



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.

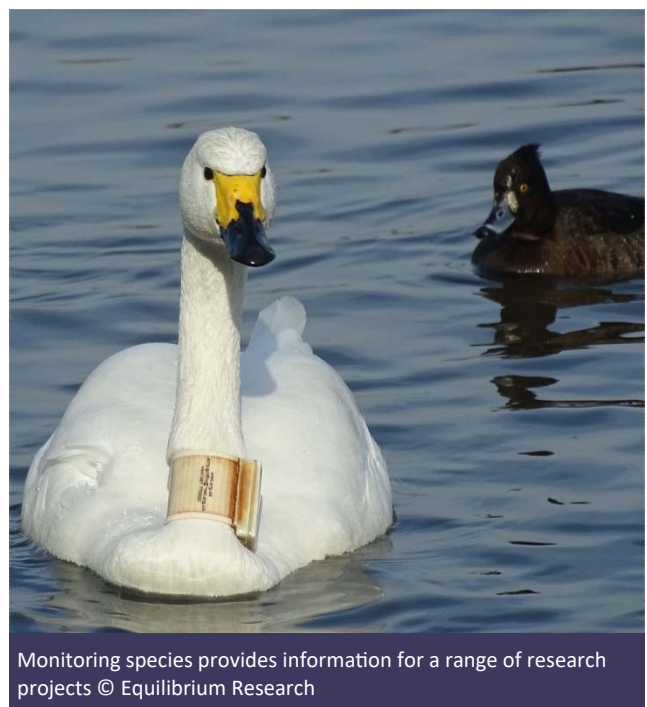
Individual responses:

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.



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.

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.



Tiger researcher in Sikhote-Alin Nature Reserve, Russia
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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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REFERENCES

- Borrini-Feyerabend, G., Dudley, N., Jaeger, T., Lassen, B., Pathak Broome, N., Phillips, A. and Sandwith, T. (2013). *Governance of Protected Areas: From understanding to action*. Best Practice Protected Area Guidelines Series No. 20. IUCN, Gland, Switzerland.
- Cook, C.N. and Hockings, M. (2011). Opportunities for improving the rigor of management effectiveness evaluations in protected areas. *Conservation Letters* 4: 372–382. DOI: 10.1111/j.1755-263X.2011.00189.x
- Cook, C.N., Valkan, R.S., Mascia, M.B. and McGeoch, M.A. (2017). Quantifying the extent of protected-area downgrading, downsizing and degazettement in Australia. *Conservation Biology* 31 (5): 1039-1052. Doi: 10.1111/cobi.1290
- Given, L. M. (2008). *The SAGE encyclopedia of qualitative research methods*. Thousand Oaks, CA: SAGE Publications Ltd Doi: 10.4135/9781412963909
- Greggor, A. L., Berger-Tal, O., Blumstein, D. T., Angeloni, L., Bessa-Gomes, C., Blackwell, B. F., St Clair, C. C., Crooks, K., de Silva, S., ... Sutherland, W. J. (2016). Research Priorities from Animal Behaviour for Maximising Conservation Progress. *Trends in Ecology & Evolution* 31(12): 953-964 Doi.org/10.1016/j.tree.2016.09.001
- Gross, J.E., Woodley, S., Welling, L.A. and Watson, J.E.M. (eds.) (2016). *Adapting to Climate Change: Guidance for protected area managers and planners*. Best Practice Protected Area Guidelines Series No. 24. IUCN, Gland, Switzerland.
- Hockings, M., Adams, W., Brooks, T.S. et al. (2013). A draft code of practice for research and monitoring in protected areas. *PARKS* 19, 85-94. Doi.org/10.2305/IUCN.CH.2013.PARKS-19-2.MH.en
- Jonas, H., Roe, D. and Makagon, J.E. (2014). *Human Rights Standards for Conservation: An Analysis of Responsibilities, Rights and Redress for Just Conservation*. IIED Issue Paper. International Institute for Environment and Development, London.
- Lemieux, C.J., Beechey, T.J. and Gray, P.A. (2011). Prospects for Canada's protected areas in an era of rapid climate change. *Land Use Policy* 28: 928-941. Doi.org/10.1016/j.landusepol.2011.03.008
- Leverington, F., Lemos Costa, K., Pavese, H., Lisle, A. and Hockings, M. (2010). A global analysis of protected area management

- effectiveness. *Environmental Management* 46, 685–698. Doi: 10.1007/s00267-010-9564-5.
- Mascia, M.B. and Pailler, S. (2011). Protected area downgrading, downsizing and degazettement (PADD) and its conservation implications. *Conservation Letters* 4: 9-20. DOI: 10.1111/j.1755-263X.2010.00147.x
- Mihók, B., Kovács, E., Balázs, B., Pataki, G., Ambrus, A., Bartha, D., Czirák, Z., Csányi, S., Csépanyi, P., ... Báldi, A. (2015). Bridging the research-practice gap: Conservation research priorities in a Central and Eastern European country. *Journal for Nature Conservation* 28 (Supplement C): 133-148. Doi.org/10.1016/j.jnc.2015.09.010
- Pretty, J., Sutherland, W.S., Ashby, J., Auburn, J., Baulcombe, D., Bell, M., Bentley, J., Bickersteth, S., Brown, K., ... Pilgrim, S. (2010). The top 100 questions of importance to the future of global agriculture. *International Journal of Agricultural Sustainability* 8, 219-236.
- QSR International (2015). NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 11, 2015.
- Reed, M.S., Stringer, L.C., Fazey, I., Evely, A.C. and Kruijsen, J.H.J. (2014). Five principles for the practice of knowledge exchange in environmental management. *Journal of Environmental Management* 146, 337-345. Doi.org/10.1016/j.jenvman.2014.07.021
- Sutherland, W.S., Adams, W.M., Aronson, R.B. et al. (2009). One hundred questions of importance to the conservation of global biological diversity. *Conservation Biology* 23, 557-567. Doi: 10.1111/j.1523-1739.2009.01212.x.
- UNEP-WCMC and IUCN. (2016). *Protected Planet Report 2016*. UNEP-WCMC and IUCN: Cambridge UK and Gland, Switzerland, pp 29-32
- United Nations. Undated. Transforming our World: The 2030 Agenda for Sustainable Development. New York. <https://sustainabledevelopment.un.org/post2015/transformingourworld>
- United Nations (2017). *The Sustainable Development Goals Report 2017*. <https://unstats.un.org/sdgs/report/2017/>
- Watson, J.M., Dudley, N., Hockings, M. and Segan, D. (2014). The performance and potential of protected areas. *Nature* 515, 67-73. Doi:10.1038/nature13947
- Watson, J. E. M., Darling, E. S., Venter, O., Maron, M., Walston, J., Possingham, H. P., Dudley, N., Hockings, M., Barnes, M. and Brooks, T. M. (2016). Bolder science needed now for protected areas. *Conservation Biology* 30, 243–248. Doi:10.1111/cobi.12645
- Woodley, S., Bertzky, B., Crawhall, N., Dudley, N., Miranda Londoño, J., MacKinnon, K., Redford, K. and Sandwith, T. (2012). Meeting Aichi Target 11: What does success look like for protected area systems? *PARKS* 18 (1): 23-36. Doi: 10.2305/

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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.