le manque de ressources adéquates reste le défi majeur pour le contrôle des animaux à problèmes. D'autres défis identifiés sont notamment l'ingérence politique et une collaboration insuffisante entre le personnel des agences de conservation de la faune.

HABITS, BEACHES, DOGS AND LEASHES: NON-COMPLIANCE WITH PARK REGULATIONS

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ABSTRACT

Protected areas are important for both conserving natural resources and providing visitor experiences, but these two objectives are sometimes compromised when visitors do not comply with regulations. This issue was explored in a study in Canada's Pacific Rim National Park Reserve where non-compliance with off-leash dog regulations has led to negative impacts on wolves, shorebirds and visitor experiences. The theory of planned behaviour (TPB) was applied to explore factors that influence non-compliance with off-leash dog regulations. This study found moderate to strong relationships between visitor behavioural intentions towards compliance and the three concepts associated with the TPB that may shape intentions: attitude, subjective norms and perceived behavioural control. Weaker relationships were found between these concepts and beliefs thought to influence each concept. The relationship between intentions to comply and actual compliance behaviour was weaker, but these predictions became stronger when past behaviour regarding leashing dogs in the park (habit) was considered. This paper discusses how habitual off-leash dog walking affects TPB's ability to predict future behaviour of dog walkers, and how management strategies aimed at providing persuasive arguments for dog leashing are not likely to be as successful, unless combined with other approaches outlined in the paper.

Keywords: Theory of planned behaviour, actual behaviour, non-compliance with park regulations, habit

INTRODUCTION

Management of visitor behaviour in protected areas is critical for the success of both conservation efforts and the provision of high quality visitor experiences. These can be compromised when visitors choose to not comply with regulations. This study examines the issue of visitors choosing to ignore regulations to leash dogs in a national park (See Figure 1), regulations aimed at reducing conflict with other park visitors and reducing the impact of dogs on wildlife in the park.

Visitor impacts in parks and protected areas are often unintended, but occur from lack of awareness or knowledge of the results of their behaviour (Marion & Reid, 2007). Managing visitor impacts can employ 'direct approaches' that mitigate undesired behaviour (such as enforcement, regulations, zoning and closing areas for certain uses), or 'indirect approaches' aimed at influencing rather than regulating visitor behaviour, through interpretation, visitor education and information programmes (Dawson & Hendee, 2009). Indirect approaches are thought to be cost effective, 'softer' and usually more consistent with leisure experiences than 'harder' direct approaches. However, deciding the most appropriate management response depends in part on an understanding of why visitors decide to comply or not comply with park regulations.

Accordingly, the Theory of Planned Behaviour (TPB) (Fishbein & Ajzen, 2010) was used in this study to gain insight into why visitor compliance with keeping domestic dogs on-leash in a protected area remained low despite considerable educational efforts using signs and other information to encourage compliance. TPB (Figure 2) proposes that behaviour depends on one's intentions to behave in certain ways, which is

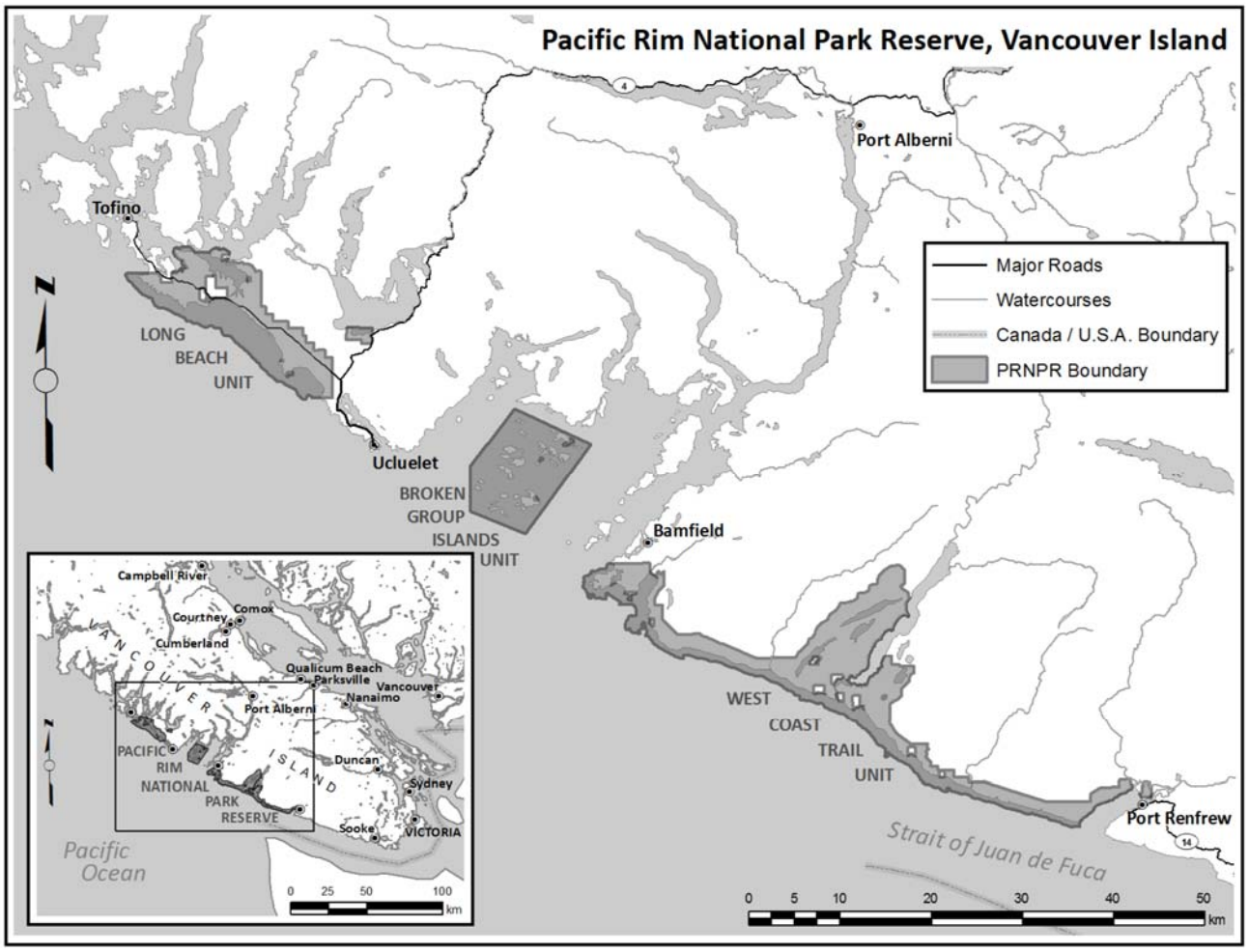

Figure 1. Location of the Long Beach Unit of Pacific Rim National Park Reserve (Parks Canada, 2014)

determined by three main concepts: (a) attitude towards the decision (i.e. how good or bad people feel about complying with the off-leash regulations), (b) subjective norms (i.e. influence of important others on my decisions to comply with regulations), and (c) perceived control over behaviours (e.g. do people have the ability to comply with regulations). Each of these concepts is influenced by relevant beliefs (Fishbein & Ajzen, 2010), as illustrated in Figure 2.

The TPB approach has been applied to national park behaviours including feeding wild birds (Ballantyne & Hughes, 2006; Hughes et al., 2009), staying on designated trails (Beeton et al., 2005; Bradford & McIntyre, 2007), 'bear proofing' and appropriate food storage (Lackey & Ham, 2003) and littering and garbage disposal (Brown et al., 2010). Specific to this article, Hughes et al. (2009) applied the TPB to leashing domesticated dogs. Message interventions targeted behavioural and normative beliefs to persuade park visitors to leash their pets. A 19 per cent increase in leashing was noted, however the presence of researchers may have influenced compliance. In addition, increase in compliance did not lead to influencing beliefs or subsequent attitudes. Non-compliers had strong intentions to let their dogs run free in the park. Furthermore, these non-compliers tended to be repeat visitors, suggesting that allowing dogs to be off-leash was habitual behaviour, thereby challenging the TPB model.

The TPB is premised on rational decision-making where people make behavioural decisions through a consideration of the relevant beliefs (outcomes) of their behaviour. However, a possible weakness of the TPB is related to habitual behaviour that does not routinely involve rational consideration of outcomes. Actions performed many times become habitual, automatic and stimulated by cues in the environment (Aarts & Dijksterhuis, 2000; Ouellette & Wood, 1998). Similarly, wilderness recreationists with more experience have been argued to be less susceptible to persuasive

influences (Krumpe & Davis, 1982; Manfredo & Bright, 1991; Roggenbuck & Berrier, 1982). Consequently, indirect attempts at behaviour modification (e.g. park interpretation, signs) are less likely to succeed where behaviours are habitual and experienced many times over, particularly with off-leash dogs (Hughes et al., 2009). Ajzen (1991), Fishbein and Ajzen (2010) and others (e.g. Ajzen & Fishbein, 2005; Albarracín et al., 2001; Conner & Armitage, 1998; Ouel-lette & Wood, 1998) also acknowledge that TPB can be inadequate to explain the relationship between past behaviour and future behaviour, thereby challenging persuasive attempts to influence actions.

These issues were explored in a study conducted in Pacific Rim National Park Reserve located on the west coast of Vancouver Island in British Columbia, Canada, where non-compliance with regulations to leash dogs has led to conflict with other park visitors. Further, dogs running free on beaches in the park is one of the greatest sources of disturbance and displacement of sensitive habitat for migratory shorebirds (Esrom, 2004; Zharikov, 2011), and habituates wolves to dogs and people causing pets to become easy prey (Parks Canada Agency Human-Carnivore Conflict Specialist, personal communication, 2011, 2012, 2013, 2017). In a recent shorebird and visitor use study in this park, the compliance rate for leashing was just 39 per cent (Zharikov, 2011) despite considerable indirect management efforts with increased use of signs.

The research question investigated in this article is how does habit influence application of the TPB to gain insights into non-compliance behaviour, such as refusal to leash dogs in a national park?

METHODS

The first phase of the study consisted of a belief-elicitation phase involving semi-structured interviews with convenience samples, on Long Beach in Pacific Rim National Park Reserve (see Figure 3), of 21 observed on-leash (i.e. compliers) and 21 off-leash (i.e. non-compliers). Following Middlestadt et al. (1996) and Fishbein and Ajzen (2010), interviews were used to elicit behavioural beliefs, or outcomes of leashing behaviour (e.g. What do you see as advantages to keeping your dog leashed/unleashed here on Long Beach?); normative beliefs or social referents (e.g. Who would approve/object to keeping your dog leashed here on Long Beach?) and control beliefs or factors that either facilitate or mitigate leashing (e.g. What things make it easy/difficult to keep your dog leashed on the beach here on Long Beach?).

Interviews were recorded on an iPhone, transcribed into a Word document and exported into qualitative research software, NVivo for analysis. A content analysis of the responses to the above questions resulted in a list of modal salient behavioural, normative and control beliefs. The concept of 'habit' also emerged as an

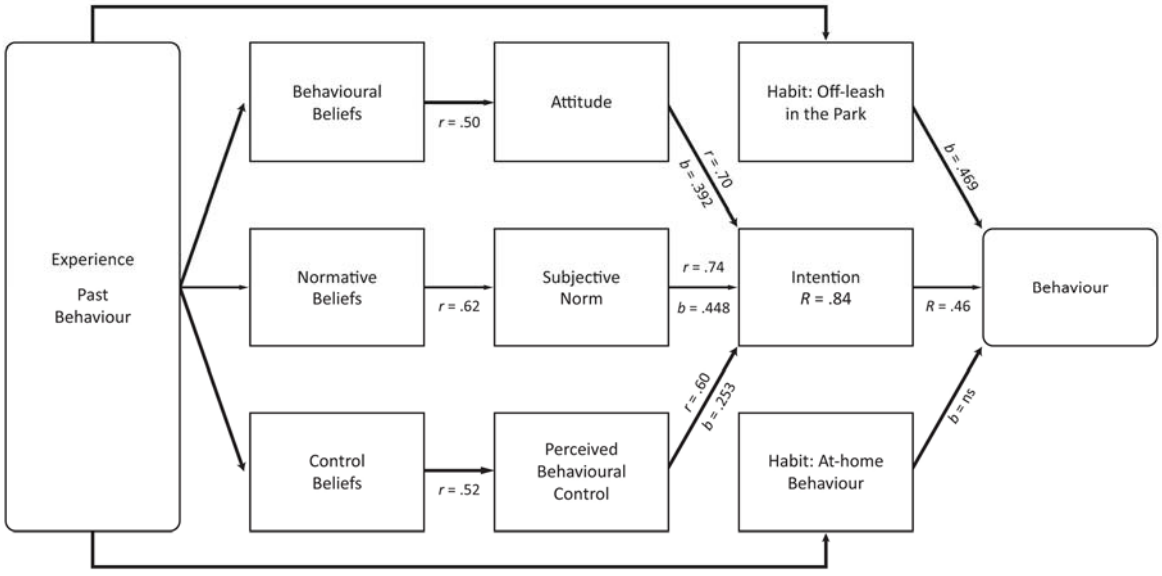

Figure 2. The theory of planned behaviour (adapted from Fishbein & Ajzen, 2010) as applied to dog-leashing in Pacific Rim National Park Reserve.

important insight from this formative research. The list of modal salient beliefs and habit informed the development of a questionnaire used to measure habit and beliefs in addition to standardised TPB measurement of attitudes, subjective norms, perceived behavioural control, intention and behaviour of observed on and off-leash dog walkers.

Measurement of variables

Attitude

Attitude about leashing their dog in the park was measured with a score formed by computing a mean score from responses to three items: (a) "leashing my dog on Long Beach is…" (7-point scale from "bad" to "good"), (b) "walking my dog on a leash on Long Beach is…" (7-point scale from "unpleasant" to "pleasant"), and (c) "using a leash for my dog on Long Beach is…" (7 -point scale from "useless" to "useful").

Subjective norm

Subjective norm about leashing their dog in the park was measured by computing a mean score from responses to three items: (a) "most people walking their dogs here on the beach have them off-leash" (7-point scale from "false" to "true"), (b) "most people like me leash their dog on Long Beach" (7-point scale from "strongly disagree" to "strongly agree"), and (c) "I feel under social pressure to leash my dog at Long Beach" (7-point scale from "strongly disagree" to "strongly agree").

Perceived behavioural control

Perceived behavioural control about leashing their dog in the park was measured by computing a mean score to responses from two items: (a) "whether or not I leash my dog here is entirely up to me" (7-point scale from "strongly disagree" to "strongly agree"), and (b) "to keep my dog on leash is beyond my control" (7-point scale from "strongly disagree" to "strongly agree"). Although

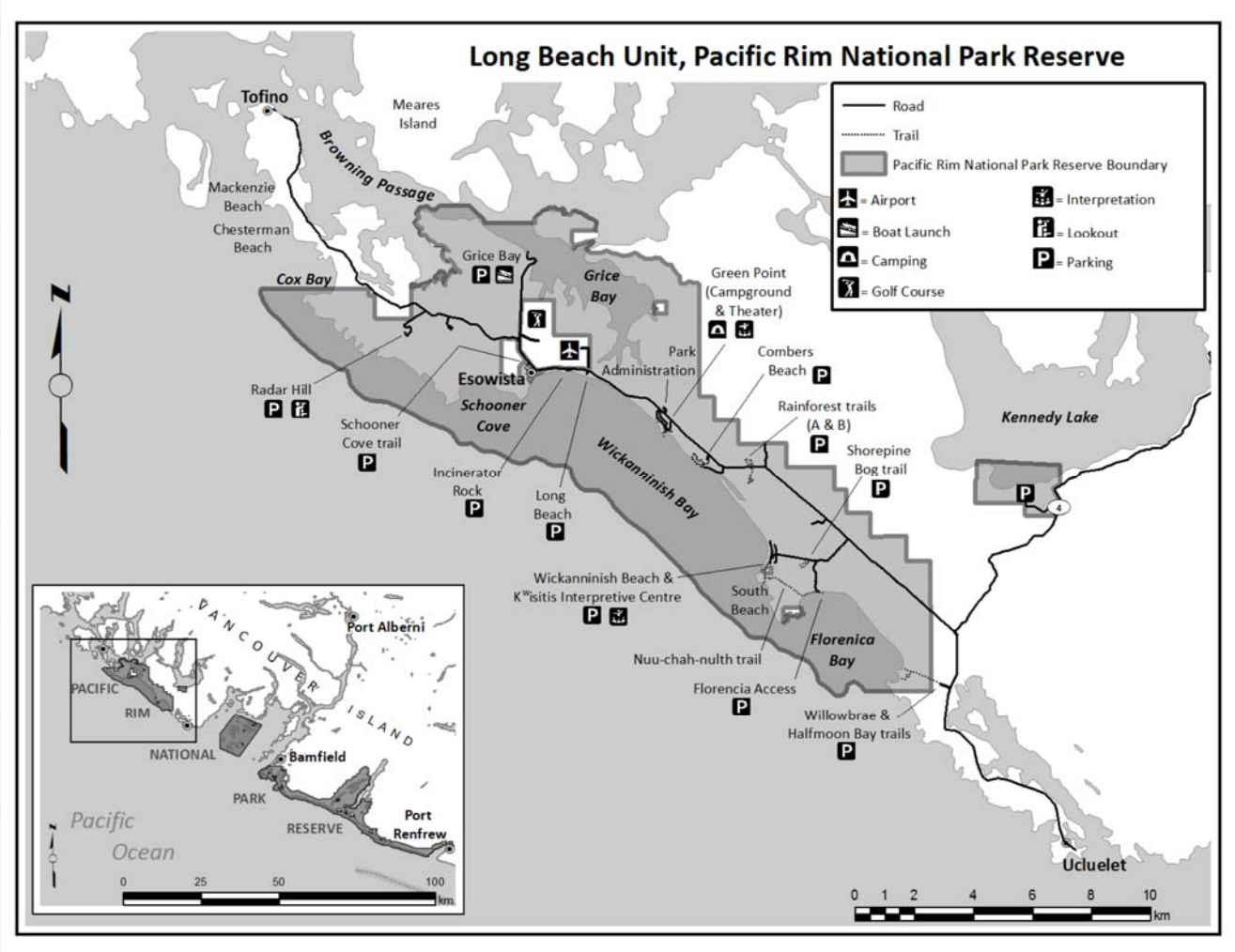

Figure 3. The Long Beach Unit of Pacific Rim National Park Reserve (Parks Canada, 2014).

Long Beach, Pacific Rim National Park Reserve © Matthew Bowes

it seems that leashing should be easy to control, perceived control of this behaviour may vary. There is no current accepted method in TPB to measure actual control, so perceived behavioural control was used as a proxy for actual control (Fishbein & Ajzen, 2010).

Behavioural beliefs

Salient behavioural beliefs were measured in two dimensions: belief strength, determined on a 7-point scale from "very unlikely" to "very likely " (e.g. "If I keep my dog on-leash, my dog will not run through flocks of shorebirds"), and belief evaluation determined on a 7-point scale from "bad" to "good" (for analysis, this was converted to -3 to +3) (e.g. "My dog, not running through flocks of shorebirds is..."). To determine the influence of each belief on attitude, a behavioural belief cross-product score was computed by multiplying the belief strength by the evaluation for each item, and then summing to derive a composite score that was then correlated with attitude.

Normative beliefs

Normative beliefs were also measured in two dimensions: normative belief strength, determined on a 7-point scale from "strongly disagree" to "strongly agree" (for analysis, this was converted to -3 to +3) (e.g. "Park wardens think I should leash my dog."), and motivation to comply, determined on a 7- point scale from "I should not" to "I should" (e.g. "I want to do what park wardens think I should do."). A cross-product was computed for each belief by multiplying the normative belief strength by the motivation to comply. The cross-products for each item were summed to derive a composite score that was correlated with the subjective norm score.

Control beliefs

Control beliefs were also measured in two dimensions: belief strength, determined on a 7-point scale from "less likely" to "more likely" (e.g. "to have the right equipment to leash my dog"), and belief power, measured on a 7-point scale from "strongly disagree" to "strongly agree" (e.g. "that having the right equipment makes it easier to leash my dog"). The cross-products for each control belief were summed to derive a composite score that was correlated with the subjective norm score.

Habit

Habitual behaviour in this park was measured with two items: compliance behaviour in the park and compliance behaviour at home (Aarts & Dijksterhuis, 2000; Ouellette & Wood, 1998). At home compliance was measured on a 7-point scale from "strongly disagree" to "strongly agree" that "when at home I always comply with on-leash dog laws". Compliance in the park was measure on a 5-point scale from "0 per cent" to "100 per cent" "of the time when I am in the park".

Compliance behaviour

Compliance behaviour was categorised by selecting sample respondents according to their observed

behaviour when the questionnaires were administered as either compliers or non-compliers (Bowes, 2015).

An initial fixed-item questionnaire was pilot tested (n = 20) with a sample of compliers (n = 10) and non-compliers (n = 10) on Long Beach (see Figure 3) in June 2013 to discover any problems with wording and formatting. After each completed survey, every other complier or non-complier was selected. Following refinement of the instrument, the main study was then conducted with 162 compliers and 142 non-compliers on Long Beach between 1 July and 30 September 2013. After each completed survey, every other complier or non-complier was selected after they were first observed unobtrusively in the park. Interviews were not conducted on rainy days, when the number of visitors on park beaches was low. The intent of this approach was to approximate systematic random sampling, and avoid bias in sample selection. Out of the total number of visitors contacted (n = 322), the response rate was 94 per cent (n = 302).

RESULTS

Characteristics of the sample were as follows. For age, 1 per cent were under 21 years old, 26 per cent were 21-30 years old, 25 per cent were 31-40 years old, 27 per cent were 41-50 years old, and 22 per cent were over 50 years old. The sample consisted of 61 per cent men, 35 per cent women, and 4 per cent identifying as other. Most respondents were repeat visitors to this park (86 per cent) with few first time visitors (14 per cent). Place of residence consisted of 48 per cent from Vancouver Island, 46 per cent from elsewhere in British Columbia, 5 per cent from elsewhere in Canada, and 1 per cent from other countries.

Compliers leashed their pets both at home and in the park to a greater degree than non-compliers, although the standard deviation for each group indicates some variability in compliance (Table 1). The effect sizes were 'substantial' (Vaske, 2008) for compliance in the park (h = 0.41) and at-home (h = 0.37).

Dogs on leash sign © Matthew Bowes

Testing the TPB Model

Reliability of the questionnaire was tested with Cronbach's Alpha for intention: (.819), attitude (.864), subjective norm (.612) and perceived behavioural control (.493). The low alpha score for control reflects in part the use of just two items.

Relationships predicted by the TPB are illustrated in Figure 2. As predicted by the TPB model, linear regression indicates that intentions were influenced by attitudes (r = .70, beta = .392), subjective norms (r = .74, beta = .448) and perceived behavioural control (r = .60, beta = .253). The effect size of each of these relationships was substantial (over .50) (Vaske, 2008).

Table 1. Comparing Observed Compliance and Self-Reported Compliance at Home and in Park

Compliance	Observed Complier		Observed Non-Complier				
	Mean	*SD*	*Mean*	*SD*	*t*	*p*	*Eta*
At Park (1-5 Scale)	4.0	1.01	2.0	1.12	13.64	< .001	.41
At Home (1-7 Scale)	4.6	2.19	3.0	2.02	6.64	< .001	.37

At Park - 1=never, 2=~25 %, 3=~50 %, 4=~75 %, 5=always
At Home - 1=Strongly Disagree, 2=Somewhat Disagree, 3=Slightly Disagree, 4=Neutral, 5=Slightly Agree, 6=Somewhat Agree, 7=Strongly Agree

When these relationships were analysed with multiple regression, the multiple r was also substantial (r = .84) (Vaske, 2008). However, the correlation between intention and observed leashing behaviour was lower (r = .46) and 'typical' (Vaske, 2008).

Next, the influence of habit was examined through a multiple regression model with the dependent variable as observed leashing behaviour, and the independent variables as intention, habit at home, and habit in the park. The result was improved prediction of behaviour (r = .582) from the original model in Figure 2 (r = .470). Further, habit in the park was significant (beta = .469, p = .000), as was intention (beta = .206, p = .000), but habit at home was not significant.

Finally, the impacts of beliefs on attitudes, subjective norms and perceived behavioural control were computed using linear regression, as specified in the TPB literature (Fishbein & Ajzen, 2010). The relationship between attitude and behavioural beliefs was relatively strong (r = .50), as was the relationship between perceived behavioural control and control beliefs (r = .62) and the relationship between subjective norms and normative beliefs (r = .52). Each of these relationships was .50 or greater (i.e. 'substantial', Vaske, 2008).

Analysis of beliefs

Analysis was undertaken to explore how compliers and non-compliers differed regarding behavioural beliefs,

Warning sign, Pacific Rim National Park Reserve © Matthew Bowes

Dogs on-leash and off-leash on Long Beach, Pacific Rim National Park Reserve © Matthew Bowes

normative beliefs and control beliefs, comparing the mean cross-product scores in each case. Compliers and non-compliers viewed just four of the nine behavioural belief items differently, and scores for compliers were more positive than for non-compliers for these items (Table 2). The effect sizes were generally minimal (Vaske, 2008), with the exception of slightly stronger ('typical') effect sizes for items dealing with the animal's freedom and the degree of control a leash affords.

Normative belief comparisons between compliers and non-compliers were statistically significant in all cases (Table 3). These scores were generally positive and higher among compliers and the greatest differences occurred for friends, families with small children, elderly people and family. Effect sizes were generally typical to minimal (Vaske, 2008).

Control beliefs were significantly different and more positive for compliers (Table 4). The greatest differences were evident with dogs well trained to be on -leash and having the right equipment. Effect sizes, however, were minimal (Vaske, 2008).

In summary, the TPB model demonstrated strong relationships between intentions and the three concepts that TPB posits to influence intentions: attitude, subjective norm and perceived behavioural control, with an overall robust predictive ability of intention. However, the relationship between intention and behaviour was somewhat weaker, but stronger when habit was included in the analysis. When comparing compliers with non-compliers, substantial differences in beliefs were expected, but this was not the case, particularly with behavioural beliefs thought to influence attitude. This finding indicates that respondents are unlikely to be influenced by management messages aimed at influencing beliefs and attitudes, which is possibly linked to the strong influence of previous leashing behaviour in the park, as outlined in the following discussion.

DISCUSSION

When visitors fail to comply with park regulations, such as leashing their dogs, management objectives aimed at supporting visitor experiences and conserving biodiversity may be compromised. In this study, the TPB was useful in providing a better understanding of non-compliance behaviour. The model demonstrated strong relations between intention and measures of attitude, subjective norm and perceived behavioural control, with an overall robust predictive ability of intention. However, relationships at the belief level were not as strong between behavioural beliefs and attitude, normative beliefs and subjective norm, and control beliefs and perceived behavioural control.

A plausible explanation for these findings is that habitual behaviour (86 per cent of participants were repeat visitors), which is resilient to persuasive influence, may be overwhelming the other influences that are included in the model. A routine behaviour that becomes 'habit' reduces reasoning in the decision-

Table 2. Behavioural Beliefs Regarding Dog Leash Regulations: Comparing Mean Cross-Product Scores for Compliers and Non-Compliers

Behavioural Beliefs	*Mean				
If I keep my dog on-leash…	Complier	Non-Complier	*t*	*p*	*Eta*
My dog will be safer from wolves.	10.30	8.29	2.07	.038	.13
It will be safer for other people.	8.70	6.70	2.36	.019	.14
My dog loses the freedom to run, play, explore, sniff around and 'just be a dog.'	-7.14	-13.13	5.31	<.001	.30
I have more control over my dog.	13.20	8.63	4.70	<.001	.26
My dog will attract wolves to me.	-4.80	-4.80	-0.04	.969	.02
My dog will bother other people.	-4.32	-4.40	0.14	-.887	.03
My dog will run through flocks of shorebirds	-3.76	3.45	-0.52	.604	.04
My dog will behave aggressively towards other dogs.	-5.60	-5.30	-.048	.633	.04
My dog pulls me around and it is hard to keep up to it.	-4.90	-5.90	1.41	.160	.10

*Cross-product mean for each behavioural belief can vary between -21 and +21

Table 3. Normative Beliefs Regarding Dog Leash Regulations: Comparing Mean Cross Product Scores for Compliers and Non -Compliers

*Mean					
Normative Beliefs of Important Social Referents	Compliers	Non-Compliers	*t*	*p*	*Eta*
People who don't like dogs	11.70	7.91	4.62	.001	.26
People afraid of dogs	13.32	9.44	5.08	.001	.29
Families with small children	10.54	4.48	6.37	<.001	.35
Elderly people	8.50	2.67	6.20	<.001	.35
Other cultures	6.56	3.93	3.10	.002	.19
Wildlife conservationists	9.53	5.43	5.00	<.001	.28
Wardens	13.67	9.05	5.46	<.001	.31
Tourists	5.31	1.48	4.67	<.001	.27
Dog freedom people	-6.35	-9.45	3.20	.002	.19
People with well trained dog	11.34	9.74	5.00	<.001	.28
Local residents	7.91	-3.52	4.25	<.001	.24
My family	2.12	-7.11	7.09	<.001	.38
My friends	1.20	-6.64	6.80	<.001	.37

Table 4. Control Beliefs Regarding Dog Leash Regulations: Comparing Mean Cross Product Scores for Compliers and Non-Compliers

*Mean					
Control Beliefs	Compliers	Non-Compliers	t	p	Eta
Not enough education makes it difficult	-2.22	-4.35	2.20	.029	.02
Dog trained well to be on leash makes it easy	11.80	2.60	7.50	<.001	.16
Breed of dog makes it difficult	4.35	-3.73	5.20	<.001	.10
The right equipment makes it easy	8.65	1.93	5.00	<.001	.08

*Cross-product mean for each behavioural belief can vary between -21 and +21

Beach scene, Pacific Rim National Park Reserve© Matthew Bowes

making process (Aarts & Dijksterhuis, 2000; Ouellette & Wood, 1998), thereby challenges attempts at persuasive communication aimed at influencing visitor behaviour.

Hughes et al. (2009) found similar inconsistencies with park leashing behaviour. Although owners tended to leash pets in the presence of the research team and the 'authority' of the message in an intervention, dogs would later be set free once away from these sources of compliance behaviour. Furthermore, Zharikov (2011) observed dog walkers letting pets off-leash in the park once they were away from beach access points, where encounters with park officials were more likely and where 'dogs on-leash' signs were located.

Management implications

The TPB is an effective approach for better understanding non-compliance with park regulations and how to reduce non-compliance. TPB identifies the beliefs that influence attitudes, subjective norms and perceived constraints. With this knowledge, park managers can target messages that challenge these beliefs, and ultimately improve compliance behaviour. For example, messages aimed at informing visitors of the impact of off-leash dogs on wildlife and on visitor safety will likely be effective in reducing non-compliance with many visitors (Dawson & Hendee, 2009). However, this approach is less likely to be effective with frequent visitors who have a history of keeping their dog off leash. For these experienced, repeat non-compliers with whom letting dogs run free is habitual behaviour, more complex strategies may be required (Roggenbuck, 1992; Hughes et al., 2009).

For these more experienced visitors, direct methods such as increased patrolling, actively enforcing regulations and closing sensitive areas may be required, but are more likely to be effective if combined with persuasive communication (Hughes et al., 2009; Roggenbuck, 1992) and other approaches (Mackenzie-Mohr, 2011; Coghlan & Kim, 2012; Weiler & Smith, 2009). One promising approach is community-based social marketing (Mackenzie-Mohr, 2011).

Similar to community-based social marketing, which emphasises personal contact in creating effective behaviour change strategies, the effectiveness of personal contact is well established in the parks and interpretation literature (e.g. Hughes & Morrison-Saunders, 2005; Roggenbuck, 1992; Roggenbuck & Berrier, 1982). Community-based social marketing to foster sustainable behaviour draws on similar notions, which suggest that initiatives carried out at the community level and that incorporate personal contact have a higher likelihood of being more effective (Mackenzie-Mohr, 2011).

In national parks, relationships forged by community outreach can be fundamental to successful programmes aimed at influencing visitor behaviour (Knapp & Benton, 2004). Although much social capital exists in communities adjacent to the park, some parks suffer from a lack of integration with these gateway communities to foster environmental stewardship among local residents (Vaugois et al., 2007). Similarly, gateway communities can be partners in promoting park values and conveying conservation messages to park visitors (Knapp & Benton, 2004).

Another major barrier to compliance behaviour is convenience (Mackenzie-Mohr, 2011). Providing an alternative area in the park or in close proximity, where dogs can be set free and where habitual behaviour can be continued, may make it easier for visitors and their dogs to comply with park regulations.

These approaches argue for more sophisticated approaches for addressing entrenched visitor behaviours, such as keeping dogs off leash. Educational strategies derived from TPB may be effective for many visitors, particularly new visitors to a park, but these approaches are less likely to be effective with frequent visitors who have a history of keeping their dog off leash. For these visitors, direct approaches such as more frequent patrolling may be more effective. However, two additional approaches are suggested here for exploration: (1) community-based social marketing; and (2) addressing visitor needs by providing an off-leash area in the park or nearby.

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RESUMEN

Las áreas protegidas son importantes tanto para la conservación de los recursos naturales como para brindar experiencias a los visitantes, pero estos dos objetivos a veces se ven comprometidos cuando los visitantes no cumplen con las normas. Esto fue examinado en un estudio realizado en la Reserva del Parque Nacional de la Cuenca del Pacífico de Canadá, donde el incumplimiento de la normativa para perros sin correa ha tenido un impacto negativo en los lobos, las aves playeras y las experiencias de los visitantes. Se aplicó la teoría del comportamiento planificado (TPB, por sus siglas en inglés) para estudiar los factores que influyen en el incumplimiento de las normativas sobre perros sin correa. Este estudio encontró relaciones de moderadas a fuertes entre las intenciones de comportamiento de los visitantes hacia el cumplimiento y los tres conceptos asociados con la TPB que pueden definir las intenciones: actitud, normas subjetivas y control percibido del comportamiento. Se encontraron relaciones más débiles entre estos conceptos y las nociones que se cree influyen en cada concepto. La relación entre las intenciones de cumplir y el cumplimiento real fue más débil, pero estas predicciones cobraron fuerza cuando se consideró el comportamiento anterior en relación con los perros con correa en el parque (hábito). El presente artículo examina cómo el caminar habitual sin correa afecta la capacidad de la TPB para predecir el comportamiento futuro de los paseadores de perros, y cómo las estrategias de gestión dirigidas a proporcionar argumentos convincentes para atar con correa a los perros tienen poca probabilidad de éxito, a menos que se combinen con otros enfoques descritos en el documento.

RÉSUMÉ

Les aires protégées sont importantes à la fois pour la conservation des ressources naturelles et pour l'expérience offerte aux visiteurs, mais ces deux objectifs sont parfois compromis lorsque les visiteurs ne se conforment pas aux réglementations. Ce problème a été examiné lors d'une étude menée dans la Réserve du parc national Pacific Rim au Canada, où la non-conformité aux règlements sur la circulation des chiens sans laisse a eu des répercussions négatives sur les loups et les oiseaux de rivage, ainsi que sur l'expérience des visiteurs. La Théorie du Comportement Planifié (TCP) a été appliquée pour explorer les facteurs qui influencent le non-respect des règlements concernant les chiens. Cette étude a révélé un rapport modéré à fort entre les intentions comportementales des visiteurs vis-à-vis de la conformité aux règlements et les trois concepts associés au TCP (l'attitude, les normes subjectives et le contrôle comportemental perçu) qui peuvent façonner leurs intentions. Une relation plus faible a été constatée entre ces concepts et les croyances susceptibles d'influencer chaque concept. Le rapport entre l'intention de se conformer et le comportement d'acquiescement réel était faible. Mais ces prédictions sont devenues plus fortes lorsque l'on a tenu compte des comportements passés (les habitudes) concernant la tenue en laisse des chiens. Cet article examine comment l'habitude de circuler avec un chien sans laisse peut influencer la capacité du TCP à prédire le comportement futur du promeneur de chien dans le parc, et comment les stratégies de gestion visant à fournir des arguments convaincants en faveur de la tenue en laisse ne sont susceptibles de réussir que si elles sont associées à d'autres approches décrites dans le document.

BOOK REVIEWS

The Future has Other Plans: Planning Holistically to Conserve Natural and Cultural Heritage by Jonathan M. Kohl and Stephen F. McCool, (2016), Golden, CO, Fulcrum Publishing, 314 pp., $44.95 (paperback), ISBN 9781682750001. Reviewed by Karen Vella.

Creating Wilderness. A Transnational History of the Swiss National Park by Patrick Kupper (2014) New York: Berghahn Books., 276 pp., $95.00 ISBN 9781782383741. Reviewed by Maja Vasilijević.

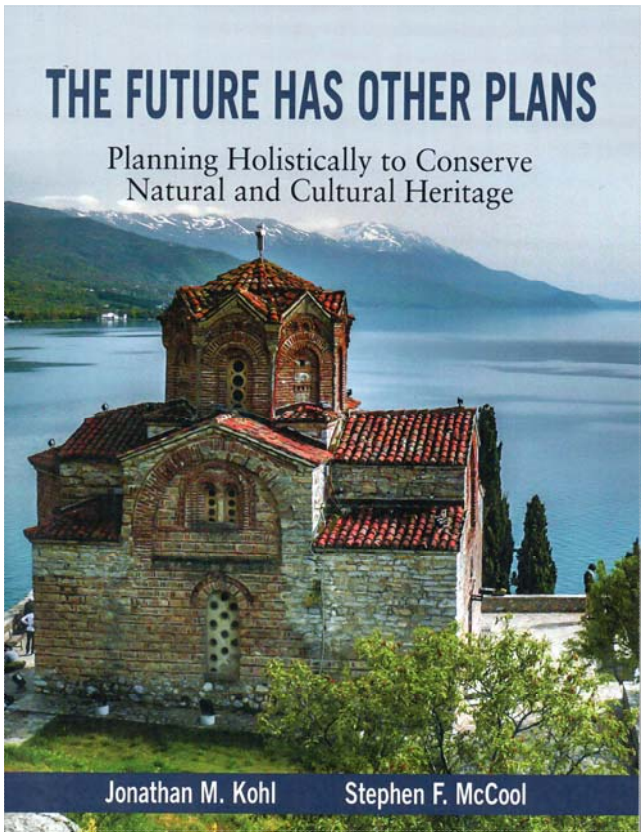
National Park Science: A century of research in South Africa by Jane Carruthers, (2017) , UK, Cambridge University Press, 512 pp., $70.07 (hardcover) , ISBN 9781108123471. Reviewed by Marc Hockings

THE FUTURE HAS OTHER PLANS: PLANNING HOLISTICALLY TO CONSERVE NATURAL AND CULTURAL HERITAGE BY JONATHAN M. KOHL AND STEPHEN F. MCCOOL

The challenges involved in plan implementation will be familiar to those involved in protected area planning and management. In 'The Future has Other Plans: Planning Holistically to Conserve Natural and Cultural Heritage', Jonathan M. Kohl and Stephen F. McCool provide a new framework for transforming the paradigm of heritage management to address plan implementation problems.

Kohl and McCool are two very experienced and well-respected voices in protected area management. Kohl brings extensive field experience in planning and heritage interpretation and McCool adds experience as a practitioner and scholar in planning and management, public involvement, and protected area governance. Kohl and McCool have fostered strong relationships, both with each other, and with UNESCO through the establishment of the Public Use Planning Program. Their book, 'The Future has Other Plans' is an integrated text combining theory and practice for protected area management, which seeks to reframe education and practice for heritage planning and management and stem the tide of non-implementation.

The book aims to provide readers with an opportunity to explore the reasons for plan failure in protected area management and a framework for successful planning and implementation. As Kohl and McCool argue, plan failure is tied to rational comprehensive planning, which underpins the majority of protected area management to this day. The authors use examples from their vast experience to highlight how this approach creates barriers to plan implementation. They



highlight that rational comprehensive plans fail to acknowledge the dynamic, complex and ever-changing nature of 'wicked' protected area management problems. They then draw on their experience to demonstrate how psychological, cultural, and institutional conditions are of fundamental importance for protected area management, and propose 'holistic planning', a "facilitated, continuous dialogue with heritage area constituencies designed eventually to construct a consensus about a desired evolving future" (p. 244), as a way forward.

The main text is divided into two parts. Part One, titled 'The Conventional Planning Story is Poorly Adapted to a Changing World', contains four chapters. Chapter One provides an overview of conventional site planning and begins to develop the argument for a fundamental shift in the paradigm for protected area management. Chapter Two continues by critiquing the underlying assumptions and failings of the rational comprehensive model and its dominance in planning. Chapter Three explores the characteristics of wicked problems that pose challenges for protected area planning, while Chapter Four outlines integral theory as a framework to understand reality. The authors draw on the work of Brown (2007) and outline four quadrants of the integral framework, namely: psychology, behaviour, culture and systems that can affect planning outcomes.

Part Two is titled 'Holistic Planning Responds to the Challenges of a Changing World'. In Part Two, Kohl and McCool apply integral theory to protected area management and planning outcomes. In Chapters Five to Eight, they synthesise theory and their experience and identify planning barriers in each quadrant, while also providing examples of planning strategies and techniques to improve implementation in each quadrant. The final chapter, Chapter Nine, lays out a framework for holistic planning. Here, Kohl and McCool advocate for participatory processes to integrate knowledge, build consensus, create relationships, develop teams, address relations of power and design plans to manage technical problems and build social capital. They emphasise a framework of continuous planning and implementation and a continuous learning culture.

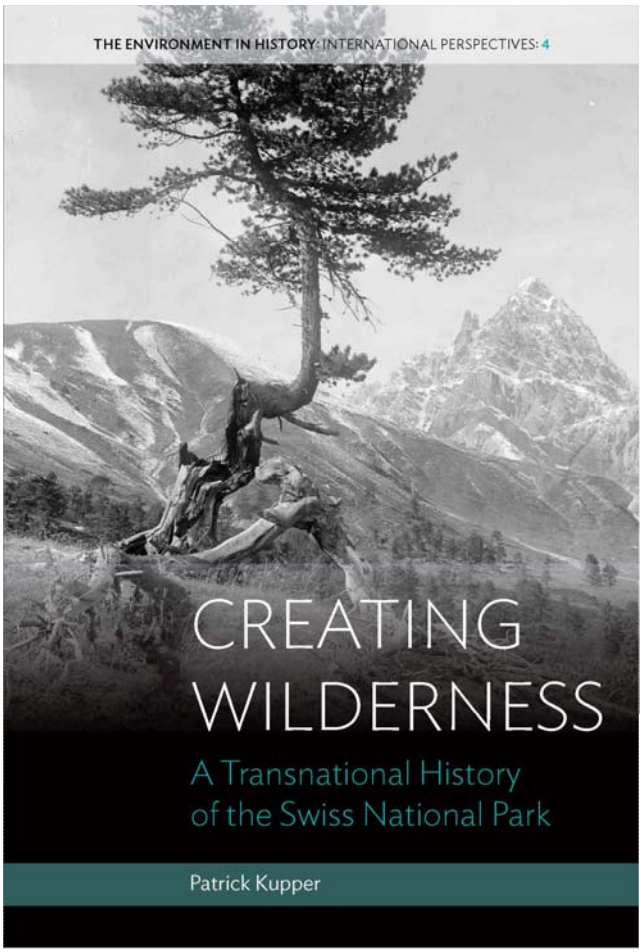
This book will be of interest to practitioners and students who aim to improve planning and implementation. It is targeted toward heritage managers of national parks, wilderness areas, biosphere reserves, historic monuments and battlefields, heritage cities, and ancient rock art sites. However, the ideas developed in the book ensure that it would be equally useful for planners and landscape managers and others working across urban and regional settings. Positive features for use at Masters and graduate level include references for further reading, explanatory dialogues and the extensive use of examples. The narrative is easy to read and provides practical strategies. Perhaps the only downside is that the headings and sub-headings lack some clarity until after a passage has been read.

Overall, I found this book to be a useful resource for planning education and reflection by protected area practitioners. It offers a deep exploration of why it is important to construct planning processes that are more responsive to the factors affecting plan quality, and it integrates stories and lessons from management practice with a thoughtful analysis of planning and management theory. The result is a rich narrative that argues for a fundamental shift in the paradigm for protected area management and offers new theories and practical strategies to assist planners to achieve this shift.

Karen Vella, School of Civil Engineering and Built Environment, Queensland University of Technology

CREATING WILDERNESS. A TRANSNATIONAL HISTORY OF THE SWISS NATIONAL PARK BY PATRICK KUPPER

The Swiss National Park, established in 1914, was the first national park in Europe, and is still the only national park in Switzerland, located in the Lower Engadine. Patrick Kupper's book documents the historical development of the Swiss National Park by providing an in-depth overview of the establishment



process and evolution of the park since its designation. At the same time, this book positions the park in a wider international context, comparing it and distinguishing it from the U.S. national park idea. While the U.S. Yellowstone Park embodied the alliance between state-supported conservation and public recreation, the national park in Switzerland was oriented towards a stricter protection regime with scientific research being its core purpose.

The author reviews the origin of national parks at a global scale, positioning Yellowstone at the forefront of officially designated conservation areas, critically examining the position of Indigenous Peoples and the diminishing of previous forms of nature protection. He emphasises the purpose of the Swiss National Park which was to protect all animals and plants from human influence; a goal that, as history will show, was not entirely feasible.

The book describes how the Swiss National Park was perceived by international bodies, primarily by IUCN (the then International Union for the Protection of Nature), and leads us through the designation process of the park where local institutions occupied a major role. Although strongly supported by local institutions, this did not lead to higher acceptance of the park by local people who viewed the park as a foreign body and culturally as belonging to the German-speaking people rather than the Romansh, at least until the 1990s when locals started becoming employees of the park. The complex and often difficult relations between the park administration and local communities are discussed, to providing interesting insights into the problems of the establishment of national parks at international scale related to the position and access rights of local people and Indigenous Peoples.

Kupper follows the evolution of the Swiss National Park from the concept of 'total protection' to 'process protection'. Although 'total protection' became the park's trademark, human interventions occurred throughout the years, such as the reintroduction of ibex and bearded vulture, the use of artificial salt licks, and the elimination of foxes, showing that total protection without human interference was not feasible. This is further exemplified by interventions in deer management (massive elimination a number of times) and the impact of the hydropower plant erected on the Spöl River.

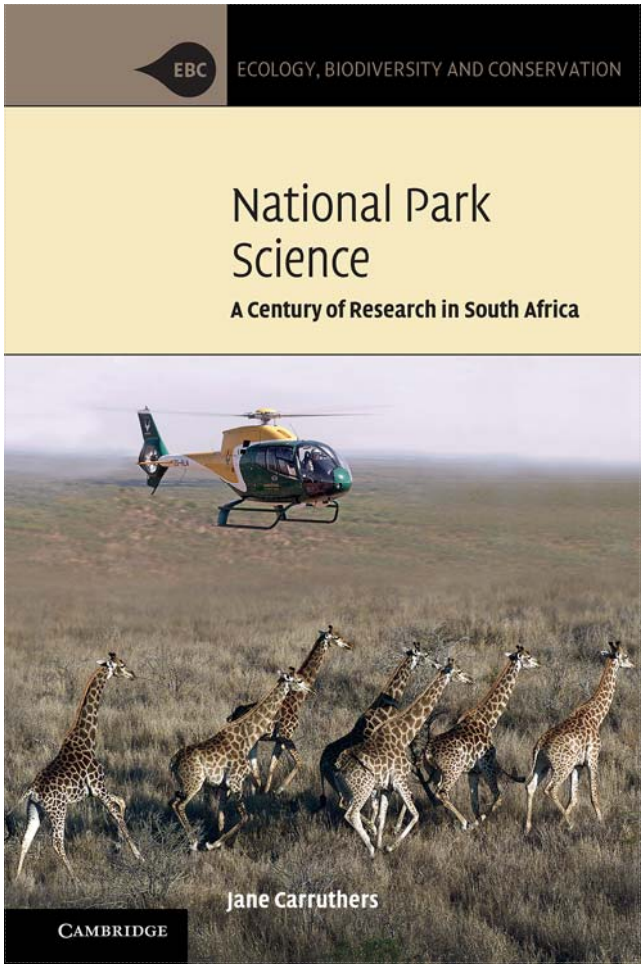
The author explains the conditions affecting research in the Swiss National Park that was widely recognised as a 'scientific national park'. The resurgence of scientific research only occurred in recent years, aided by some of the key factors that enabled quality field research: long-term monitoring, expansion of GIS, strengthened interaction between park research and management, and better facilities. Kupper charts the park's shifting position related to the (in)active management of the rising number of visitors and deer population, and conflicts connected to land use, throughout the park's history. It is evident from this comprehensive and detailed historical overview that the initial idea of eliminating human interference was an illusion and, indeed, that it was through human intervention that wilderness was created.

Maja Vasilijević, IUCN WCPA, Croatia

NATIONAL PARK SCIENCE: A CENTURY OF RESEARCH IN SOUTH AFRICA BY JANE CARRUTHERS

The first book reviews in PARKS were published in Issue 23.2 in November last year. Of the four books reviewed in that issue, three were essentially conservation histories although none of the books reviewed were written by an historian, perhaps because professional historians focussing on conservation are relatively rare. The author of the book reviewed here, Emeritus Professor Jane Carruthers, is a notable and prominent exception, best known for her seminal book, *The Kruger National Park: A Social and Political History* published in 1995. In her most recent book, *National Park Science: A century of research in South Africa*, she has added to her impressive record of environmental history with a detailed scholarly analysis of the development of scientific study and the application of science to management within the national park and conservation sector in South Africa. She traces the development of science in national parks, examining both how science has contributed to the development and management of national parks and how work in the national parks has helped the development of conservation science. The book develops its analysis both chronologically and thematically, linking dominant paradigms and approaches to science in the parks to development of the park system set within a broader political and social context which shaped both the park system and the science.

Carruthers chronicles the development of the natural sciences in South Africa in the early parts of the 20th Century based around Museums, Botanical Gardens and the emerging university sector. Academic botany was particularly strong in South Africa at the time and well



linked into the broader international scientific community. The emerging science of ecology both influenced and was influenced by work in South Africa.

During the period labelled by Carruthers as Measuring, Monitoring and Manipulating 1960s to 1990s, many leading biological scientists in South Africa remained well connected into the broader scientific community, despite the international isolation of South Africa resulting from the apartheid regime. Names such as Brian Huntley and Brian Walker will be well known by conservation biologists around the world although connections between their research conducted through institutions such as the Council for Scientific and Industrial Research and the National Parks Board and the National Programme for Ecological Research was not as strong as it could have been.

The transformation of the National Parks Board (soon to be re-badged as SANParks), under G.R. (Robbie) Robinson, re-structured research within the organisation. This heralded a new direction and approach to the application of science to management of the parks, including the establishment of a social ecology unit. SANParks has retained a strong science capability when many other park agencies around the world have reduced their internal scientific programmes. The impact of this internal science capacity shows in the way science is integrated into management. The innovative work of SANParks scientists and their collaborators in developing strategic adaptive management is well known to the global protected area community. This work and the contributions of Richard Bell, Kevin Rogers and Harry Biggs are well documented by Carruthers in Part III of the book, Integration, Innovation and Internationalisation, 1990-2010.

This book is more than a just a chronological history of science in the national park system in South Africa. It examines how science and management are set within the broader political and social context. The importance of the interaction between science and management is evident, as the recent transformations in the management and application of science within SANParks documented in the book make clear.

Connecting research and management is one of the aims of this journal and we aim to speak to both audiences. Both scientists and managers can learn much from this book.

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