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Developing capacity for a protected planet

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IUCN PROTECTED AREA DEFINITION, MANAGEMENT CATEGORIES AND GOVERNANCE TYPES

IUCN DEFINES A PROTECTED AREA AS:

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

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

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

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

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

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

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

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

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

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

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

IUCN defines four governance types.

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

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

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

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

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

IUCN WCPA'S BEST PRACTICE PROTECTED AREA GUIDELINES SERIES

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

A full set of guidelines is available at: www.iucn.org/pa_guidelines
Complementary resources are available at: www.cbd.int/protected/tools/

PARKS: THE INTERNATIONAL JOURNAL OF PROTECTED AREAS AND CONSERVATION

Edited by Sue Stolton and Nigel Dudley, Equilibrium Research and IUCN WCPA

sue@equilibriumresearch.com, nigel@equilibriumresearch.com
Rock House, Derwenlas, Machynlleth, Powys, SY20 8TN, Wales

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Editing and layout by: Sue Stolton and Nigel Dudley, www.equilibriumresearch.com

Produced by: Sue Stolton and Nigel Dudley, www.equilibriumresearch.com

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Global Programme on Protected Areas
Rue Mauverney 28
1196 Gland
Switzerland
Tel +41 22 999 0000
Fax +41 22 999 0002
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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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PUBLISHING FOR THE PROTECTED AREA COMMUNITY: A VISION FOR PARKS FROM ITS EDITORIAL BOARD

Thora Amend[1], Tom Brooks[2], BC Choudhury[3], Lauren Coad[4], Nigel Dudley[5], Marc Hockings[6], Cyril Kormos[7], Nikita (Nik) Lopoukhine[8], Wayne Lotter[9], Kathy MacKinnon[10], Helen Newing[11], Kent H. Redford[12], Sue Stolton[13*] and Bas Verschuuren[14]

* Corresponding author: sue@equilibriumresearch.com
[1] IUCN WCPA, Germany
[2] IUCN Head of Science and Knowledge Unit, Gland, Switzerland
[3] Wildlife Trust of India: Senior Advisor Science, aquatic and marine programmes, New Delhi, India
[4] Oxford University Centre for the Environment, UK
[5] Equilibrium Research, Machynlleth, UK; Industry Fellow School of Geography, Planning and Environmental Management, University of Queensland, Australia
[6] IUCN WCPA Vice Chair Science; School of Geography, Planning and Environmental Management, University of Queensland, Australia; UNEP-WCMC Senior Fellow, Cambridge, UK
[7] IUCN WCPA Vice-Chair for World Heritage; Vice President for Policy, The Wild Foundation, USA
[8] IUCN WCPA former Chair; retired Director General of National Parks, Parks Canada, Canada
[9] Vice President of the International Ranger Federation; PAMS Foundation, Tanzania
[10] Deputy Chair of the IUCN World Commission on Protected Areas, Cambridge, UK
[11] DICE, School of Anthropology and Conservation University of Kent, UK
[12] Archipelago Consulting, Portland, USA
[13] Equilibrium Research, Machynlleth, UK
[14] Co-Chair of the IUCN WCPA Specialist Group on Cultural and Spiritual Values of Protected Areas; Associate Researcher, Department of Sociology of Development and Change, Wageningen University, The Netherlands

ABSTRACT

In this editorial essay, members of the Editorial Board of *PARKS* review the status of conservation literature. Three problems are identified: 1) the growing gap between the formal conservation literature and the so-called 'grey literature' of project reports, studies and working papers; 2) the effectiveness of the majority of conservation literature in promoting good conservation; and 3) the lack of open access to much of the conservation literature currently available. The article sets out the vision of this journal: *PARKS*, the International Journal of Protected Areas and Conservation, published by the International Union for Conservation of Nature (IUCN) expert World Commission on Protected Areas (WCPA). *PARKS* aims to encourage new writers, including younger researchers, conservation professionals who do not generally write for peer-reviewed publications and people from developing countries, including indigenous and local people, to share their best practices in protected area management. *PARKS* is published twice a year as an online, open-access and peer reviewed journal and welcomes submissions of papers from all protected area professionals worldwide.

Key words: protected area management, conservation, lessons learned, academic publishing

INTRODUCTION

The once-a-decade World Parks Congress has created a series of milestones in the philosophy of protected areas; each Congress reflecting the practice over the last 10 years and stimulating changes in approach, audience and challenges. The new directions emerging at the 2014 IUCN World Parks Congress in Sydney have been explored in a previous editorial for *PARKS* (Sandwith et al., 2014) and will be expanded in papers featured in this and subsequent issues of the journal. In this context it is time to reflect on the role of *PARKS* itself, or more fundamentally on the interface between the researchers and practitioners who make up the core audience of a journal like *PARKS*.

Researcher showing slides to Seringalzinho inhabitants, Jaú National Park, Brazil © Juan Pratginestos / WWF-Canon

CONSERVATION LITERATURE: DOES IT INFORM CONSERVATION PRACTICE?

Over the last two decades, there has been a growing gap between the formal conservation literature of academia, with its peer-reviewed papers and sophisticated impact rating systems, and the so-called 'grey literature' of project reports, articles, NGO studies and working papers. In some topics it almost seems as if there are three conversations running in parallel: the first, a highly theoretical discussion amongst professional academics, many of whom know each other; a second more practical, less formal and much more fragmented debate going on amongst field practitioners and conservationists; and a third set of conversations taking place between people locally and which unfortunately seldom get communicated to a wider audience.

There are a number of reasons for this split. The success of academic journals is measured by their 'Impact Factor', the number of times that its articles have been cited, which rewards journals for publishing articles with a broad geographical scope, that offer novel findings. Case studies, or single-species studies, while often reporting findings highly relevant to conservation practitioners, are less likely to be highly cited and are therefore less likely to be accepted by major journals.

In the same way, for conservation academics (i.e. those employed in a university position) 'success' is generally measured in the frequency and Impact Factor of scientific journal publications. The term 'publish or perish' is well known to post-doctoral researchers, employed on short-term contracts, competing for limited academic positions, and therefore under intense pressure to publish frequently in high-impact publications. This often means that research projects that focus on case studies and involve long periods of fieldwork are overlooked in favour of studies with a larger potential readership that can be completed relatively quickly. The incentive structure for conservation academics therefore currently does not often reward or fund the publication and dissemination of conservation 'best practice' examples.

Conversely, there are disincentives for conservation practitioners to publish their best-practice findings in peer-reviewed journals. Few conservation projects receive ring-fenced funding for peer-reviewed publication of project results, and practitioners seldom have the free time required to write journal articles which require specific formats and several lengthy periods of revision before publication. There are also significant geographical biases in authorship; the majority of international journals are published in English, and therefore the pool of successful authors is narrowed to those who are native English speakers, excellent linguists or can afford to have an English editor look through their work. In addition, turn-around times from submission to publication for many journals exceeds one year, delaying dissemination of project findings, which might reach a practitioner audience more swiftly and comprehensibly through 'grey literature' publication.

These issues are backed up by survey findings. A survey in 2009 of 268 ecological scientists found that although 43 per cent reported that scientific papers were the most important factor in assessing their academic performance, only 15 per cent believed that peer-reviewed journals were effective in promoting conservation (Shanley & Lopez, 2009). Maybe unsurprisingly, the very elements that increase the

conservation impact of an academic article are those that make its publication in the academic literature less likely. A survey of authors of all the species-based research articles published in five major conservation journals during 2000–2005 found that articles with the most conservation impact were those with a non-academic corresponding author, where the study was part of a long -term conservation project, undertaken with NGO support, and where results had been disseminated in formats other than peer-reviewed publication (Milner-Gulland et al., 2009).

These disparities result in a rapid growth in publications dealing with conservation and development that are poorly connected to the practice. Thus there is a far stronger emphasis on planning than on implementation, monitoring and reporting; little critical review of results and outcomes; and a lack of readily accessible up-to-date information on new tools and techniques that are likely to be practicable for a busy and under-staffed protected area manager or other practitioners.

There are a very small number of journals that attempt to address these issues.

- *Conservation Letters* (founded in 2008) specialises in publishing short papers of immediate relevance for policy debates and management solutions (www.conbio.org/publications/conservation-letters). It has succeeded in cutting the time to publication significantly while retaining a rigorous peer review system. However, papers are heavily dominated by academics from the 'north': a rapid review of first author contact details in the May/June 2014 issue of the journal reveals that in 19 of 23 articles the first author listed a university affiliation and in 22 of 23 articles they listed an affiliation in North America, Europe (principally the UK) or Australia.

- Flora and Fauna International's journal *Oryx* also prioritises papers that inform conservation practice and attempts to: 'support the publishing and communication aspirations of conservation practitioners and researchers worldwide', for example through training workshops on science writing (www.oryxthejournal.org/). This approach is reflected in the diversity of contributing authors: in the July 2014 issue, only 14 of 28 first authors listed a university affiliation and only 18 listed an affiliation in Europe, North America or Australia; other countries represented included China (three articles), Thailand (two articles), South Africa (two articles) and one article each from Namibia, Cape Verde, Uganda, Bolivia.

- *Conservation Evidence* (founded in 2004) is an open-access journal that publishes research, monitoring results and case studies on the effects of conservation interventions (www.conservationevidence.com). All papers include some monitoring of the effects of the intervention and are written by, or in partnership with, those who did the conservation work. Issue 11 (2014) accessed in August 2014 had seven papers. Of these three were from the UK and one each from Brazil, New Zealand, Singapore and Sri Lanka.

One final, but critically important issue is that most journals also charge for full papers to be accessed. A recent survey (Fuller et al., 2014) of scientific research published since the year 2000 in 20 conservation science journals, found that of the 19,207 papers published, only 1,667 (just over eight per cent) are freely downloadable from an official repository and only 938 papers (i.e. less than five per cent) meet the standard definition of open access in which material can be freely reused providing that attribution to the authors is given. Fuller et al. conclude that it would cost some US$ 51 million to make all conservation science published since 2000 freely available. This situation is hopefully set to change soon as many academic journals have or are moving from a model where authors publish for free and readers pay for access to a model where authors will pay a fee to publish and access will be free. This change will be a huge improvement in terms of access to the academic literature, but of course the downside is that it will create a new barrier to publication by practitioners, because the fees for publication are likely to be substantial.

PARKS: A NEW VISION FOR PROTECTED AREA PUBLISHING

The new incarnation of *PARKS* aims to bridge some of the gaps between conservation academia and conservation practice and join those journals listed above in trying to improve the relevance of journal publications, with a particular emphasis on protected areas. We are aiming for academic rigour but are more interested in practical insights for conservation practice than in contributions to theory. For example, *PARKS* publishes far more case studies and overviews than would be the case for many journals, although only if the authors have taken the trouble to analyse and draw lessons from them. In this way, they are of use to other readers facing similar challenges as well as to those that seek to draw on a new strand of peer reviewed conservation literature. More generally, papers are only accepted if they can be shown to have a clear management message. We are also 'open access' so all papers are free to download and there are no publishing

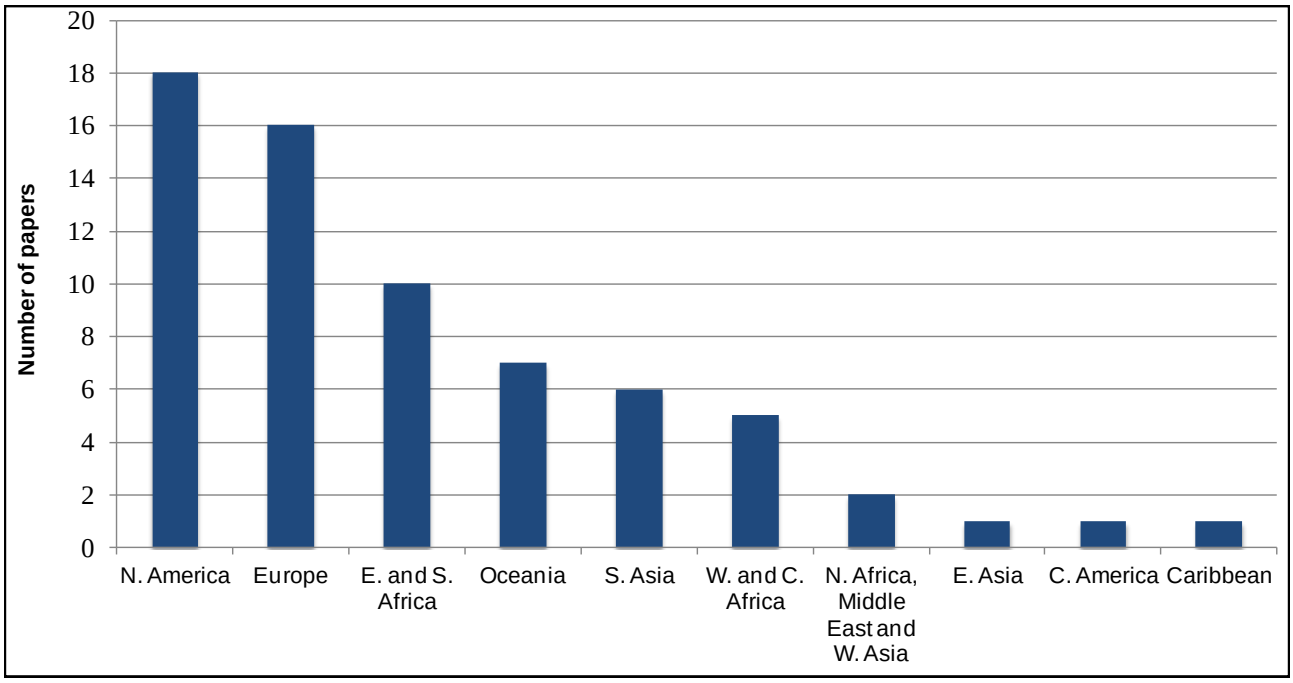

Figure 1: Lead author nationality of *PARKS* papers by WCPA Region— issues 18.1 to 20.2

fees as we rely on the goodwill of the IUCN WCPA membership to help coordinate, edit, review and publicise the journal. While we currently only publish in English, the editors and many peer reviewers are keen to work with authors who have great research or experience to report but are struggling to articulate this in the English language. PARKS encourages new writers, including younger researchers, conservation professionals who do not generally write for peer-reviewed publications and people from developing countries, including indigenous and local people who still often fail to have a voice in these debates or are pushed to the back of a list of authors. However we also encourage established and more senior researchers and academics to submit relevant, applied articles in the journal – not because of the academic standing of the journal but as a way to communicate more directly with conservation practitioners. We are working to develop a clear ethical framework for researchers operating in protected areas (see Hockings et al., 2013).

So far the approach seems to be paying off. To date (issue 18.1 to 20.2) about half our authors have been from outside Europe, North America and Australia (see figure 1 broken down by WCPA region, note that Oceania includes Australia and New Zealand and the islands of the Pacific, which have been the source of some papers). We are impressed and grateful for the amount of time that reviewers have been prepared to put into ensuring that non-academic authors, and those with English as a second language, get the support they need to publish high-quality research. Feedback has been good. But we remain too much of a hidden resource; some of the material published is not getting out to the right people and we need help from the IUCN WCPA network and beyond to reach potential authors who have experiences to share with their peers. A new dedicated website and a publicity push at the World Parks Congress will hopefully help to address this.

With this current issue we also welcome a new editor, Dr Lauren Coad of Oxford University, currently based in Indonesia at the Center for International Forestry Research. PARKS remains open to contributions, feedback and ideas, particularly practical, inspirational research that focuses on solutions. We encourage contributions particular from those who do not generally report their findings in peer review literature: practitioners, rangers, community groups, indigenous people and those not working primarily in the English language. Please let us know your thoughts.

About the Authors

Thora Amend is an ethnologist and geographer, with several decades of experience in protected area management, concept development, training and communication. She has worked for the German development cooperation (GIZ and others) for the integration of conservation and development needs, especially at local scales, but also at systems level.

Tom Brooks heads Science and Knowledge at IUCN. His background is in tropical forest bird conservation (Kenya, Paraguay, Indonesia, Philippines). He has previously worked at NatureServe, CI, and TNC, served on the Conservation Leadership Programme's Executive Committee, and co-chaired the WCPA/SSC Biodiversity and Protected Areas Taskforce. He has authored 210 publications.

BC Choudhury was with the Wildlife Institute of India till his retirement in 2012 teaching wildlife management largely focused on wetlands and coastal and marine situations. Currently he works on several marine species and habitat restoration projects and in capacity building for NGOs making their activism scientific information based.

Lauren Coad is a member of the Forest Governance Group at the University of Oxford, and the WCPA. Her research focuses on the effectiveness of protected area management and the impacts, and potential management, of the wild meat trade in Central Africa and South East Asia. She has previously lived and worked in Gabon and Cambodia, and is now based in Java, Indonesia.

Nigel Dudley is a co-editor of *PARKS*, partner in Equilibrium Research and Industry Fellow, School of Geography, Planning and Environmental Management at the University of Queensland. His work focuses mainly on the planning and management of protected areas with a particular interest in their wider benefits.

Marc Hockings is Professor and Program Director in the School of Geography, Planning and Environmental Management at the University of Queensland. His research covers broad aspects of protected area management with a focus on management effectiveness. Marc is Vice-Chair for Science for WCPA and a member of the Commission's Executive Committee.

Cyril Kormos is Vice President for policy at The WILD Foundation and IUCN-WCPA Vice-Chair for World Heritage. Cyril holds a B.A. in English from the University of California, Berkeley, an M.Sc. in Politics of the World Economy from the London School of Economics and a J.D. from the George Washington University.

Nikita (Nik) Lopoukhine retired in 2005 as Director General of National Parks, Parks Canada. He subsequently served for eight years as Chair of the IUCN WCPA. Nik was recently honoured with the Golden Leaf and J.B. Harkin Awards for his life-long commitment to Canadian conservation.

Wayne Lotter is a director of the PAMS Foundation in Tanzania. He has 23 years of experience in protected area management, law enforcement, community development, risk management systems and certification. He has an exceptional track record in the fields of wildlife crime law enforcement and invasive alien vegetation control.

Kathy MacKinnon is Deputy Chair, WCPA. She was formerly Lead Biodiversity Specialist at the World Bank and has considerable experience in planning and managing protected areas in developing countries, especially in Asia.

Helen Newing is a lecturer at the Durrell Institute of Conservation and Ecology (DICE) at the University of Kent, UK. She has worked in international conservation since the 1980s, both as an academic and in policy and practice. Her PhD was on antelope ecology in West Africa but she now works as a social scientist on community conservation issues. In 2011 she published the first comprehensive textbook on social science research methods in conservation.

Kent H. Redford is a conservationist working on protected areas, the practice of conservation and the intersection between conservation and synthetic biology. He is principal at Archipelago Consulting, based in Portland, Maine (USA).

Sue Stolton is the co-editor of PARKS. She is a partner in Equilibrium Research which for 25 years has promoted positive environmental and social change by linking targeted research to field application. A member of IUCN WCPA she specialises in protected area management issues and the wider social, economic and cultural arguments for protection.

Bas Verschuuren has 20 years of experience in linking practical biocultural conservation work and applied scientific research. Bas is co-chair to the IUCN WCPA Specialist Group on Cultural and Spiritual Values of Protected Areas, coordinator for the Sacred Natural Sites Initiative and researcher at the department of Sociology of Development and Change at Wageningen University.

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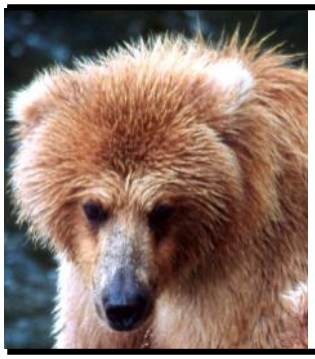
RESUMEN

En este ensayo editorial, los miembros del Consejo Editorial de PARKS examinan la situación de la literatura relacionada con la conservación. Se identificaron tres problemas: 1) la brecha creciente entre la literatura formal sobre conservación y la llamada "literatura gris" de los informes sobre proyectos, estudios y documentos de trabajo; 2) la eficacia de la mayoría de la literatura relacionada con la conservación en la promoción de prácticas adecuadas para la conservación; y 3) la falta de acceso libre a gran parte de la literatura sobre conservación actualmente disponible. El artículo expone la visión de esta revista: PARKS, la revista internacional que se ocupa de las áreas protegidas y la conservación, es publicada por la Comisión Mundial de Áreas Protegidas (CMAP) de la Unión Internacional para la Conservación de la Naturaleza (UICN). PARKS tiene por objeto alentar a nuevos escritores, incluyendo a investigadores más jóvenes, profesionales de la conservación, que por lo general no escriben para publicaciones revisadas por pares y a personas de países en desarrollo, incluidos los pueblos indígenas y las comunidades locales, a compartir sus prácticas óptimas en la gestión de áreas protegidas. PARKS se publica dos veces al año como una revista en línea, de acceso libre y arbitrada, y acoge favorablemente los trabajos presentados por los profesionales de las áreas protegidas de todo el mundo.

RESUME

Dans cet essai éditorial, les membres du comité de rédaction de PARKS examinent la situation de la littérature sur la conservation. On peut identifier trois problèmes : 1) l'écart croissant entre la littérature réglementaire sur la conservation et la littérature dite ‘grise’ des rapports de projet, des études et des documents de travail; 2) le niveau d'efficacité de la plupart de la littérature sur la conservation dans sa promotion d’une bonne conservation; et 3) le manque d'accès libre à la majorité des ouvrages sur la conservation actuellement disponibles. L'article présente la vision de ce journal: PARKS, le Journal international des aires protégées et de la conservation, publié par la Commission mondiale des aires protégées (CMAP), composée d’experts de l'Union internationale pour la conservation de la nature (UICN). PARKS vise à encourager les nouveaux écrivains, y compris les chercheurs les plus jeunes, et des professionnels de la conservation qui généralement n'écrivent que peu souvent pour des publications examinées par leurs pairs, ainsi que des personnes provenant de pays en voie de développement, y compris des personnes indigènes et locales, à partager leurs meilleures pratiques dans la gestion des aires protégées. PARKS est un journal en ligne en libre accès, revu par des pairs, et publié deux fois par an, qui accueil des propositions de communications en provenance de tous professionnels des aires protégées dans le monde entier.



THE FUTURE ROLE OF NATIONAL PARKS: INTRODUCING THE 'REVISITING LEOPOLD' REPORT AND RESPONSES

Jonathan B. Jarvis

Corresponding author: jon_jarvis@nps.gov
Director, National Park Service, USA

ABSTRACT

Published in 1963 "Wildlife Management in the National Parks", more commonly referred to as the "*Leopold Report*" after its lead author A. Starker Leopold was the work of a small team of scientists bought together to evaluate and recommend changes to the management of wildlife in the national parks of the US. The Report created for the first time a unified vision for the US National Park System for management of wildlife and by extrapolation, all natural resources, a vision which has driven policy and practice in US national parks for over 50 years. In 2011, the National Park System Advisory Board Science Committee was asked to revisit the report. A new team of highly respected scientists prepared *Revisiting Leopold,* published here in full, which will guide US National Park natural and cultural resource management into a second century. The development and management of National Parks in the US has often been used as a template across the world and the US National Park Service hopes that the *Revisiting Leopold* may offer some guidance and inspiration for all protected areas. The *Revisiting Leopold* report is thus complemented here with four commentaries on it findings from leaders of protected area agencies around the world.

Key words: Leopold Report, US National Parks System, Revisiting Leopold, protected area policy and

A shelf in my office holds stacks of reports, prepared by notable authorities, decorated with stunning scenes of natural or cultural wonders, and replete with recommendations on the management of our national parks or other public lands. Most gather dust and only a few will ever be implemented or even referenced in the future. None of them will have the impact of an unadorned, twenty three page report from 1963 entitled "Wildlife Management in the National Parks", more commonly referred to as the "*Leopold Report*".

A. Starker Leopold was a PhD Biologist, son of renowned conservationist Aldo Leopold, and science advisor to President Kennedy's Secretary of Interior. In 1963 he was asked to bring a small team of scientists together to evaluate and recommend changes to the management of wildlife in the national parks. Eloquent, visionary and to the point, the *Leopold Report* created for the first time a unified vision for the US National Park System (NPS) for management of wildlife and by extrapolation, all natural resources. The *Leopold Report* called upon the NPS to create a 'vignette of primitive America'. This vision has driven policy and practice in the US national parks for over 50 years, resulting in the return of natural fire, the elimination of invasive exotics, and restoration of extirpated species such as wolves in Yellowstone National Park.

For my nearly 40 years working as a biologist, ranger, superintendent and now Director in the NPS, the *Leopold Report* has been my guide. But in recent years, I have seen challenges to that paradigm, much of it due to a rapidly changing climate. I witness glaciers melting, species driven by climate appearing for the first time in parks, fires burning for a longer season, and storms ravaging coastal parks. I realized that attempting to hold our national parks in some sort of ecological stasis based on an interpretation of a pre-contact America was no longer possible and not even viable. We needed a new paradigm for the management of our natural and cultural resources that was reflective of these emerging challenges but also respectful of our history and basic mission to leave these parks 'unimpaired for future generations.'

So, in 2011, I tasked the National Park System Advisory Board Science Committee to revisit the *Leopold Report*. Under the leadership of Committee Chair Dr. Rita Colwell and with the assistance of Science Advisor to the Director, Dr. Gary Machlis, a team of highly respected scientists traveled to national parks, conferred with colleagues and prepared another report which is published here in full. *Revisiting Leopold* is not as prescriptive as the original *Leopold Report*. No longer do we have an 'illusion of primitive America' to envision and

strive for, but instead a challenge to "steward for continuous change that is not yet fully understood". The report acknowledges that climate change presents us with multiple futures and the necessity to adapt. Like the original, *Revisiting Leopold* will guide our natural and cultural resource management into our second century. Its recommendations, visionary in their own right, will help us develop new policies around assisted migration, ecological resiliency and the role of parks as climate refuges. At its core, *Revisiting Leopold* reminds us that we should always apply the precautionary principle to our decisions, leaving us (and future generations) the widest range of options for an uncertain future in order to ensure ecological integrity and cultural authenticity.

I have officially accepted the report and have an NPS team now preparing the implementation policies for the National Park Service, scheduled for completion in 2016, our Centennial. The IUCN, WCPA and the editors of *PARKS* have graciously included the full text of *Revisiting Leopold* in this issue, and invited a number of leaders of protected area agencies around the world to comment on the report from the perspective of their own countries. I hope that *Revisiting Leopold* may offer some guidance and inspiration for protected areas around the world as facing an uncertain future.

ABOUT THE AUTHOR

Jonathan B. Jarvis is the 18th Director of the US National Park Service. His 37-year career has taken him from being a ranger to resource management specialist to park biologist to superintendent, regional director, and director. He is responsible for overseeing an agency with more than 22,000 employees, a US$3 billion budget, and 401 national parks that attract more than 280 million visitors every year who generate US$30 billion in economic benefit to the US.

RESUMEN

Publicado en 1963, "Wildlife Management in the National Parks" (La gestión de la vida silvestre en los parques nacionales), más comúnmente conocido como el "Informe Leopold" que lleva el nombre de su autor principal, A. Starker Leopold, fue el trabajo de un pequeño grupo de científicos reunidos para evaluar y recomendar cambios en la gestión de la vida silvestre en los parques nacionales de EE. UU. El informe creó por primera vez una visión unificada para el Sistema de Parques Nacionales de Estados Unidos para la gestión de la vida silvestre y, por extrapolación, de todos los recursos naturales, una visión que ha impulsado la política y la práctica en los parques nacionales de Estados Unidos por más de 50 años. En 2011, se pidió al Consejo asesor para Ciencia del Sistema de Parques Nacionales que revisara el informe. Un nuevo equipo de científicos altamente respetados preparó el informe Revisiting Leopold (Revisión del Informe Leopold), que aquí se publica en su totalidad, que servirá para orientar la gestión de los recursos naturales y culturales de los Parques Nacionales de los Estados Unidos en su segundo siglo. El desarrollo y la gestión de Parques Nacionales en los EE. UU. han sido utilizados con frecuencia a modo de plantilla en todo el mundo y el Servicio de Parques Nacionales de los Estados Unidos espera que Revisiting Leopold pueda ofrecer orientación e inspiración para todas las áreas protegidas. Por esta razón, el informe Revisiting Leopold se complementa aquí con cuatro comentarios sobre las conclusiones de los organismos responsables de las áreas protegidas del mundo.

RESUME

Publié en 1963 «Gestion de la faune et la flore dans les parcs nationaux» plus communément appelé «Rapport Leopold» d'après le nom de son auteur principal A. Starker Leopold, était le travail d'un petit équipe des scientifiques qui s'étaient ressemblés pour évaluer et recommander des changements dans la gestion de la faune et de la flore des parcs nationaux des États-Unis. Le Rapport a créé pour la première fois une vision unifiée pour le Réseau de parcs nationaux des États-Unis dans le cadre de la gestion de la faune et de la flore et, par extrapolation, de toutes les ressources naturelles, une vision qui réglemente la politique et la pratique dans les parcs nationaux depuis plus de 50 ans. En 2011, on a demandé au Comité scientifique du Conseil consultatif du Réseau de parcs nationaux de réviser le rapport. Une nouvelle équipe de scientifiques hautement respectés ont préparé la Révision du Leopold, publié ici dans son intégralité, qui servira de guide pour la gestion des ressources naturelles et culturelles des parcs nationaux pour un nouveau siècle. Le développement et la gestion des parcs nationaux aux États-Unis ont été souvent utilisés comme un modèle dans le monde entier et le National Park Service espère que la Révision du Leopold pourra offrir des conseils et inspirer des idées à appliquer dans toutes les aires protégées. Le rapport Révision du Leopold est donc complété ici par des commentaires sur ses conclusions provenant de dirigeants des agences des aires protégées dans le monde entier.

REVISITING LEOPOLD: RESOURCE STEWARDSHIP IN THE NATIONAL PARKS

Dr. Rita Colwell [1], Dr. Susan Avery [2], Dr. Joel Berger[3], Dr. Gary E. Davis[4], Dr. Healy Hamilton[5], Dr. Thomas Lovejoy[6], Dr. Shirley Malcom[7], Dr. Ann McMullen[8], Dr. Michael Novacek[9], Sir Richard J. Roberts, Ph.D[10], Dr. Richard Tapia[11] and Dr. Gary Machlis[12*]

* Corresponding author: Gary_Machlis@nps.gov
[1] University of Maryland College Park and Johns Hopkins University Bloomberg School of Public Health; and CosmosID, Inc., College Park, MD, USA
[2] Woods Hole Oceanographic Institution, Woods Hole, MA, USA
[3] Wildlife Biology Program, University of Montana, Missoula, MT; and Wildlife Conservation Society, Bronx, NY, USA
[4] GEDavis and Associates, Westlake Village, CA, USA
[5] Marine Conservation Institute, Fairfax, CA, USA
[6] George Mason University; and The Heinz Center for Science, Economics and the Environment, Washington, DC, USA
[7] American Association for the Advancement of Science, Washington, DC, USA
[8] National Museum of the American Indian, Smithsonian Institution, Washington, DC, USA
[9] American Museum of Natural History, New York, NY, USA
[10] New England Biolabs, Ipswich, MA, USA
[11] Rice University, Houston, TX, USA
[12] National Park Service, Washington, DC, USA

ABSTRACT

The US National Park System is significantly different – in scope, number of units, size and complexity – than in the 1960s when the *Leopold Report*. Scientific understanding of natural and cultural resources has expanded dramatically. Developments since the 1960s include increasing biodiversity loss, habitat fragmentation, land use change, groundwater depletion, invasive species, rapid and sometimes unplanned development, growing air, noise, and light pollution and the impacts of climate change. The cultural values and interests held by the American people have also broadened, generating pressing demands for parks to reflect diversity and relevance for new generations. Fifty years on, the National Parks Service and its National Park System Advisory Board have revisited the *Leopold Report*. The new report, *Revisiting Leopold*, published here, focuses on the natural and cultural resource management of the National Park System and answers three questions: 1) What should be the goals of resource management in the National Park System?; 2) What policies for resource management are necessary to achieve these goals?; 3) What actions are required to implement these policies?

Key words: Leopold Report, US National Park System, Revisiting Leopold, protected area policy and

PROLOGUE

It is an early summer morning in a western national park. A stream runs alongside a campground, cascading toward the old historic hotel. The campground is full and relatively quiet; the hotel is stirring as the staff prepares for breakfast service. Upstream, elk and deer graze on grasses, while a few early-rising visitors have stopped their cars to eagerly watch and photograph the wildlife. On the higher slopes, alpine flowers—columbine, Indian paintbrush, mountain bluebells—are in bloom, and pikas dart among them. Tent campers who had hiked up from the valley the day before are making coffee on small camp stoves. Higher above, a bighorn sheep stands alert on rock above the boundary of bare ground and the snow -covered slope. Still higher, a small glacier and its annual snowpack reflect the rising summer light. The scene stands as a portrait of a national park at a single moment in time.

But there is another window through which this scene can be viewed, one fitted with the lens of science. Monitoring stations show that the soil is warming earlier in the season. High temperatures and several years of low rainfall have caused the now widespread non-native

grasses to dry into fire fuels more rapidly than in previous years. Wildlife studies document an elk herd increasing in number and exceeding estimates of what the valley can sustain. Surveys show early season visitation to the park at an all-time high due to changes in school calendars and an increased population of seniors. Educational programs on local history (based on new research) are attended by enthusiastic tourists. Field botanists have documented alpine flowers blooming days earlier than previously recorded, a trend that began over a decade ago. Ecologists note the pika population moving several hundred feet higher in elevation in response to increased summer temperatures. Glacial ice is declining, exposing new moraine. The scene shifts from just a moment in time or "portrait" to a moving record of a dynamic and continuously changing system. And it is one we do not yet fully understand.

INTRODUCTION

The national parks of the United States stand as a singular achievement of the nation. From the establishment of Yellowstone as the first national park in 1872, the National Park System has grown to include 397 national parks, historical sites, urban recreation areas, national monuments, wild and scenic rivers, and national trails, with more than 279 million visits each year. The character and importance of this precious heritage lies at the heart of the American experience, and stewardship of the national parks is an enduring responsibility shared by all Americans.

The extraordinary natural and cultural resources of the National Park System are the environmental, cultural, legal, political, and moral basis of the commitment of the American people to their national parks. The distinctive qualities and features of these resources are the ultimate source of public engagement with the National Park Service (NPS), and their protection, conservation, and restoration are essential elements of the NPS mission. This is not just the technical task of resource "management." The national parks require an ethic of stewardship that focuses on passing the parks unimpaired to future generations. As a result, *park stewardship* is a preeminent duty of the NPS.

This enduring responsibility has been examined previously. In 1963, the *Leopold Report* (officially titled *Wildlife Management in the National Parks*) was submitted to then Secretary of the Interior Stewart Udall by an advisory board of scientists chaired by conservationist, author, and scientist A. Starker Leopold, son of ecologist Aldo Leopold. The report reviewed the management of wildlife in the national parks as practiced in the 1960s and proposed major recommendations. Since that time, the influence of the *Leopold Report*'s findings upon the philosophy, policies, and professionals of the National Park Service has proved lasting and significant.

Yet new knowledge and emerging conditions—including accelerating environmental change, a growing and more diverse population of Americans, and extraordinary advances in science—make it urgent to re-examine and if necessary revise the general principles of resource management and stewardship in the national parks as described in the *Leopold Report*. The current committee has endeavored to meet this challenge by providing the following conclusions and recommendations.

NEW CONDITIONS, NEW NEEDS

Environmental changes confronting the National Park System are widespread, complex, accelerating, and volatile. These include biodiversity loss, climate change, habitat fragmentation, land use change, groundwater removal, invasive species, overdevelopment, and air, noise, and light pollution. All of these changes impact park resources, from soil microbes to mountain lions and from historic objects to historic landscapes. Parks once isolated in a rural or wildland context are now surrounded by human development. Increasing pressures on public lands—from recreational use to energy development—amplify the importance of protected public lands and waters, creating challenges far more complex than in the Leopold era.

Cultural and socioeconomic changes confronting the National Park Service are difficult to overstate. These include an increasingly diversified, urbanized, and aging population, a transforming US economy, and constrained public funding for parks. The National Park System is significantly different—in scope, number of units, size, and complexity—than in the 1960s when the *Leopold Report* was released. Additions to the system include significant cultural, recreational, and urban resources. The cultural values and interests held by the American people have greatly broadened, generating pressing demands for diversity in the National Park Service and for relevancy of the National Park System to new generations of citizens.

Simultaneously, scientific understanding of natural and cultural resources has dramatically expanded, continues to grow at an accelerating pace, and is becoming more quantitative and technologically sophisticated. The conservation sciences have exponentially extended their theories, methods, and findings since the *Leopold Report*

Brown bear (*Ursus arctos*), Katmai National Park, Alaska, USA © Kevin Schafer / WWF-Canon

was issued (tellingly, the term "biodiversity" had not yet been coined when Leopold's advisory board prepared its report). Systematic surveys of major organismic groups—not only for vertebrate wildlife but for plants, insects, fungi, and microbes—have expanded on both national and international fronts. Ecosystem management has matured into a science-based activity. There are new realizations of the profound risks human activities pose to oceans and the critical need to protect marine resources. Understanding of system complexity and interrelatedness has advanced along with recognition that this understanding is incomplete. The need for science—to understand how park ecosystems function, monitor impacts of change (even from afar), inform decision makers and their decisions, and enrich public appreciation of park values—has never been greater. In addition, the National Park System is an extraordinary national asset for advancing science and scholarship—from new discoveries of valuable genetic resources to monitoring benchmarks for environmental change and increasing knowledge of the impact of thousands of years of human history on the American landscape.

For all these reasons, revisiting the *Leopold Report*—which requires reexamining the core purposes of the National Park System and the stewardship responsibilities of the National Park Service—is both necessary and compelling as the NPS approaches 2016, the year of its centennial celebration.

THE SCOPE OF THIS REPORT

The 1963 *Leopold Report* addressed three basic questions:

1. *What should be the goals of wildlife management in the national parks?*
2. *What general policies of management are best adapted to achieve the pre-determined goals?*
3. *What are some of the methods suitable for on-the-ground implementation of policies?*

Leopold and his advisory board confronted the question of goals boldly and directly, recommending that "biotic associations within each park be maintained or where necessary recreated as nearly as possible in the condition that prevailed" before the arrival of Europeans on the continent. In a memorable phrase, the report declared, "A national park should present a vignette of primitive America." The authors also described implications of this goal as "not done easily nor can it be done completely." The report was adamant:*"Yet, if the goal cannot be fully achieved it can be approached. A reasonable illusion of primitive America could be recreated, using the utmost in skill, judgment, and ecologic sensitivity. This in our opinion should be the objective of every national park and monument."*

The current committee has responded to the charge given to it by the NPS and its National Park System Advisory Board—to revisit the *Leopold Report*—by

Photo of Manassas National Battlefield Park in Virginia at dawn © NPS/Brad Waldron

answering three contemporary and expanded questions framed as in the original report:

1. *What should be the goals of resource management in the National Park System?*
2. *What policies for resource management are necessary to achieve these goals?*
3. *What actions are required to implement these policies?*

The current committee elected neither to offer an extended critique of the original *Leopold Report* nor to restrict its recommendations to the central topic that drew Leopold and his colleagues' attention—wildlife management. The committee has neither accepted all of Leopold's conclusions nor rejected them out of hand, and several of the *Leopold Report* findings remain valid and significant. These include:

- The need for the NPS to "recognize the enormous complexity of ecologic communities and the diversity of management procedures required to preserve them."
- The necessity that management "may involve active manipulation of the plant and animal communities, or protection from modification or external influences."
- The high importance of science to stewardship, such that the *Leopold Report* urged "the expansion of the research activity in the Service to prepare for future management and restoration programs."

Several key findings serve as the foundation of the current committee's recommendations. This report focuses on natural and cultural resource management for the units of the National Park System. Many if not most parks include both natural and cultural resources, and many park resources feature natural and cultural attributes—Yellowstone bison are both ecologically important and culturally significant. Parks exist as coupled natural-human systems. Natural and cultural resource management must occur simultaneously and, in general, interdependently. Such resource management when practiced holistically embodies the basis of sound park stewardship. Artificial division of the National Park System into "natural parks" and "cultural parks" is ineffective and a detriment to successful resource management.

While individual parks can be considered distinct units, they are—regardless of size—embedded in larger regional and continental landscapes influenced by adjacent land and water uses and regional cultures. Connectivity across these broader land- and seascapes is essential for system resilience over time to support animal movements, gene flow, and response to cycles of natural disturbance. Migration of aerial, terrestrial, and marine species like the wood thrush, pronghorn, and leatherback turtle routinely transcend park and even national boundaries. Resource stewardship requires land- and seascape strategies and tactics at larger regional scales. The same principle applies for cultural phenomena: scientific testing of drinking vessels from Chaco Canyon indicates the Chacoans drank chocolate beverages made with beans imported from Mesoamerica, linking Chaco with civilizations to the south. Cultural history transcends park boundaries. Large-scale stewardship means that collaborations, partnerships, and networks are and will continue to be critical to preserve and protect resources.

In contemporary and future resource management, the functional qualities of biodiversity, evolutionary potential, and system resilience matter as much as observable features of iconic species and grand land- and seascapes. Iconic species (from wolves to whales) and

grand land- and seascapes (from coral reefs to mountains) depend on the much more difficult to observe but essential characteristics and processes of healthy ecosystems, from decomposition by microorganisms to fixation and flow of nitrogen. Similarly, cultural resources extend beyond iconic buildings, historic sites, and landscapes to include indigenous values, sense of place, historical meaning, diverse forms of cultural knowledge, and the recent past.

Consequently, broad disciplinary and interdisciplinary scientific knowledge and scholarship are necessary to manage for change while confronting uncertainty. New and emerging scientific disciplines—including conservation biology, global change science, and genomics—along with new technological tools like high-resolution remote sensing can provide significant information for constructing contemporary tactics for NPS stewardship. This knowledge is essential to a National Park Service that is science-informed at all organizational levels and able to respond with contemporary strategies for resource management and ultimately park stewardship.

In addition, the American people—including but not limited to visitors and residents of communities near parks—must be recruited as "co-stewards" of the national parks. The public must be made aware of the challenges facing the National Park System and urged and empowered to take action to preserve and protect these resources as part of their enduring responsibility as citizens.

WHAT SHOULD BE THE GOALS OF RESOURCE MANAGEMENT IN THE NATIONAL PARK SYSTEM?

The overarching goal of NPS resource management should be *to steward NPS resources for continuous change that is not yet fully understood, in order to preserve ecological integrity and cultural and historical authenticity, provide visitors with transformative experiences, and form the core of a national conservation land- and seascape.*

Continuous change is not merely constant or seasonal change; it is also the unrelenting and dynamic nature of the changes facing park systems expressed as extreme, volatile swings in conditions (such as unexpected, severe wet seasons) within long-term trends of change (such as decadal droughts). Variations in environmental conditions, including extreme events like catastrophic wildland fires, hurricanes, and droughts increasingly exceed historic experiences. Significant uncertainty exists regarding responses of park ecosystems and historical resources to these conditions. It is an essential finding of this committee that given the dynamic and complex nature of this change, the manager and decision maker must rely on science for guidance in understanding novel conditions, threats, and risks to parks now and in the future.

Ecological integrity describes the quality of ecosystems that are largely self-sustaining and self-regulating. Such ecosystems may possess complete food webs, a full complement of native animal and plant species maintaining their populations, and naturally functioning ecological processes such as predation, nutrient cycling, disturbance and recovery, succession, and energy flow.

Cultural and historical authenticity describes the capacity of a historical object or setting to be an accurate representation of a specific cultural time and place, revealing meaning and relevance of the object to its "parent" culture or context, and displaying a genuine and realistic connection to factual historical events. Authenticity—of material objects or intangible heritage like traditional harvesting practices—is multidimensional and rarely absolute. Some attributes of authenticity might be intact (such as the materials in a historic building) while other attributes may have been substantially altered (such as the functional use of the building or its community context).

Transformative experiences held by visitors to parks are of many kinds, and are based on interaction with natural and cultural resources. This interaction should both educate *and* inspire. Such experiences can be a weeklong, confidence-building wilderness adventure, a first encounter with a night sky free of artificial light, exploring a tidal pool with a park interpreter, or the emotional and patriotic response to standing on a historic battlefield or in an early Native American dwelling. A first, tentative nature walk for the city-raised child may prove as memorable as an exuberant hike by a seasoned park visitor. Distinctive and transformative experiences should be available to all Americans in all units of the National Park System. This requires expanding the relevance and benefits of parks to underrepresented minority groups and communities.

A coherent and sustainable *national conservation land- and seascape* recognizes that 21st-century conservation challenges require an expansion in the spatial, temporal, and social scales of resource stewardship. A comprehensive national conservation land- and seascape includes working lands and waters (for forestry, agriculture, and fishing), recreation areas, historical sites, wilderness areas, wild and scenic rivers, and marine protected areas. Connecting isolated and

Yosemite National Park, California, USA © Edward Parker / WWF-Canon

individual conservation sites into a network adds to their individual and collective resilience over time. The National Park System contains many of the land- and seascapes most capable of sustaining ecological integrity and cultural and historical authenticity. It can and must be both core and essential to a larger national vision, with the national parks and historic sites serving as permanent anchors of conservation in a continuum of uses.

The contemporary strategies proposed by this committee (with their focus on coupled human-natural systems and connectivity across the larger land- and seascapes) require NPS resource management to embrace a holistic vision and design. This vision emphasizes the role of parks as spatially fixed, largely intact areas embedded in a matrix of adjacent lands and waters where use will change dynamically over time. The NPS should assume its responsibility for "life cycle stewardship" (the goal of managing resources such that species' full life cycles are sustainable over time) and collaborative resource management, whether resources are migratory species moving transiently within parks (such as spawning salmon in Olympic National Park) or co-managed sites important to indigenous communities and tribes (such as Chesapeake Bay or Devils Tower National Monument).

Confronted with continuous and dynamic change and the goal of preserving ecological integrity, NPS management strategies must be expanded to encompass a geographic scope beyond park boundaries to larger landscapes and to consider longer time horizons. Specific tactics include improving the representation of unique ecosystem types within the National Park System, prioritizing the protection of habitats that may serve as climate refugia, ensuring the maintenance of critical migration and dispersal corridors, and strengthening the resilience of park ecosystems.

The National Park System should become the core element of a national (and with international collaboration, continental and oceanic) network of lands and waters proposed above. Where terrestrial and aquatic protected areas share borders, such as Point Reyes National Seashore and the Gulf of the Farallones Marine Sanctuary, or Olympic National Park and the Olympic Coast National Marine Sanctuary, unique opportunities exist to embrace this holistic vision across ecologically connected boundaries. This network should be managed for resiliency and connectivity, guided by scientific research, and responsible for life cycle stewardship, thereby fulfilling a conservation imperative of protecting the distinctive role and future of the

National Park System within the broader American landscape and consciousness.

Because ecological and cultural systems are complex, continuously changing and not fully understood, NPS managers and decision makers will need to embrace more fully *the precautionary principle* as an operating guide. Its standard is conservative in allowing actions and activities that may heighten impairment of park resources and consistent in avoiding actions and activities that may irreversibly impact park resources and systems. The precautionary principle requires that stewardship decisions reflect science-informed prudence and restraint. This principle should be integrated into NPS decision making at all levels.

Contemporary understanding of environmental history and diverse American cultures has enriched our appreciation for the interaction between human and natural systems. The NPS should embrace continued traditional and sustainable use of natural and cultural resources by indigenous communities and tribes, within the broader goal of preserving ecological integrity and cultural authenticity.

WHAT POLICIES FOR RESOURCE MANAGEMENT ARE NECESSARY TO ACHIEVE THESE GOALS?

The NPS should make as its central resource policy the stewardship of park resources to preserve ecological integrity and cultural and historical authenticity, provide transformative visitor experiences, and manage the National Park System as the core of a national conservation network of connected lands and waters. This policy should formally embrace the need to manage for change, the precautionary principle, and to the maximum extent possible, maintain or increase current restrictions on impairment of park resources.

The NPS and its stakeholders are uniquely positioned to propose specific revisions of technical policies for the organization. These policies should define ecological integrity and cultural and historical authenticity and guide park stewardship over time. Such policies should clearly distinguish appropriate management actions and activities that preserve these qualities from those that can degrade or eliminate ecological integrity and/or cultural and historical authenticity. This will require concerted examination by NPS professionals and stakeholders, as well as the relevant scientific, legal, and policy analyses.

The NPS needs a specific and explicit policy for park stewardship and decision making based on *best available sound science*, *accurate fidelity to the law*, and *long-term public interest*. Best available sound science is relevant to the issue, delivered at the appropriate time in the decision-making process, up-to-date and rigorous in method, mindful of limitations, peer-reviewed, and delivered in ways that allow managers to apply its findings. Accurate fidelity to the law means that the NPS decision-making process must adhere with precision to law, be mindful of legislative intent, and consistently and transparently follow public policy and regulations. Long-term public interest emerges from the NPS mission, the expert judgment of park professionals, and an evolving understanding of public wants and needs. The key is "long-term," which is a necessary consequence of the NPS mission and reflects—at minimum—concern for multiple future generations in time.

While increased scientific capacity is an essential asset of a 21st-century National Park Service, scientific research findings must be delivered to resource managers and decision makers in the form of usable knowledge. The NPS will require a broad technology innovation policy that encourages adoption of new technologies and establishes coherent strategies for data sharing and access that can be deployed in support of science, resource management, and park stewardship. Existing policies and procedures must be improved to encourage participation of external scientists, scholars, and students in scientific and scholarly research conducted in national parks, and expand the appropriate use of parks as national laboratories for science.

WHAT ACTIONS ARE REQUIRED TO IMPLEMENT THESE POLICIES?

The NPS should undertake a major, systematic, and comprehensive review of its policies, despite the risk and uncertainty that this effort may entail. The committee emphasizes that it is not recommending revision of the Organic Act, altering the mission of the NPS, or relaxation of restrictions on impairment of park resources. Rather, this review should explicitly focus on aligning policies with the goals for resource management recommended here, and streamlining, clarifying, and improving consistency and coherence to provide guidance in resource management and decision making.

To implement the resource management goals and policies described in this report, the NPS will need to significantly expand the role of science in the agency. The committee has several recommendations. The NPS must materially invest in scientific capacity building by hiring a new and diverse cohort of scientists, adequately supporting their research, and applying the results. The NPS should train, equip, retain, and support the career advancement of these research scientists and scholars.

Bird watching, Grand Teton National Park, Wyoming, USA © WWF-Canon / Richard Stonehouse

They should be stationed in parks to provide place-based expertise and knowledge, long-term institutional memory, and technical support for resource management. NPS scientists (and the agency) would greatly benefit from strengthened and supportive supervision, increased opportunities to interact with the scientific community, including professional associations, and specific responsibility and opportunity for publishing their work in the scientific literature. Both NPS managers and scientists require training and requisite skills in communication, critical thinking, analysis, science, technology, and mathematics. The NPS should integrate scientific achievement into its evaluation and performance reward systems, providing incentives for scientists and managers who contribute to the advancement of science and stewardship within their park or region.

This expanded scientific capacity must be interdisciplinary as well as disciplinary, and leverage scientific partnerships with academic institutions, other federal agencies, and both non-profit and private sectors. It should include well-established sciences such as wildlife ecology, botany, and anthropology. It should also incorporate the newer and increasingly relevant sciences such as genomics and climate change science, and innovative areas of research such as ecological economics, spatial modeling, and related methods.

The NPS should establish a standing Science Advisory Board that includes representatives from a range of disciplines within the scientific community. The board would offer external perspectives on science in the parks, provide advice and guidance on science policy, priorities and controversies, and advocate on behalf of science within the agency. The board should be given specific responsibilities and appropriate resources in order to operate effectively.

Investing in science is essential, but it is only one element in preparing NPS stewardship for the future. The NPS must also expand its capacity to manage natural and cultural resources efficiently across large-scale landscapes, avoiding unnecessary bureaucracy while engaging networks, collaborations with academic institutions and other federal agencies (notably the U.S. Geological Survey), and partnerships with states, tribes, and the private sector.

An expanded role for monitoring is an essential component of managing for change. The NPS should function as a scientific leader in documenting and monitoring the conditions of park systems, including inventories of biodiversity and cultural resources. Monitoring represents an important opportunity to engage the American public (particularly youth) in stewardship of park resources through outreach programs and emerging technologies that support citizen science. The NPS should also lead the way in establishing baseline environmental quality standards and benchmarks of ecological integrity and cultural and historical authenticity. It should invest in and apply analytic and decision-support tools systemwide. The agency should increase understanding of the natural and cultural resources under its care, improve linkages between its substantial current monitoring effort and research needs, and increase access to monitoring data by resource managers and the scientific community.

The NPS has an excellent corps of resource managers, but these managers must be supported with the necessary funds and personnel, as well as with training and professional development. NPS professionals, and especially park superintendents, should be required to possess and maintain significant scientific literacy that extends to an understanding of the strengths and limitations of scientific findings, appropriate application of scientific research to management and policy, and familiarity with key scientific concepts in both biophysical and sociocultural disciplines.

CONCLUSION: OPPORTUNITY AND URGENCY

Resource stewardship in the National Park Service owes a debt to Leopold's Advisory Board for the cogent principles, philosophy, and recommendations provided in its 1963 report. Now, almost 50 years later, revisiting the key questions raised by Leopold and his colleagues must be done in the context of a new century.

Resource stewardship within the National Park System of the future must be accomplished while addressing development pressures, pollution impacts, climate change, terrestrial and marine biodiversity loss, habitat fragmentation, and the loss of cultural resources. These challenges will only accelerate and intensify in the future. Future resource management based on historically successful practices cannot be assumed as effective park stewardship. Neither is crisis management a sufficient response. Structural changes and long-term investment are necessary to preserve the natural and cultural resources of the National Park System.

There is great urgency in the recommendations put forward in this report—accompanied with an exhortation to the NPS to act immediately, boldly, and decisively. The 2016 Centennial of the National Park Service offers an extraordinary opportunity for action and provides a critical benchmark for progress in meeting this enduring responsibility.

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NATIONAL PARK SYSTEM ADVISORY BOARD SCIENCE COMMITTEE

Dr. Rita Colwell (Committee Chair): Distinguished University Professor, University of Maryland College Park and Johns Hopkins University Bloomberg School of Public Health; Chairman and President, CosmosID, Inc., College Park, MD

Dr. Susan Avery: President and Director, Woods Hole Oceanographic Institution, Woods Hole, MA

Dr. Joel Berger: John J. Craighead Chair and Professor, Wildlife Biology Program, University of Montana, Missoula, MT; Senior Scientist, North American Program, Wildlife Conservation Society, Bronx, NY

Dr. Gary E. Davis: USNPS, Ret., President and Founder, GEDavis and Associates, Westlake Village, CA

Dr. Healy Hamilton: Senior Research Fellow, Marine Conservation Institute, Fairfax, CA

Dr. Thomas Lovejoy: University Professor, Environmental Science and Policy, George Mason University; Biodiversity Chair, The Heinz Center for Science, Economics and the Environment, Washington, DC

Dr. Shirley Malcom: Head, Directorate for Education and Human Resources Programs of the American Association for the Advancement of Science, Washington, DC

Dr. Ann McMullen: Curator and Head of Collections Research and Documentation, National Museum of the American Indian, Smithsonian Institution, Washington, DC

Dr. Michael Novacek: Senior Vice President, Provost of Science, Curator at the American Museum of Natural History, New York, NY

Sir Richard J. Roberts, Ph.D: 1993 Nobel Laureate in Physiology or Medicine, Chief Scientific Officer, New England Biolabs, Ipswich, MA

Dr. Richard Tapia: University Professor, Director of the Center for Excellence and Equity in Education; Director of Alliances for Graduate Education and the Professoriate, Maxfield and Oshman Professor in Engineering, Rice University, Houston, TX

Dr. Gary Machlis: (Liaison to the Committee) Science Advisor to the Director, National Park Service, Washington, DC

RESUMEN

El Sistema de Parques Nacionales de Estados Unidos es sustancialmente diferente –tanto en alcance, como en número de unidades, tamaño y complejidad– al de la década de 1960 cuando se elaboró el Informe Leopold. El conocimiento científico de los recursos naturales y culturales se ha expandido dramáticamente. La evolución desde la década de 1960 incluye una creciente pérdida de biodiversidad, fragmentación del hábitat, cambios en el uso del suelo, agotamiento de las aguas subterráneas, especies invasoras, desarrollo rápido y a veces no planificado, creciente contaminación atmosférica, acústica y lumínica e impactos del cambio climático. Los valores e intereses culturales del pueblo estadounidense también se han ampliado, generando exigencias urgentes para que los parques reflejen la diversidad y relevancia para las nuevas generaciones. Cincuenta años después, el Servicio de Parques Nacionales y su Consejo asesor para el Sistema de Parques Nacionales revisaron el Informe Leopold. El nuevo informe, Revisiting Leopold, aquí publicado, se centra en la gestión de los recursos naturales y culturales del Sistema de Parques Nacionales y responde a tres preguntas: 1) ¿Cuáles deberían ser los objetivos de la gestión de recursos en el Sistema de Parques Nacionales? 2) ¿Qué políticas para la gestión de los recursos son necesarias para alcanzar estos objetivos? 3) ¿Qué medidas son necesarias para poner en práctica estas políticas?

RESUME

Le Réseau de parcs nationaux des Etats Unis est très différent – en ce qui concerne sa visée, le nombre d'unités, leur taille et leur complexité - par rapport aux années ‘60, quand avait paru le Rapport Leopold. Les connaissances scientifiques des ressources naturelles et culturelles ont bien évolué depuis. Parmi les développements depuis les années ‘60, citons l’intensification de l’appauvrissement de la biodiversité, la fragmentation des habitats, les changements dans l’utilisation des sols, l'épuisement des eaux souterraines, les espèces invasives, le développement rapide et parfois non planifié, l'augmentation de la pollution atmosphérique, sonore et lumineuse, et les répercussions des changements climatiques. Les valeurs culturelles et les intérêts du peuple américain se sont également élargis aboutissant ainsi à de pressantes demandes de parcs afin d’illustrer la diversité et l’importance de la nature à l’intention des nouvelles générations. Cinquante ans plus tard, le National Parks Service et son Comité consultatif du Réseau de parcs nationaux ont révisé le Rapport Leopold. Le nouveau rapport Révision du Leopold, publié ici, porte sur les aspects de la gestion des ressources naturelles et culturelles du Réseau de parcs nationaux et répond aux trois questions suivantes : 1) Quels devraient être les objectifs de la gestion des ressources dans le Réseau de parcs nationaux? 2) Quelles politiques sont essentielles pour réaliser ces objectifs? 3) Quelles mesures sont requises pour permettre la mise en œuvre de ces politiques?

PARKS RESPONSES

Traditional thatch being put on education facilities building in Kasungu National Park, Malawi © John E. Newby / WWF-Canon

RESPONSE AND REACTION TO THE PAPER 'REVISITING LEOPOLD' FROM THE DEPARTMENT OF NATIONAL PARKS AND WILDLIFE

Brighton K. Kumchedwa, Director and William O. Mgoola, Assistant Director

Department of National Parks and Wildlife, Malawi

The Department of National Parks and Wildlife is the Government's executive arm in Malawi mandated to conserve, manage and regulate the sustainable use of wildlife resources both in protected areas and outside protected. Malawi's wildlife estate comprises five national parks, four wildlife reserves and three nature sanctuaries that cover about 11.1 per cent of the total land area of the country.

Generally the overarching goal of the US National Park System of resource management, i.e. '*to steward NPS resources for continuous change that is not yet fully understood, in order to preserve ecological integrity and cultural and historical authenticity, provide visitors with transformative experiences, and form the core of a national conservation land- and seascape',* is similar in some aspects to the goals of wildlife conservation and management in the context of Malawi as provided in the wildlife policy and legislation. Our goals include the conservation and preservation of selected examples of biotic communities, protection of rare, endemic, and endangered species of wild plants and animals as well as providing for recreation and enjoyment through tourism among others.

However, the environmental, cultural and socioeconomic changes confronting the US National Park System are different to the conditions affecting the park management system in the context of Malawi. The loss of biodiversity generally through poaching and other illegal uses is attributed to livelihood needs especially of the surrounding local communities living adjacent to protected areas in addition to organised wildlife crime syndicates for international wildlife ivory illegal trade and other wildlife products. About 80 per cent of the local communities depend on natural resources for their livelihood and most of them around protected areas live below the poverty line. Furthermore, increasing human population densities around protected areas have exacerbated human–wildlife conflicts. Law enforcement is one of the major core functions of the Department to combat poaching and illegal trade. These issues are largely absent in the proposed actions to implement the policies.

The ecological principle of connectivity across broader land- and seascapes is essential for system resilience over time to support animal movements, gene flow, and response to cycles of natural disturbance. This has been embraced mostly through the transfrontier conservation approach of protected areas having an international boundary like the case of the Malawi Zambia Transfrontier Conservation Area. However, for intra-connectivity and establishment of networks within the country, this proves to be a challenge. Our country is small with high human population density coupled with increasing demand for land for agricultural production for livelihood even in marginal areas and settlement. The protected areas are islands of biodiversity hotspots in a sea of human populations.

The idea of recruiting communities near parks as co-stewards of national parks, to be empowered to take action to preserve and protect natural resources is a move in the right direction. One of the core functions of the Department is to involve local communities living close to protected areas as partners and beneficiaries in the ownership and management of wildlife through the promotion of the process of collaborative management. However, this approach should be coupled with a tangible incentive system for communities to effectively contribute to conservation otherwise it becomes a conversation with them.

The recommendation to significantly expand the role of science in the national park system in order to implement the resource management goals and policies is very relevant in the context of Malawi protected area management system. One of the core functions is wildlife research and monitoring. There are designated research units with staff stationed in protected areas. The challenge has been to adequately train, equip, retain and support the career advancement of these research scientists and scholars.

On the systematic and comprehensive review of policies, it is an important strategic issue that should be addressed so that wildlife conservation and management is reflective of the current emerging issues. In the case of the Department, the current Wildlife Policy was adopted by Government in the year 2000. Over the years, there have been several emerging issues which have taken place within and outside the sector which have had an influence in the overall implementation of the current policy. For example the paradigm shift to involve the private sector in the conservation and management of protected areas. Private sector participation in the form of ecotourism concessions and protected area management concessions are the direction being undertaken by Government for economic growth. With limited Government financial resources to support protected areas, Public - Private Partnerships are one of the management strategies being employed, and therefore it is necessary that protected area managers have the requisite skills and knowledge.

Protected areas in Malawi are one of the vehicles for the revenue generation through tourism. This is not highlighted in the paper as one of the priority areas. The need for mineral exploration and extraction to boost the economy of the country has been increasing over the recent years. Protected areas are viewed as areas that have mineral deposits that can economically benefit the country. The wildlife legislation does not provide for such activities. It is important that as we move into the future, these issues are adequately addressed.

Serengeti National Park © Equilibrium Research

'REVISITING LEOPOLD' IN THE CONTEXT OF TANZANIA NATIONAL PARKS AND TANZANIA AS A COUNTRY

Allan J H Kijazi, Director General

Tanzania National Parks

National Parks of Tanzania are in the highest category of Protected Areas in the country. Other protected areas, in the context of wildlife conservation include Ngorongoro Conservation Area, Game Reserves, Game Controlled Areas and Wildlife Management Areas.

The first National Park in Tanzania, the Serengeti, was established in 1959 before independence when the country was under the British colony. One of the pioneers in establishing the national parks system in the country was Bernhard Grzimek who started this task in 1950s. To date, 55 years later, there are 16 national parks across the country.

The mandate of national parks in the country is: "To manage and regulate the use of areas designated as National Parks by such means and measures to preserve the country's heritage, encompassing natural and cultural resources, both tangible and intangible resource values including the flora and fauna, wildlife habitats, natural processes, wilderness quality and scenery therein and to provide for human benefit and enjoyment of the same in such manner and by such means as will leave them unimpaired for future generation"

In comparison to national parks goal as recommended in the Leopold Report, "biotic association within each Park be maintained or where necessary recreated as nearly possible condition that prevailed", it is evident that, this recommendation talks about one component in conservation which can be summarized as "ecosystems / habitats restoration". It could have been expanded to include conservation of cultural components which are within the areas designated as national parks. Cultural components are one of the various kinds of visitors' attractions in the parks and may also be of educational / research value.

The current Committee's response to Leopold's report states the goal of National Parks System as "to steward NPS resources for continuous change that is not yet fully understood to preserve ecological integrity and cultural

and historical authenticity, provide visitors with transformative experiences and form the core of a national conservation land and sea scape". Having covered cultural and historical components as well as enjoyment of visitors in the National Parks, this goal does not hint about what to do to prevent encroachment in the National Parks which may be caused by anthropological activities. In our experience as a country (Tanzania) we are currently facing a big problem of wildlife corridors and wildlife migrator routes encroachment which may lead to "genetic weakness" among the victims (i.e. wildlife species which could survive if allowed moving from one area to another).

All three goals, i.e. the mandate of TANAPA, a goal as suggested by Leopold and the response from the current American NPS, do not mention about provision of conservation education which at present seems to be a key component in conservation of national parks in the world.

The Revisiting Leopold policies match those of TANAPA however, they could be improved to include the permission of human interference in resolving some ecosystem problems; for example, because of climate change which affect the national parks as well, TANAPA has a policy of artificially providing water for the wildlife in some of its national parks. Another sort of human interference is provision of veterinary services to wildlife in case of diseases outbreaks in or adjacent to the parks.

Because of their pristine condition, national parks of Tanzania serve as living laboratories which are conducive for conducting scientific researches which provides useful information for adaptive management. Sharing of conservation information with other conservation organizations outside the country is vital tool in improving management of the Parks in the country. TANAPA is thus in the process of establishing a 'sister ship' approach with protected areas of a similar nature with a respective counterpart in Tanzania.

In the reviewed Leopold report, the role of science has been given higher consideration as the only requirement in implementation of NPS's goals and policies. However, in the context of Tanzania as a country, conservation goals and policies will be best implemented if the conflicting laws / policies across the ministries could be resolved; conservation experts were given opportunities (not be interfered) to accomplish their respective responsibilities; the local communities be well equipped with conservation education and the importance of conservation in provision of ecosystem services such climate regulations and others.

CONCLUSION

In conclusion, the reviewed goals and policies by the current NPS Committee do not differ largely with TANAPA's. The focuses are the same, emphasizing preservation of ecological integrity, cultural and historical authenticity as well as providing spectacular or transformative visitors' experiences.

Sharing of information with regard to conservation is of vital importance as it may be a way of solving several conservation challenges especially the ones brought about by the climate change. Adaption and use of new technology in enhancing conservation is of enormous importance as it may help cut operational costs especially in protection of resources in the Tanzania National Parks and other protected areas. Currently, TANAPA has embarked on e-management including use of Geographical Information System (GIS) in various management and conservation matters.

Despite all these good policies and goals, the national parks of Tanzania face a number of challenges some of which are caused by conflicting policies; for example, some parks are facing serious water problems especially during dry seasons. The conflict here is agriculture for human food and availability of water for wildlife (conservation purpose).

It could be of great assistance if there would be coordinated global efforts in matters relating to conservation. For example, without considering political boundaries, conservation laws, goals and policies could be synchronized. This would help to solve a lot challenges including poaching of elephants and rhino in Tanzania.

Aerial view of peat bog, Oulanka National Park, Finland © Wild Wonders of Europe /Widstrand / WWF

'REVISITING LEOPOLD': A EUROPEAN PERSPECTIVE

Rauno Väisänen, Director

Parks & Wildlife Finland (Metsähallitus)

The conservation world owes a lot to the United States for inventing the superb concept of a national park, 'America's best idea'. In Europe, the idea was promoted by the Finnish explorer Adolf Erik Nordenskiöld who made a proposal to establish national parks in Nordic countries in 1880. The first European national parks were established in Sweden in 1909. In the 1960s and 1970s, several leading Finnish conservationists visited the United States and studied there so that the basic ideas of the *Leopold Report* were rooted deeply in the national mainstream thinking of park managers.

Thanks to such a long common history and continuing interaction, the over-arching goal of NPS resource management outlined in the updated and revised report is easy to agree with. It does not contradict any of our policies or practices, which is not surprising since the basic goal of the management of national parks should be clear and permanent. It takes into account the new results of scientific studies emphasizing continuous change, cooperation and the need of system level management. It is easy to accept the report in Northern European countries where the American 'wilderness-like' national park concept is prevailing, whereas in UK and Central and Southern Europe the situation may be different due to strong human impact in the parks. The report also covers those conditions better than the original *Leopold Report* by involving cultural and historical authenticity in the over-arching goal.

However, what I felt was missing from the report was an approach dealing with the prioritization and the optimal allocation of the limited human and monetary resources for scientific research and resource management. In particular:

- It would be useful to be clear about what is needed for the urgent management needs of parks, and what can contribute to the understanding of the 'not yet fully understood concept of continuous change.

- In regard to management needs, it would be good to know how to integrate the use of scientific tools and methods in everyday parks management.

- It is also important to think about which information needs are sensibly fulfilled by the parks agencies themselves by hiring scientists, and where it is wise just to rely on the cooperation with academia in order to guarantee high scientific quality. A standing advisory panel may be helpful for a parks agency, but the money may be better-used by organizing scientific *ad hoc* events for specific purposes when needed. The scientific results are often not so strictly site-specific that they could not be generalized to the conditions in other countries. Relevant scientific information and best practices in park management should be readily available for all parks. In fact, some of the biggest bottlenecks may be in the lack of concerted actions to identify global research needs, and to globally deliver the results in an understandable form to parks practitioners rapidly enough.

Even though the revised report focuses on natural and cultural resources, I feel that the scope is somewhat too limited to natural sciences. In order to be successful in our actions, we should also know much more about the development of the other sectors of the society. How the behaviour of customers and visitors will change? How traffic, transportation and energy consumption will change? How the development of new technologies will affect the society and individual visitors, and further impact our parks? Just think about the development of Internet and the availability of huge amounts of increasingly open and accurate information. What kind of new stress, threats and opportunities for parks management will be caused by all those changes in other sectors and outside the parks? We need strategic foresight and thus both an out-of-the-box approach and relevant results from the social, economic and engineering research. This is especially crucial when we think about the increasing fragmentation of the nature and the lacking connectivity of the existing protected areas.

In Europe, Natura 2000 is the first and only regional biodiversity protected area approach in the world (Crofts, 2014), including a large number of national parks and providing another science-based view on natural resource stewardship. It emphasizes the natural values of the protected areas, their species and habitats and the maintenance of ecological quality in requiring the achievement of favourable conservation status. This approach to develop a coherent European ecological network of special areas of conservation is quite similar to that of maintaining ecological integrity, and to a lesser degree, of cultural authenticity. Natura 2000 has proved to be a great conservation success due to its transnational, regional approach, use of scientific data and its legally binding mechanisms. It has also facilitated fund-raising for conservation projects in parks, and maybe even more importantly, it has involved many new stakeholders, facilitated the use of a wider landscape approach, and built a wider constituency for conservation.

Supported by the encouraging experiences from Natura 2000 and the common environmental policy of the European Union, my last point is that we should emphasize both nationally and internationally the need of a system-level approach. Considering resource stewardship for both protected areas and the wider landscape (and seascape), instead of the more common individual park-level approach, protected areas can ensure effective use of scarce resources and the support of citizens and politicians. In spite of the fact that there is no formal global network of parks, parks agencies and managers can work together successfully by applying similar goals. The goals of the resource management of the US national parks system are feasible and worth considering in other countries and regions. The *Revisiting Leopold* report in appreciating the former work and using new knowledge is a welcome opening of discussion not only as regards to the national parks of the United States, but also in a global perspective. And, global the perspective should be!

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Overpasses to create ecosystem connectivity and reduce human wildlife conflicts (collisions) © Parks Canada

PARKS CANADA COMMENTS ON THE 'REVISITING LEOPOLD' REPORT

Alan Latourelle, CEO

Parks Canada Agency

INTRODUCTION

In our rapidly transforming world, the "Revisiting Leopold: Resource Stewardship in the National Parks" report provides a reflection of the need for a new approach to policy, planning, and management of resources to confront the widespread, complex, accelerating, and volatile changes and challenges facing the National Park Service (NPS), and protected area agencies worldwide. The report has opened opportunities to re-vision, and to identify ways to achieve the greatest conservation gains for natural and cultural heritage for the people of America through their national park system.

Most of the challenges identified in this report have a striking similarity with those we are grappling with at Parks Canada, the Agency mandated, on behalf of the people of Canada, to protect and present nationally significant examples of Canada's natural and cultural heritage, and to foster public understanding, appreciation and enjoyment in ways that ensure the ecological and commemorative integrity of these places for present and future generations (Parks Canada, 2000).

The Parks Canada Agency (PCA) manages Canada's heritage places comprising national parks, national historic sites and national marine conservation areas. The Rouge Urban National Park is being established and will create a new category of federally protected area in the Greater Toronto Area. It is within easy reach of 20 per cent of the Canadian population.

As in the USA, managing protected areas in Canada is becoming more challenging due to increasing threats from invasive species, wildlife diseases, pollution, fragmented habitats, changing land use and climate change. In addition, the Canadian society is becoming more diverse, urban, and technologically oriented, with people increasingly not being as connected with nature and history due to changing lifestyles, value systems, leisure patterns and economic trends (Jager, 2010).

The *Revisiting Leopold Report* addresses three issues: 1) what the goals of resource management in the US National Park System should be; 2) the policies for resource management necessary to achieve these goals; and 3) the actions required to implement these policies.

This review looks at some of the issues raised in the report, the recommendations made to the NPS and, where applicable, provides comments on how PCA has addressed similar issues.

PARKS CANADA AND THE NATIONAL PARKS SERVICE

In reviewing the issues and recommendations of the Revisiting Leopold Report, I must state that the NPS and PCA have a unique relationship: a partnership forged by shared geography, comparable mandates and challenges, similar values, and deep conservation ties. This partnership leads to joint initiatives including the protection of transboundary ecosystems and protected areas such as Waterton-Glacier National Parks, and Kluane / Wrangell-St. Elias / Glacier Bay / Tatshenshini-Alsek system, two UNESCO World Heritage Sites that protect the largest non-polar icefield in the world and contain examples of some of the world's longest and most spectacular glaciers.

RESOURCE MANAGEMENT GOALS

The Report identifies the overarching goal for park resource management as "to steward NPS resources for continuous change that is not yet fully understood, in order to preserve ecological integrity and cultural and historical authenticity, provide visitors with transformative experiences, and form the core of a national conservation land- and seascape". This goal resonates with Parks Canada mandate, vision and strategic outcome. The need to manage for change is reflected in Parks Canada's definition of ecological integrity, which recognizes that ecosystems have dynamic elements that change in time and space. Further, the Revisiting Leopold Report observes that many if not most parks include both natural and cultural resources, and recommends that the management of these resources must occur simultaneously and, in general, interdependently. This approach recognizes that the wildlife, the wetlands, lakes and rivers, and the forests, grasslands and tundra – the entire protected landscape and its components has both natural and cultural values.

In the past 30 years, Parks Canada has moved towards incorporating the broad spectrum of Canadian values related to nature and culture in the establishment and management of national parks and other heritage places. In a historic event, the government signed an agreement with the Inuvialuit people of Yukon in 1984 to establish Ivvavik NP and laid out the structure for an enduring co-operative conservation regime composed of joint Inuvialuit and government management committees. This co-operative management team draw on both scientific and traditional knowledge, benefiting from Inuvialuit skills and knowledge accumulated over thousands of years. The result is a cooperative management system that protects both Inuvialuit subsistence and cultural practices, and the ecological integrity (EI) of the park. Since then, 12 parks have been established and managed under similar arrangements. Recently, the Agency has worked with the Dehcho First Nation and other partners to expand six fold the Nahanni NPR and with the Naha Dehé to establish Nááts'ihch'oh NPR, further increasing the area protected within the Nahanni ecosystem seven-fold. Working closely with Aboriginal people and other groups, we have taken action that will result in a 58 per cent increase in the land we manage since 2006.

To facilitate, enhance and broaden the role of Aboriginal partners in natural and cultural resource management, Parks Canada established the Aboriginal Secretariat in 1999. Reporting directly to the CEO of the Agency, the Secretariat promotes the development of meaningful relationships with Aboriginal communities and ensures that traditional knowledge and voices inform all aspects of resource management (Langdon at al., 2010).

The *Revisiting Leopold Report* observes that the 21st century conservation challenges require an expansion in the spatial, temporal, and social scales of resource stewardship, and recommends that NPS management strategies should be expanded to encompass a geographic scope beyond park boundaries. This recommendation echoes a similar realisation that the protection and enhancement of biodiversity and ecosystems in national parks in Canada are dependent on conservation and stewardship actions, including on working landscapes and seascapes. This approach requires the support and co-operation of diverse partners. Parks Canada realizes that the challenge of safeguarding part of what defines us as Canadians, our nature, our cultural heritage, our protected lands and wild places, will not be achieved by any single agency. Consequently, Parks Canada works closely with surrounding land owners, Aboriginal communities, local and regional governments, and other partners to promote conservation at landscape levels.

Aware that it is not possible to protect every significant natural or cultural feature within the protected area system, the Government of Canada has developed a National Parks System Plan to guide the identification and establishment of a representative system of national parks that includes examples of Canada's 39 distinct natural regions (Parks Canada, 2009). Using this framework, Parks Canada has established 44 national parks covering an area of 306,706 km^2 and representing 28 of Canada's 39 terrestrial regions. Efforts to create parks in the unrepresented natural regions are on-going, and there are prospects for a significant addition in the coming years.

Reintroduction of bison in Grasslands NP © Parks Canada

RESOURCE MANAGEMENT POLICIES

With regard to policy, the *Revisiting Leopold Report* recommends that the preservation of EI and cultural and historical authenticity be the central NPS resource policy for resource management, and to have these terms clearly defined in policy. This is a road that Parks Canada has trended. Both EI of national parks and commemorative integrity of national historic sites are embedded in the Agency mandate, policy and legislation. EI, for example, was introduced in the Canada's national park policy in 1979 and into the *Canadian National Parks Act* in 1988 to legally require "maintenance of EI through the protection of natural resources" be Parks Canada's first priority when considering park zoning and visitor use in a management plan (Government of Canada, 1988). In 2000, the *Canadian National Parks Act* was amended to make maintenance or restoration of EI through the protection of natural resources and natural processes the first priority of Parks Canada when considering all aspects of the management of national parks (Parks Canada, 2000b). EI was legally defined in the *Act* in a manner that made the concept useful to scientists and managers, applicable to field situation, and rooted in scientific understanding of ecology.

The *Revisiting Leopold Report* recommendation for the preservation of EI should go beyond preservation of EI to include its restoration in order to compel managers to take action to restore degraded areas and to re-establish the ecological values of impaired ecosystems. Parks Canada has embarked on the most aggressive ecological restoration programme in its history; managing invasive species, helping the recovery of endangered species, restoring damaged habitats, managing wildlife diseases, increasing ecological connectivity, reintroducing the role of fire in ecosystems, managing the impacts of hyperabundant wildlife populations, and reintroducing native species. For example, after a 120-year absence from the prairies, the plains bison was reintroduced to Grassland National Park in 2006, restoring the grazing process to the grassland ecosystem and enabling Canadians to once again have the opportunity to view these symbols of the wild prairie. Similarly, the black-footed ferret, once considered North America's rarest mammal, was reintroduced to Grasslands National Park in 2010 after being extinct in Canada for 70 years. Recent examples of ecological restoration initiatives have been documented in a series of publications (Parks Canada, 2005; 2008; 2013). From these experiences, Parks Canada pioneered the development of *Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Areas* (Parks Canada, 2008) and led in the development of the IUCN's *Ecological Restoration for Protected Areas: Principles, Guidelines, and Best Practices* (Keenleyside at al., 2012).

Another issue highlighted in the *Revisiting Leopold Report* is the need to make national parks relevant to the American people. The PCA is also faced with the challenge of remaining relevant to Canadians in a changing social, cultural, economic and demographic context. Scientific research has shown that experiencing national parks through visitation is a powerful way of inspiring, engaging, and connecting people to these amazing places, and ensuring support for their long term protection (Parks Canada, 2010). The question for Parks Canada as it strives to be more relevant to Canadians is how to integrate its mandate into decisions that allow Canadians to see themselves in these special places; to enhance their appreciation of their natural and cultural heritage; to inspire them to see the world around them with new eyes; to connect with nature and the cultural stories of place; to embrace the values of protected areas; to participate in a range of activities from canoeing to photography; and to discover how nature looks, feels and smells. We are also promoting protected areas as natural solutions to societal challenges, demonstrating their role in climate change adaptation, in food security, in social and economic development, as areas that can provide Canadians with spiritual inspiration and physical renewal, serve as centres for research; and as areas that provide ecological services such as nutrient cycling, clean water, flood control, fish spawning grounds, pollination and natural pest control.

The importance of enhancing the relevance of protected areas led Parks Canada, along with many partners, to carry out this mission globally. Its motion that called on the IUCN conservation community to strengthen its commitment to connecting people with nature was adopted as an IUCN Resolution at the 2012 IUCN World Conservation Congress. As a follow-up, Parks Canada is leading a Stream during the 2014 World Parks Congress that aims at empowering the growth of an enduring global initiative for a new generation to experience, connect with, be inspired by, value, and conserve nature.

RESOURCE MANAGEMENT ACTIONS

The actions proposed for implementing policies include to "undertake a major, systematic, and comprehensive review of NPS policies" to align them with the goals for resource management. A key strategy to implement the resource management goals and policies, according to the *Revisiting Leopold Report*, is to "significantly expand the role of science in the Agency by investing in scientific capacity, establishing a standing Science Advisory Board, and to require NPS professionals, and especially park superintendents, to possess and maintain significant scientific literacy". Parks Canada equally recognizes the role of science in resource management, and requires management decisions to be made using the best available science. However, science in Parks Canada is used in an inclusive sense, and includes natural, social and archaeological sciences. Science in Parks Canada is also needed to help raise public awareness and appreciation, achieve conservation gains, and connect or re-connect Canadians to their heritage places. In addition, the Agency places high value on the role of Aboriginal and community experiential knowledge in providing valuable information on historic and current ecosystem conditions, and long-term human ecological interactions stemming from generations of land stewardship.

In addition to science capacity (in its broadest sense), Parks Canada has found that the incorporation of traditional or community experiential knowledge, a strong ecological monitoring and reporting system and an adaptive management approach have been key to advancing the conservation of natural and cultural resources in national parks. In addition to scientists, the views of diverse constituents representing the face of America should be sought during policy review, and incorporated in the revised policies.

It is important to accept that maintaining parks forever "unimpaired for future generations" will remain a daunting challenge. Implicit in managing for change is an understanding that an "unimpaired" state may no longer be realistic or achievable in many national parks. The *Revisiting Leopold Report* itself seems captive to the traditional resource management approach. It calls upon the NPS to develop policies that "formally embrace the need to manage for change" and in the same sentence states "and to the maximum extent possible to maintain or increase current restrictions on impairment of park resources".

We have come to understand that the future of conservation and the health of our planet depend on the way we can act together to produce and manage change. Protection and conservation of natural areas must be about new approaches. It is less about protecting the past and more about protecting the future. With this understanding, we can develop policies and take actions that will help us leave our children a legacy of healthy, vibrant ecosystems and protected habitats, and inspire a new generation of conservation leaders. We can bequeath to them not only the indispensable ecological benefits of iconic native wildlife and clean water, but also magnificent natural and cultural landscapes to experience.

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DEVELOPING A MONITORING PROGRAMME FOR MAMMALS IN HIMALAYAN PROTECTED AREAS: A CASE STUDY FROM KHANGCHENDZONGA NATIONAL PARK AND BIOSPHERE RESERVE, SIKKIM, INDIA

Sambandam Sathyakumar*[1], Tapajit Bhattacharya[1], Tawqir Bashir[1] and Kamal Poudyal[1]

* Corresponding author Email: ssk@wii.gov.in
[1] Wildlife Institute of India, Dehradun, India

ABSTRACT

We tested the applicability of wildlife field techniques such as trail monitoring, scan counts, camera trapping and dung counts in Khangchendzonga National Park (NP) and Biosphere Reserve (BR) in Sikkim, India, during 2008-2012 to develop appropriate monitoring programmes for mammals. In total, 42 species of mammals were confirmed in the Khangchendzonga NP and BR out of which 40 species were confirmed through visual encounters, photo-captures and signs. Camera trapping was found to be the most applicable field method for all carnivores and solitary ungulates. For snow leopard (*Panthera uncia*) populations, to detect 10 per cent annual decline with 70 per cent power, 800 effective camera days per year would be required for seven years. To detect desired percentages of annual decline/increase in mammal population with significant power, the required effort and time period were estimated as Rs. 3,067,000 (US$ 51,116) for a period of about 10 to 15 years. The most important habitats for the threatened carnivores and their prey in the Khangchendzonga have been identified. Regular monitoring of the most suitable habitats and strict patrolling of the condition of the alpine and *Krummholdz* zone can effectively reduce the negative effects of current anthropogenic activities such as unsupervised livestock grazing and unsustainable resource extraction for local use.

Key words: Khangchendzonga, India, monitoring, mammals, camera trapping

INTRODUCTION

For effective wildlife management, prior knowledge of species diversity, distribution and abundance is essential, so as to detect significant changes and thus appropriate management interventions. Efficient and reliable methods are required for monitoring changes in species abundance in protected areas. In the Himalayas, due to the remote and rugged high altitude terrain, monitoring of species is often a challenge for wildlife managers. In the Greater Himalaya, in particular, where road connectivity and other essential logistic support is minimal inside protected areas, monitoring of any animal population is difficult and thus monitoring programmes tend to be lacking. This paucity is apparent all over the Greater Himalayan range, including protected areas in India, Nepal and Bhutan. This case study helps fill this gap by assessing the requirements of an effective monitoring protocol for Himalayan protected areas in the context of Khangchendzonga National Park (NP) and Biosphere Reserve (BR).

The sacred mountain of Khangchendzonga (8,586 m) presides over the physiography of Sikkim, a small mountainous State in India that is wedged in between the Himalayan nations of Nepal in the west, Bhutan in the east, the Tibetan Plateau in the north and the Darjeeling District of West Bengal State in the south. In the eastern Himalaya, Khangchendzonga is positioned at the convergence of three biogeographic realms, viz., Palaearctic, Africo-tropical and Indo-Malayan (Mani, 1974) and thus provides a variety of habitats resulting in high biodiversity in the region. This area is recognised as a global biodiversity hotspot (Mittermeier et al., 2004; Myers et al., 2000) and is also one of the important Global 200 Ecoregions (Olson & Dinerstein, 1998).

The Khangchendzonga National Park (NP) and Biosphere Reserve (BR) is an important addition to the wildlife protected area network of India; it is the country's highest and the world's third highest protected area. It is an important high altitude wildlife landscape

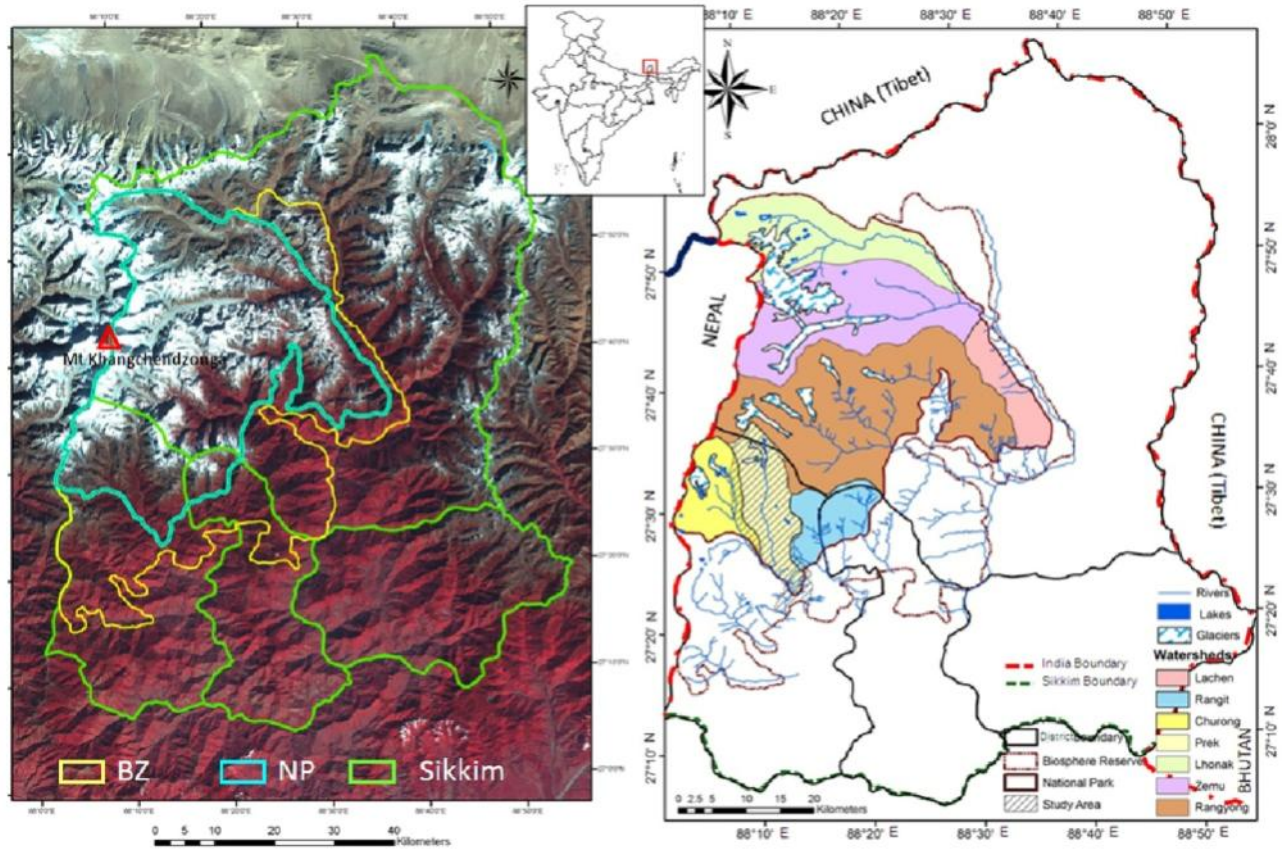


Figure 1. Geographic location of Khangchendzonga BR in Sikkim.
Left: Boundary of Khangchendzonga BR overlaid on False Colour Composite LANDSAT imagery. Right: Different watersheds in Khangchendzonga BR and *Prek chu* watershed as the study area

covering about 37 per cent of the State's biogeographic area and encompassing varying eco-zones from sub-tropical to arctic with an altitudinal range of between 1,200 to 8,586 m. In spite of such rich biodiversity, there have been only a few ecological studies and surveys on the mammals of the Khangchendzonga NP and BR (Sathyakumar et al., 2011; Bhattacharya et al., 2010, 2012; Bashir et al., 2013a, b, c).

Over the last 15 years, the Khangchendzonga NP and BR experienced several policy level changes and modifications (such as eviction of yak herders from inside the NP in Western part of Khangchendzonga NP) which may have altered the livelihood practices of the local communities (traditional livestock herding to eco-tourism initiatives) and have also changed the habitat status of wild animals (Tambe & Rawat, 2009). Findings of recent landscape-level remote sensing studies in Khangchendzonga BR (Tambe et al., 2012) revealed that, for the long-term security of this unique mountain landscape, the park management need to evolve innovative co-management models, take adequate safeguards for vulnerable habitats, strengthen buffer zone management and focus conservation measures on high impact areas. Monitoring wildlife species in the area would be useful to detect overall management effectiveness as many species are excellent indicators of habitat quality and management interventions.

Keeping these issues in mind, a research team from the Wildlife Institute of India collected baseline information on the mammalian assemblage of Khangchendzonga NP and BR including information on species distributions, habitat use and threats through conventional field sampling methods and by use of non-invasive remote camera trapping (Sathyakumar et al., 2011, 2014). We tested various wildlife field survey and monitoring methods and developed a monitoring programme for the mammals of Khangchendzonga NP and BR.

In this paper, we present the findings on the various monitoring methods, their applicability to different mammal species, monitoring frequency to detect significant changes in mammal populations and the costs for implementing the monitoring protocols in Khangchendzonga landscape.

STUDY AREA

The Khangchendzonga NP and BR is located in the State of Sikkim. According to the Biogeographic Classification of India (Rodgers et al., 2000), this region comes under 2C: Central Himalaya and adjoins the Himalayan regions

of Nepal, Chumbi Valley and Bhutan, and the large expanse of the Trans-Himalayan regions in the north (Figure 1A). The Khangchendzonga NP and BR is connected to the adjacent Khangchendzonga Conservation Area in eastern Nepal, Barsey and Maenam Wildlife Sanctuaries in Sikkim and Singalila BR in Darjeeling district of West Bengal; there are also a number of conservation corridors (Tambe, 2007). The Khangchendzonga BR covers an area of 2,619.92 km², of which the NP (core zone) covers an area of 1,784 km² and the buffer zone covers an area of 836 km². The Singalila range separates Sikkim from Nepal and forms the western border of Khangchendzonga NP and BR. The varying elevations within an aerial distance of just 42 km, with about 90 per cent area above 3,000 m and 70 per cent above 4,000 m, make this park a unique global natural heritage hotspot. The entire landscape is enormously rich in biodiversity, highly important as hydrological, environmental and recreational resources and also represents a unique amalgamation of different cultures of several ethnic communities along with their traditional livelihood practices. A recent emphasis on community based ecotourism in selected parts of Khangchendzonga BR is currently bringing prosperity to these ethnic people (Tambe, 2007).

The area of Khangchendzonga BR has been divided into seven watersheds or river subsystems viz., *Lhonak* (15 per cent), *Zemu* (23 per cent), *Lachen* (5 per cent), *Rangyong* (36 per cent), *Rangit* (6 per cent), *Prek* (8 per cent) and *Churong* (7 per cent). In this study, *Prek chu* (27°21' - 27° 37'N, 88° 12' -- 88° 17'E) (*chu* = river) catchment area (182 km²) was selected as the intensive study area (Figure 1B) because it represents all the habitat characteristics of Khangchendzonga BR (Sathyakumar et al., 2011). Surveys were also carried out in *Lhonak*, *Zemu*, *Lachen* and *Churong* watersheds. The *Prek chu* watershed was divided into six habitat classes, *viz.*, mixed sub-tropical (1 per cent), mixed temperate (16 per cent), sub-alpine (36 per cent), alpine pastures (5 per cent), rock and snow cover (41 per cent) and water bodies (1 per cent). The watershed has a typical oceanic climate with an average annual rainfall of around 2,230 mm (Tambe, 2007).

METHODS

The study was conducted from 2008 to 2012. Due to the topography and remoteness of the area all field activities were carried out in the form of field expeditions i.e., camping in different areas of the *Prek chu* watershed. One field survey was usually of 7-8 days and all the sampling units were replicated and monitored after every 7-10 days. Reconnaissance surveys were carried out in the early months of the study period in the five watersheds (*Churong*, *Lachen*, *Zemu*, *Lhonak* and *Prek*) of the Khangchendzonga BR. This was followed by application of some conventional sampling methods for the assessment of mammalian fauna (distribution and relative abundance) depending on the feasibility of the terrain.

Trail sampling and sign surveys

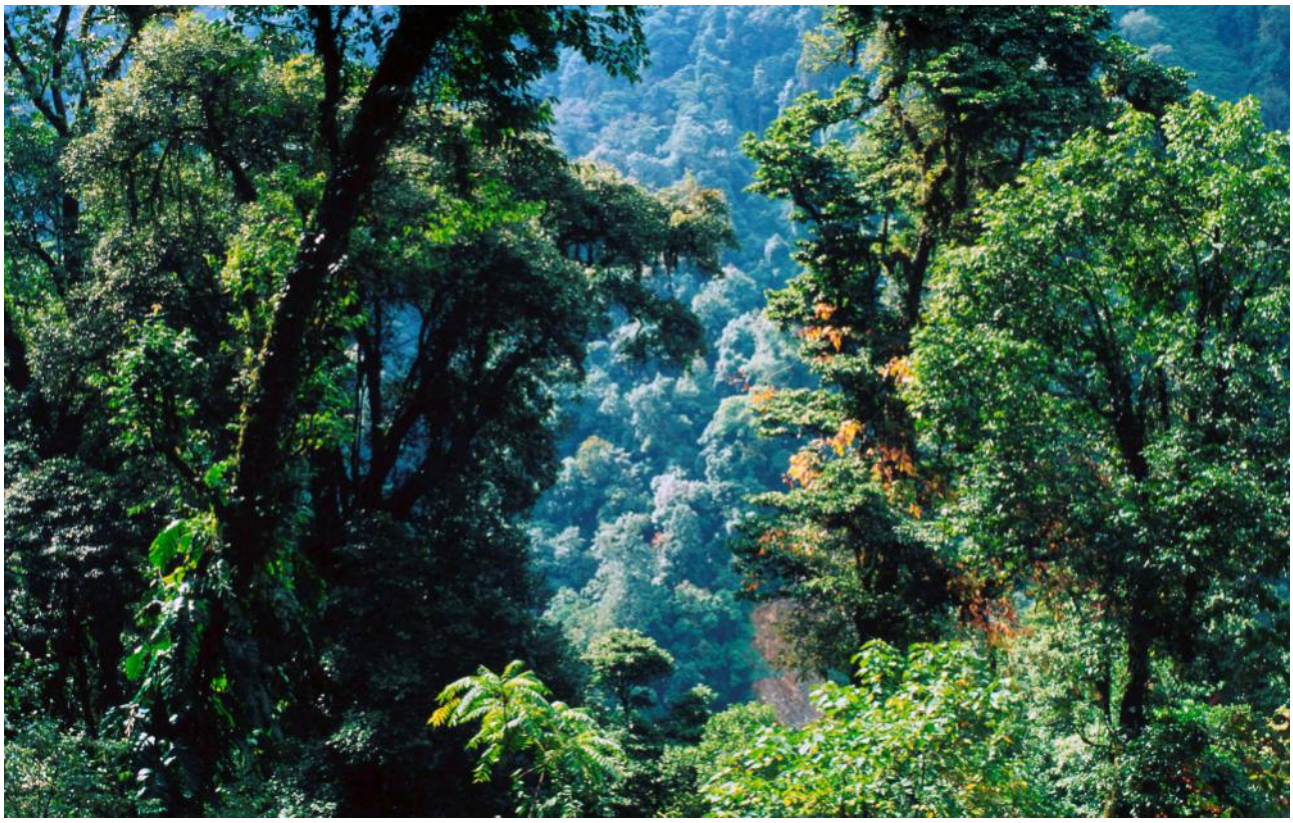
Trail sampling was used for detection of mammals in different habitats of the study area. These trails were identified with slight modification from conventional transects (Burnham et al., 1981) for Himalayan terrain (Sathyakumar, 1994; Vinod & Sathyakumar, 1999). Scan sampling, ridge walking (Bhatnagar, 1993; Green, 1978; Sathyakumar, 1994, 2004) and sign surveys along trails, ridges, *nullahs* (streams) and transects (Bennett et al., 1940; Chundawat, 1992; Fox et al., 1988; Rodgers, 1991; Sathyakumar, 1994) were also carried out. Trail sampling (n= 22; 1.5 to 7 km) within the intensive study area was repeated (784 walks), and sign surveys were carried out once a month for the intensive study area (32 surveys). Trail sampling and sign surveys were carried out once in each of the other four watersheds.

Scanning method

Scanning (Green, 1978; Sathyakumar, 1993, 1994, 2004; Bhatnagar, 1997; Kittur et al., 2010) from three vantage points (104 repeats) in *Prek chu* catchment area was carried out to detect mountain ungulates in the alpine areas. This technique involves careful scanning from vantage points using spotting scope and/or binoculars (8 × 40) for a specified period of time. The scanning was done between 0600h to 0900h and 1500h to 1800h. Scan duration varied from one to three hours, depending on the weather conditions.

Camera trapping

The map of the intensive study area was divided into 4 km² blocks using Geographic Information System (GIS) (ARC GIS 9.1). For simplicity, the area was categorised into three different survey zones according to the habitats, viz., temperate (1200–3000 m), sub-alpine (3000–4000 m) and alpine (above 4000 m) and the camera traps were deployed corresponding to the area coverage of the survey zones and their accessibility (10 blocks in temperate, 12 blocks in subalpine and 16 blocks in alpine). Twenty-seven camera traps were deployed at 71 sites in 38 blocks. The camera trapping was done continuously in all seasons (winter: January–March; spring: April–May; summer: June–September; autumn: October–December). Among the 71 camera locations, at 25 locations cameras stopped working within five days



The forest at approximately 3000 meters in Khangchendzonga National Park, Sikkim © Neyret & Benastar / WWF-Canon

due to malfunctioning or human interference. A total of 6,910 effective camera days effort was obtained from the remaining 46 locations from 2009-2011. Since the study species were rare and the area vast, the strategy was to survey more sampling units less intensively rather than less sampling units more intensively (Mackenzie & Royle, 2005). Monitoring of camera traps was done at least twice a month which included changing the batteries and memory card. In *Lhonak chu* catchment area, camera trapping was carried out in 2012, for one month.

Dung counts

Dung counts were used for estimation of dung density of mountain ungulates in the study area. Dung is a reliable indicator of animal presence and abundance in an area. Estimating dung density of an ungulate species in a habitat is an indirect way to know about its abundance or density (Bennett et al., 1940; Rodgers, 1991; Sathyakumar, 1994). The dung counts were made within a 20 × 2 m belt transect laid at every 100 m interval along the trails. For every trail, wherever possible, the dung plots were nested within the 10 m ´10 m plots laid for vegetation cover estimation. This gave a total of 337 plots. Specifically, power is defined as $(1 - \beta)$ where β is the probability of wrongly accepting a null hypothesis when it is actually false (Type II errors; Gerrodette, 1987; Fairweather, 1991). Increasing power creates a trade off against the possibility of a Type I error (i.e. saying a trend exists [$P = \alpha$] when it does not). Setting conservative α levels ($p < 0.05$) lowers the power to detect trends, but guards against wrongly alerting managers to significant population declines, which might not exist.

MONITORING MAMMALS: DETECTION OF CHANGE AT DESIRED POWER LEVEL

The identification of statistically significant changes in animal populations can be problematic (Macdonald et al., 1998; Toms et al., 1999). Adequacy of monitoring programmes depends on interactions between sample sizes (number of counts), duration (years of monitoring), frequency of surveys, and the ability to control variability in counts because of other factors (e.g. weather).

Power is often expressed as a percentage. For example, if power = 90 per cent, this means the statistical power of the monitoring programme is 90 per cent to detect a population trend of a specified magnitude. In other words, this means a Type II error (failure to detect a biologically significant trend) will be avoided with a probability of 0.9. Monitoring programmes must aim to maximise accuracy and minimise the possibility of wrong conclusions being drawn about trends. Type II errors can be costly for conservation managers. If a significant decline in a threatened species is not identified, then the population may decline beyond a threshold where recovery is impossible. In contrast, if managers respond to a perceived decline that is not real (managing a species

that is not endangered), then resources may be wasted in the short term, but the 'false alarm' is likely to be recognised. If sample sizes and survey frequencies are insufficient, a monitoring programme will fail to provide the precision needed to detect population changes over time (Walsh et al., 2001).

Based on the findings of the base-line monitoring project we provide an example of applying power analysis to designing a long-term monitoring programme for mammals in the intricate eastern Himalayan habitats of Khangchendzonga NP and BR. To assess the efficiency of the mammal monitoring programme, power for several sampling designs were estimated with the use of the computer program MONITOR (Gibbs, 1995) based on the estimates of abundance and variance. To estimate abundance of the flagship species snow leopard, data from camera traps were used that had been collected over a five month period in 2011. To estimate abundance of blue sheep (*Pseudois nayaur*) (major prey of the snow leopard), the data from scan sampling were used which had been collected over the entire study period of three and a half years. To estimate relative abundance of two relatively abundant solitary mountain ungulates, such as goral (*Naemorhedus goral*) and barking deer (*Muntiacus muntjak)*, photo-captures obtained using camera traps were used.

For monitoring of snow leopard population, density (#/100 km^2) estimates and their variances using spatially explicit maximum likelihood method with respect to different sampling efforts (effective camera days/year) were used, powers were estimated (based on 500 simulations for two-tailed tests and for significance level (α) 0.05) for 4-15 years.

For monitoring of blue sheep population, powers were estimated (based on 500 simulations for two-tailed tests and for significance level (α) 0.05) for 10 years of surveys performed every year using 3-36 scan surveys/year (increasing the number of scan surveys by an order of three, for example: first set of analysis was carried out with the abundance estimate and variance derived from the data obtained in three surveys/year, next analysis was carried out with the abundance estimate and variance derived from data obtained in six surveys/year and so on up to 36 surveys/year).

For monitoring of goral and barking deer population using camera traps, different photo-capture rates and their variances with respect to different sampling efforts (effective camera trap days/year) were used (starting from 130 days/year to 1,300 days/year in case of goral and from 100 days/year to 600 days/year for barking deer). Powers were estimated (based on 500 simulations for two-tailed tests and for significance level (α) 0.05) for 4, 5, 6, 7, 8, 9 and 10 years.

Snow Leopard in Khangchendzonga NP - WII camera trap image © WII

IDENTIFICATION OF PRIORITY AREAS FOR HABITAT MONITORING AND CONSERVATION FOR THREATENED MAMMALS

Reliable information on the locations of animals is often difficult to acquire, either because they are rare or elusive (Buckland et al., 2000, 2005; Gu & Swihart, 2004; Vine et al., 2009; Paull et al., 2012). This scenario is a severe hindrance to conservation planning. Species distribution modelling is one way of confronting this deficiency of data; however, for many species, in particular those which are most threatened, there is basically inadequate primary information to perfectly predict their occurrence (Anderson et al., 2003; Engler et al., 2004; Pearson et al., 2007). The findings of the habitat suitability models aimed to fill this information gap at least at the Khangchendzonga NP and BR landscape scale (Sathyakumar et al., 2014). The habitat suitability models predicted several areas in Khangchendzonga NP and BR as suitable habitats (Suitability index: 60-100) for different mammals. Habitat suitability indices for these threatened carnivores and their prey in the study area (Snow leopard: Endangered; Asiatic black bear

Blue sheep in Khangchendzonga National Park © Tawqir Bashir

(*Ursus thibetanus*): Vulnerable; Golden cat (*Catopuma temminckii*): Near threatened; Large Indian civet (*Viverra zibetha)*: Near threatened; Musk deer (Moschus spp): Endangered; goral and serow (*Capricornis thar*): Near threatened (IUCN, 2012)) were combined and the mean values were extracted in a 1×1 km² grid basis for the entire Khangchendzonga NP and BR landscape for alpine and forest habitats. These mean values were further averaged for these species and multiplied by a conversion factor to derive an Important Habitat Index (from 0-100). The most suitable grids (Important Habitat Index 60-100) were identified and the nearest locations were also pointed.

RESULTS

In total, 42 species of mammals belonging to seven orders and 16 families were confirmed in the Khangchendzonga NP and BR out of which 40 species were confirmed through visual encounters, photo-captures, and signs (Sathyakumar et al., 2011). Of the 42 species recorded, 18 are of high global conservation significance, categorised as critically endangered (1), endangered (4), vulnerable (4) and near threatened (9) on the IUCN Red List (IUCN, 2010). A total of 21 species recorded are characteristically high altitude fauna, although some of them occur over a wide altitudinal range. For details of these species and their distributions in Khangchendzonga NP and BR, please refer to Sathyakumar et al. (2011).

A comparison of monitoring methods for different carnivores and ungulates in the intensive study area is presented in Tables 1 and 2. Camera trapping was found to be the most applicable field method for all carnivores and solitary ungulates especially goral and serow. Detections of wild dog (*Cuon alpinus*), golden cat, large Indian civet, Himalayan tahr (*Hemitragus jemlahicus*) and wild pig (*Sus scrofa*) were achieved only through camera trapping, this method can also be used to carry out presence-absence surveys for musk deer in Khangchendzonga NP and BR. Trail sampling detected barking deer, goral, serow and wild pig, however, the number of encounters were very few and hence may not be a very applicable method in the dense and inaccessible forests of the Eastern Himalaya.

Monitoring mammals: Detection of change at desired power level

The results of the analysis show dramatically different levels of required monitoring efforts to detect changes in populations. Identifying small changes (e.g. 5 per cent increase or decline) requires significant monitoring effort. However, the ability to detect slightly larger change (e.g. 10 per cent or more change in populations) can be achieved with significantly less monitoring effort and over shorter timeframes. For snow leopard population, to detect 5 per cent annual decline with 70 per cent power, 1,000 effective camera days in every year were the minimum sampling effort required for 13 years; and to detect 10 per cent annual decline with 70 per cent power, 800 effective camera days per year would be required for seven years (Figure 2).

For blue sheep, power to detect annual population declines of up to 10 per cent per year changed little when survey effort was increased from 21 surveys/year to 24 surveys/year or more (Figure 3). To detect annual 5 per cent decline in blue sheep population with 70 per cent power, 33 scans per year would be required for 10 consecutive years. However, to detect 10 per cent annual decline with the same power level of 70 per cent, only nine scans per year would be required (Figure 3).

For goral population, to detect 5 per cent annual decline with 70 per cent power, 390 effective camera days per year for nine years would be the minimum sampling

Table 1. Recommended methods for monitoring carnivores in Khangchendzonga BR

Carnivores	Sign survey	Camera trapping	Trail/Transect
Snow leopard	√	√	×
Golden cat	×	√	×
Leopard cat	×	√	×
Red fox	√	√	×
Wild dog	×	√	×
Yellow-throated marten (*Martes flavigula*)	√	√	√
Stone marten (*Martes foina*)	×	√	×
Siberian weasel (*Mustela sibirica*)	×	√	×
Pale weasel (*Mustela altaica*)	×	√	×
Black bear	√	√	×
Tibetan wolf (*Canis lupus chanco*)	√	√	×

Table 2. Recommended methods for monitoring ungulates in Khangchendzonga BR

Species	Sign survey	Camera trap	Trail sampling	Scanning
Barking deer	√	√	√	×
Goral	√	√	√	×
Serow	√	√	√	×
Himalayan tahr	×	√	×	×
Musk deer	√	√	×	×
Blue sheep	√	×	×	√
Wild pig	×	√	√	×

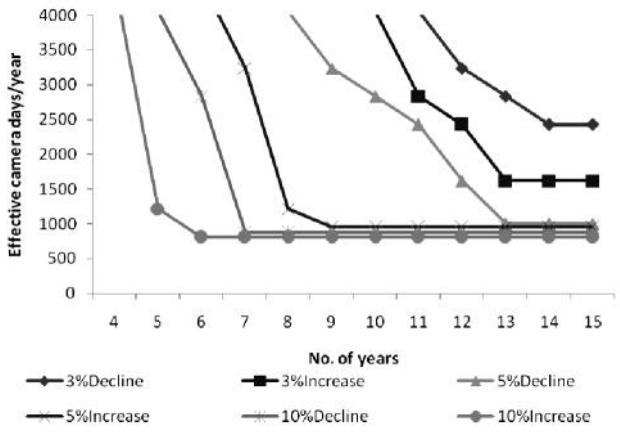


Figure 2. Relationship between number of years of monitoring and minimum sample size needed to achieve 70% power to detect existing changes of 10% per annum in snow leopard population in *Prek chu* catchment of Khangchendzonga BR (estimates based on two-tailed tests, α = 0.05 and 500 simulations)

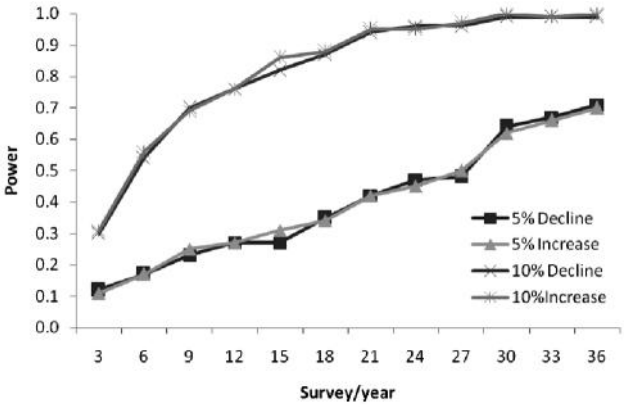


Figure 3. Estimated power to detect annual change (5 and 10%) in blue sheep abundance in *Prek chu* catchment of Khangchendzonga BR with different scanning efforts/year for 10 years (estimates based on two-tailed tests, α = 0.05 and 500 simulations)

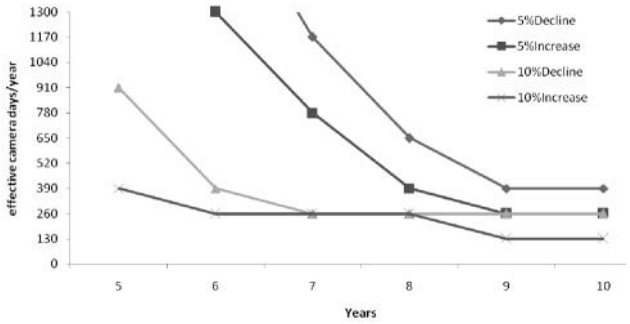


Figure 4. Relationship between number of years of monitoring and minimum sample size needed to achieve 70% power to detect existing changes of 10% per annum in goral population in *Prek chu* catchment of Khangchendzonga BR (estimates based on two-tailed tests, α = 0.05 and 500 simulations)

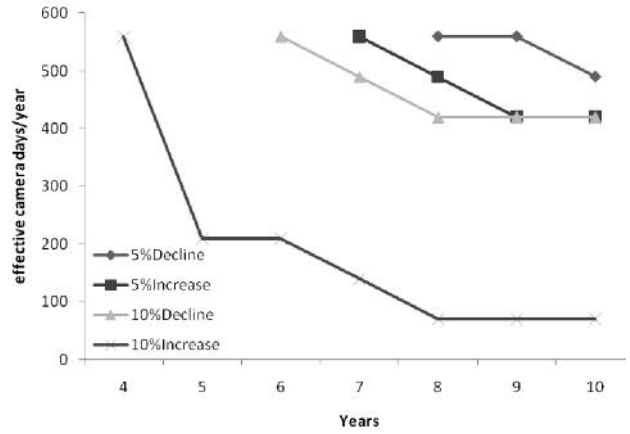


Figure 5. Relationship between number of years of monitoring and minimum sample size needed to achieve 70% power to detect existing changes of 10% per annum in barking deer population in *Prek chu* catchment of Khangchendzonga BR (estimates based on two-tailed tests, α = 0.05 and 500 simulations)

effort required; and to detect 10 per cent annual decline with 70 per cent power, 260 effective camera days per year would be required for seven years (Figure 4). For barking deer population, to detect 5 per cent annual decline with 70 per cent power, 500 effective camera days per year for 10 years would be the minimum required sampling effort. However, 10 per cent annual decline with the same power level could be detected with 400 effective camera days per year for eight years (Figure 5). Across all combinations of sampling effort and timing, for blue sheep, goral and barking deer, with power level of 70 per cent or above, effective detection of population increases could be achieved with less sampling efforts than the efforts required to detect population decline.

In the trans-Himalayan region, detection of Tibetan wolf packs was achieved both by sign survey and camera trapping; however, presence of red fox (*Vulpes vulpes*) was detected only through camera trapping. For gregarious ungulate such as blue sheep, the applicability of camera trapping was found to be limited as the complete group structure and composition could not be captured. Scanning from a vantage point was found to be the best applicable field method to monitor the blue sheep population in Khangchendzonga NP and BR. During the field work, only nine photo-captures of musk deer were obtained, however, pellet group count provided detection of 181 pellet groups of musk deer. As musk deer pellet groups are quite conspicuous in comparison with that of other ungulates, hence, along with camera trapping, this method can also be used to carry out presence-absence surveys for musk deer in Khangchendzonga NP and BR. Trail sampling detected barking deer, goral, serow and wild pig, however, the number of encounters were very few and hence may not be a very applicable method in the dense and inaccessible forests of the Eastern Himalaya.

DISCUSSION

Monitoring of ungulates in Khangchendzonga NP and BR

During the present study, all the field work was carried out in expedition mode, which involved camping in different parts of the intensive study area. For each expedition, the average expenditure was approximately Rs. 15,000/- (US$ 248 – Conversion rate 1 US$ = INR 60) including all the logistic expenses. On each expedition a maximum of three scan surveys could be carried out from different vantage points. If the initial cost of procurement of equipment is Rs. 50,000/- (US$ 827), then to achieve nine scan surveys/year for 10 years would incur a total cost of approximately Rs. 500,000/- (US$8,270). However, to detect 5 per cent annual decline in blue sheep population with 70 per cent power, at least 33 surveys would be required per year, and to achieve this the approximate expenses would be Rs. 1,700,000/- (US$ 28,125) in 10 years. In the case of barking deer and goral, 600-650 effective camera days per year would be required for eight years to detect 5 per cent annual decline with 70 per cent power. To achieve 600 effective camera days per year, deploying 10 cameras in the temperate and subalpine forests of the intensive study area for two months will be the most feasible option both in terms of logistics and inference. The cost of procuring ten camera traps and the required number of batteries may reach Rs. 107500/- (US$ 1,778). The experience of the present study indicates that camera traps will work efficiently for two and a half years if deployed for continuous monitoring. Thus, procurement of a new set of 10 cameras may become necessary after four years. Hence the total cost of camera trap procurement may reach Rs. 2 00,000/- (US$ 3,308) and the required cost

Wildlife Habitat in Khangchendzonga National Park © Tawqir Bashir

for batteries may reach Rs. 60,000/- (US$ 1,000) in eight years (Rs. 7,500/- [US$ 124] in each year). The cost of monitoring the cameras in each year may reach Rs. 30,000/- (US$ 500) (Rs. 15,000/- [US$ 250] per monitoring). In total, the monitoring of goral and barking deer population in the intensive study area using camera traps may cost up to Rs. 500,000/- (US$ 8,271) in eight years. Monitoring of snow leopard populations, will require more funds to achieve 800 effective trap days for 13 consecutive years. This would cost a total of Rs. 3,067,000 (US$ 51,116) for an implementation period of about 10 to 15 years.

Habitat monitoring and conservation of ungulates in Khangchendzonga NP and BR

For blue sheep conservation, the areas near *Goechela* and *Younglathak* were already identified as important conservation zones (Tambe, 2007). Similarly for musk deer, areas near *Relli* and *Aurelongchuk* were previously identified as conservation zones (Tambe, 2007). However, this study has indicated more areas suitable for threatened carnivores such as snow leopard and identified the grids most important for habitat monitoring. The grid-based approach will help to delineate the appropriate areas where the regular monitoring of habitats can be carried out. The identified grids in *Prek chu* catchment are situated adjacent to the *Yuksam-Dzongri* trekking trail which is a favourite destination for tourists worldwide. The impact of tourism on the habitat structure was studied for bird and butterfly communities (Chettri, 2000), however, the current position, after the enhancement of eco-tourism in this part of the protected area in the years 2004-2006, has not been assessed. The effect of tourism related extractive disturbances such as firewood extractionand pack animal grazing as well as the effect of non-degradable waste accumulation in these habitats should be assessed and monitored regularly.

In other watersheds apart from *Prek chu*, eco-tourism is still not the main livelihood option. In *Churong chu* watershed, the *Yambong* valley trek may have the engagement of local youth in eco-tourism, however, the magnitude of tourism is not currently comparable with *Prek chu*. In the northern part of Khangchendzonga BR, religious tourism in *Tolung gompa* is practised, however, the best habitats for ungulates in *Panchpokhri* areas are more or less untouched by tourists. Similarly the *Lachen-Thepala* area is only used by local people and has suitable habitats for Asiatic black bear, musk deer, serow and goral. Regular monitoring of habitats is thus needed mostly in the south western part of the Khangchendzonga BR. In the northern area, active participation of the villagers is necessary for monitoring.

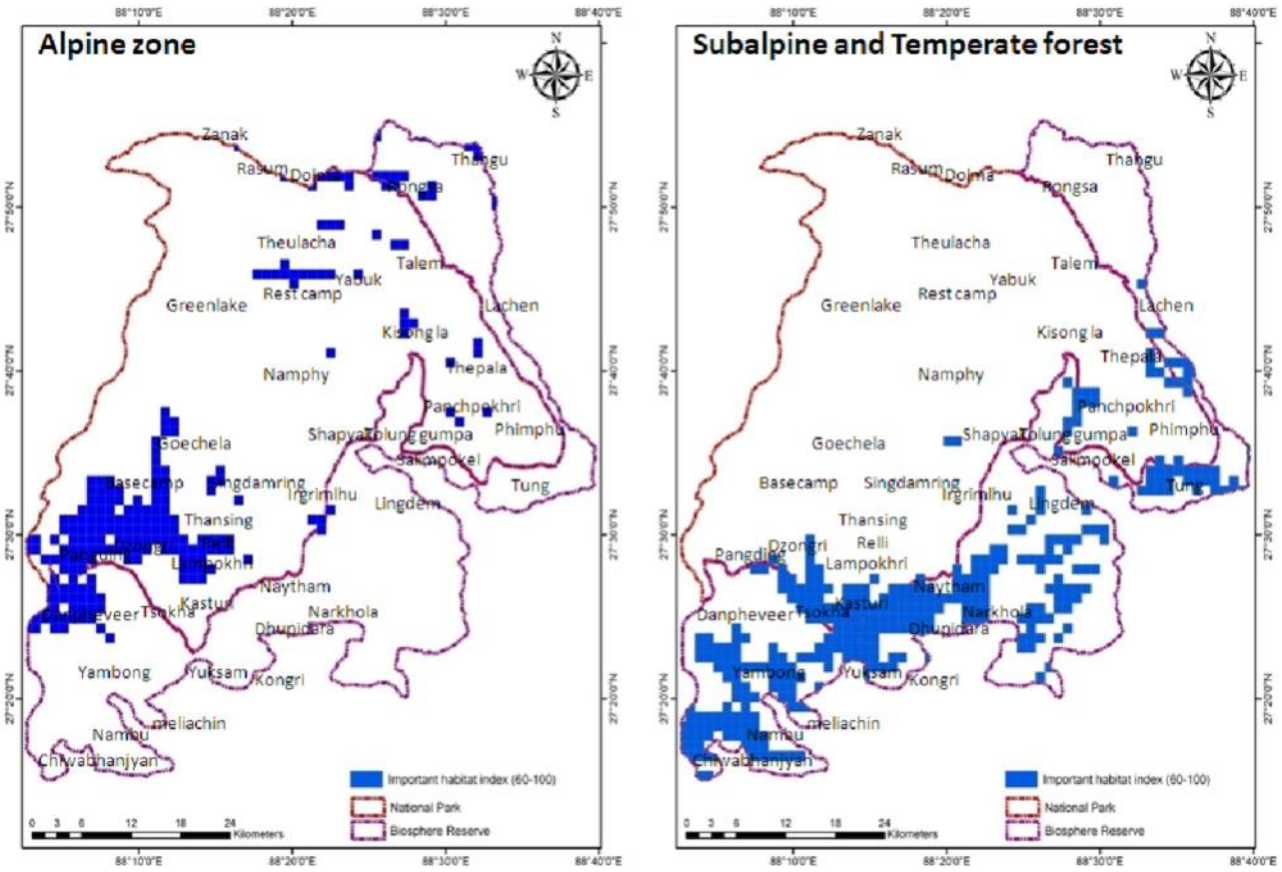


Figure 6. Identified 1×1 km^2 grids as most suitable habitats of threatened carnivores and their prey in alpine zone and in subalpine and temperate forest in Khangchendzonga BR

Identification of priority areas for habitat monitoring and conservation for threatened carnivores and their prey

In the alpine zone, the grids where the Important Habitat Index is 60-100, are situated in the south western part (Figure 6) of Khangchendzonga NP and BR. The trans-Himalayan habitats of *Zanak, Rasum* and *Dolma* along with the Green lake area were depicted as the most important habitats for threatened carnivores and their prey in the northern part of Khangchendzonga BR. In the subalpine and temperate forest, most important habitats for threatened carnivores and their prey are situated mainly along the junction of BR and NP (Figure 6). Most of these grids are situated in the BR part connecting or buffering the villages situated just outside the Khangchendzonga BR boundary and hence are also very important for regular monitoring. The transition zone of subalpine and alpine area such as dwarf Rhododendron vegetations of *Dzongri*, *Thansing*, upper *Yambong*, *Panchpokhri* and *Thepala* are most important habitats for the threatened carnivores and their prey. A summary of necessary sampling efforts to monitor the populations of different mammal species, their abundances and preferred habitats are presented in Table 3. It should be noted that the recommendation of sampling efforts for species does not of course mean that managers should not try alternate ways of monitoring or a combination of means to achieve the goal of efficient monitoring of population status change of threatened taxa.

CONCLUSION

It is evident that applications of different field methodologies are required to detect and monitor different carnivores and their prey in the Khangchendzonga landscape. Flagship species such as the snow leopard and their major prey blue sheep can be monitored across different landscapes of the Eastern Himalayan region following the monitoring model discussed above. Camera trap studies along with regular scan counts are essential for the proper documentation of the change in the abundance of these species. Already existing abundance estimates or estimates derived from pilot surveys can be used to effectively design monitoring protocols across the protected areas of Nepal, Bhutan and in similar habitats in China. Methods and modes of monitoring can be adapted locally, although scientific rigour should be maintained.

Regular monitoring of the most suitable habitats through patrolling in the alpine and *Krummholdz* zones can effectively reduce the existing harmful anthropogenic activities such as unsupervised livestock grazing,

Table 3. Distribution, abundance, habitat use, habitat suitability and monitoring methods of some mammals in Khangchendzonga NP and BR

Species	Distribution (Watershed)	Abundance/Relative abundance (SE)	Diet/Habitat variables (+ preferred; - avoided)	Suitable habitats	Monitoring
Snow leopard	*Churong, Prek, Lachen, Zemu, Lhonak*	4.77(1.81)/100 km^2 [Density]	Blue sheep, cattle Elevation (+), Alpine (+), Tree cover (-)	*Dzongri-Goechela-Lampokhri, Green lake, Lhonak valley*	Camera trapping for 13 years (10 cameras for 80 days/year) in alpine areas
Red fox	*Churong, Prek, Lachen, Rangyang, Rangit, Zemu, Lhonak*	18.21(6.00)/100 km^2 [Density]	Pika, rodent, beetle Elevation (+), Alpine (+), Tree cover(-)	*Dzongri-Thansing-Lampokhri-Yambong, Aurelungchok, Panchpokhri*	Camera trapping and sign survey in alpine zone
Stone marten	*Churong, Prek, Lachen, Rangyang, Rangit, Zemu*	10.26(4.52)/100 km^2 [Density]	Pika, rodent Elevation (+), Alpine (+),Conifer (+)	*Dzongri-Thansing-Lampokhri-Yambong, Aurelungchok, Panchpokhri*	Camera trapping in alpine and subalpine
Golden cat	*Churong, Prek, Rangit, Rangyang, Zemu, Lachen*	0.41 (0.13)/100 days [Photo-capture rate]	Conifer (+), Broadleaved (+)	*Sachen-Tsokha-Jamling-Yambong, Kasturi*	Camera trapping in subalpine and temperate
Black bear	*Churong, Prek, Rangit, Rangyang, Zemu, Lachen*	0.23 (0.08)/100 days [Photo-capture rate]	Conifer (+), Broadleaved (+)	*Sachen-Tsokha-Jamling-Yambong, Kasturi, Panchpokhri, Yuksam- Nambu*	Camera trapping in subalpine and temperate
YT marten	*Churong, Prek, Rangit, Rangyang, Zemu, Lachen*	33.52(7.80)/100 km^2 [Density]	Rodent, pika Tree cover(+), Conifer (+), Broadleaved (+)	*Sachen-Tsokha-Jamling-Yambong, Kasturi, Panchpokhri, Yuksam-Nambu*	Trail sampling and camera trapping in subalpine and temperate
Leopard cat	*Churong, Prek, Rangit,Lachen*	17.52(5.52)/100 km^2 [Density]	Rodent, pika Broadleaved (+)	*Yuksam-Sachen-Nambu-Melli, Narkhola*	Camera trapping in temperate
Large Indian civet	*Churong, Prek, Rangit*	10.67(3.71)/100 km^2 [Density]	Broadleaved (+)	*Yuksam-Sachen-Nambu-Melli, Narkhola, Lingdem*	Camera trapping in temperate
Masked palm civet	*Churong, Prek, Rangit*	14.03(6.52)/100 km^2 [Density]	Broadleaved (+)	*Yuksam-Sachen-Nambu-Melli, Narkhola, Lingdem*	Camera trapping in temperate
Blue sheep	*Churong, Prek, Lachen, Zemu, Lhonak*	5.25 (1.40)/km^2 [Density]	Elevation (+), Alpine (+), Tree cover(-)	*Dzongri-Goechela-Lampokhri, Green lake, Lhonak valley*	10 years scanning (9-10 surveys/year)
Musk deer	*Churong, Prek, Lachen, Rangyang, Rangit, Zemu*	6.40 (0.40)/ha [Dung density]	Elevation (+), *Krummholdz* (+)	*Dzongri-Thansing-Lampokhri-Yambong, Aurelungchok, Panchpokhri*	Camera trapping and pellet group count

CONTINUED OVERLEAF

Table 3. Distribution, abundance, habitat use, habitat suitability and monitoring methods of some mammals in Khangchendzonga NP and BR (CONTINUED)

Species	Distribution (Watershed)	Abundance/Relative abundance (SE)	Diet/Habitat variables (+ preferred; - avoided)	Suitable habitats	Monitoring
Serow	*Churong, Prek, Rangit, Rangyang, Zemu, Lachen*	8.71 (3.94)/100 km^2 [Density]	Elevation (+), Tree cover(+), Conifer (+), Trekking trail (-)	*Sachen-Tsokha-Jamling-Yambong, Kasturi*	Camera trapping in subalpine and temperate zone, pellet group count
Goral	*Churong, Prek, Rangit, Rangyang, Zemu, Lachen*	21.44 (6.48)/100 km^2 [Density]	Tree cover(+), Broadleaved (+), Trekking trail (-)	*Yuksam-Sachen-Tsokha-Nambu, Tung*	Camera trapping for 8 years (10 cameras for 60 days/year)
Barking deer	*Churong, Prek, Rangit*	16.93 (5.56)/100 km^2 [Density]	Tree cover(+), Broadleaved (+), Trekking Trail (-)	*Yuksam-Sachen-Nambu-Melli, Narkhola*	Camera trapping for 8 years (10 cameras for 60 days/year)
Wild pig	*Churong, Prek, Rangit*	0.30 (0.12)/100 days [Photo-capture rate]	Broadleaved (+)	*Yuksam-Sachen-Nambu-Melli,*	Camera trapping in temperate forests

unsustainable extraction of resources for local use and presence of feral dogs. Strong coalitions between the Forest Department, local NGOs and village representatives are necessary in the western part of the Khangchendzonga NP and BR. Similarly strong associations are needed in the northern part to conserve and monitor carnivores, their prey populations and habitats.

The present study generated baseline information on distribution, abundance, habitat use and co-existence of carnivores and their prey at spatial scale. However, major ecological issues such as diet overlap and niche breadth at dietary scale among these species and pack animals would provide insights into competition if any between wild and domestic ungulates inside the NP and BR. The response of these ungulates to anthropogenic factors such as disturbances due to eco-tourism is another aspect that requires scientific investigation. Camera trap studies in other watersheds (barring *Prek chu*) can help to validate the habitat suitability models prepared in this study and hence can also develop the prediction quality of these models. Implementation of these recommendations as part of a Long-term Monitoring Programme (LTMP) would help the managers in the effective monitoring of mammals in Khangchendzonga NP and BR. The described protocol is also relevant in the development of monitoring in other landscapes of Eastern Himalaya, at least for the flagship species snow leopard and its prey.

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ABOUT THE AUTHORS

Dr. S.Sathyakumar has M.Sc., and D.Phil degrees in Wildlife Sciences and is currently a Senior Scientist at the Wildlife Institute of India specialising in biodiversity research and conservation for over 26 years in a wide range of study areas. His research interests are: biodiversity inventory, assessment and monitoring, species-habitat relationships in relation to human use and human-wildlife interactions, and environmental impact assessments of developmental projects. He is a member of IUCN/SSC Caprinae, Bear and Galliformes Specialist Groups.

Tapajit Bhattacharya is M.Sc. in Forestry and Ph.D. in Zoology (wildlife biology). His research interests are the ecology and conservation of mountain ungulates, including their habitats and ungulate– habitat interactions, and community-based conservation.

Tawqir Bashir is M.Sc. in Wildlife Science and currently pursuing Ph.D. in Wildlife Science. He is interested in the ecology and conservation of carnivores in mountain ecosystems, with special reference to predator–prey interactions and reducing carnivore–human conflicts.

Kamal Poudyal is M.Sc. Zoology and currently pursuing Ph.D. in Zoology (wildlife biology). His interests are the ecology and conservation of the wildlife of the Eastern Himalaya and community participation in conservation

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RESUMEN

Durante 2008-2012, pusimos a prueba la aplicabilidad de técnicas de campo relacionadas con la vida silvestre, tales como monitoreo de rastros, recuentos, captura con cámaras trampa y conteo de estiércol en el Parque Nacional Khangchendzonga (PN) y la Reserva de la Biosfera (RB) en Sikkim, India, para desarrollar programas adecuados para el monitoreo de mamíferos. En total, se confirmaron 42 especies de mamíferos en el PN Khangchendzonga y en la RB, 40 de las cuales fueron confirmadas mediante encuentros visuales, imágenes y signos. Se determinó que la captura con cámaras trampa era el método de campo más aplicable para todos los carnívoros y ungulados solitarios. Para las poblaciones del leopardo de las nieves (Panthera uncia), para detectar la disminución anual del 10 por ciento con una eficacia del 70 por ciento, serían necesarios 800 días efectivos de cámara por año durante siete años. Para detectar porcentajes deseados de disminución/aumento anual de poblaciones de mamíferos con una eficacia significativa, el período de esfuerzo y tiempo requerido se estimó en Rs. 3.067.000 (USD51.116) por un período de 10 a 15 años. Se han identificado los hábitats más importantes para los carnívoros amenazados y sus presas en el Khangchendzonga. El monitoreo periódico de los hábitats más adecuados y el patrullaje estricto de la condición de la zona alpina y el Krummholdz podría reducir eficazmente los efectos negativos de las actividades antropogénicas actuales, tales como el pastoreo descontrolado de ganado y la extracción insostenible de los recursos para uso local.

RESUME

Au cours des années 2008-2012, nous avons testé la pertinence des techniques de terrain comme la surveillance des sentiers, l'échantillonnage, le piège photographique et le comptage d'excréments, pour élaborer des programmes de surveillance des animaux sauvages dans le parc national (PN) et la réserve de biosphère (RB) de Khangchendzonga au Sikkim, en Inde. Au total, 42 espèces de mammifères ont été recensées dans le PN et le RB de Khangchendzonga, dont 40 ont été confirmées par des rencontres directes, des photos ou des indices. Le dispositif de piège photographique a été jugé la méthode de terrain la plus appropriée pour tous les carnivores et ongulés solitaires. Pour les populations de léopard des neiges (Panthera uncia), il faudrait 800 jours effectifs d'enregistrement par an pendant sept ans pour détecter une baisse annuelle de 10% avec une efficacité de 70%. Pour détecter les pourcentages désirés de baisse ou d'augmentation annuelles de la population de mammifères avec une efficacité significative, le coût et la période nécessaire ont été estimés à Rs. 3,067,000 (51,116 $ US) pour une période d'environ 10 à 15 ans. Les habitats les plus importants des carnivores menacés et leurs proies dans la Khangchendzonga ont été identifiés. Un suivi régulier de ces habitats et une surveillance rigoureuse des conditions de la zone alpine et du Krummholdz pourront réduire les effets négatifs des activités anthropiques actuelles, telles le pâturage du bétail sans surveillance et l'extraction de ressources non durables par la population locale.

EMPOWERING THE NEXT GENERATION TO CONNECT WITH NATURE: A GLOBAL MOVEMENT

Nikita Lopoukhine[1*], Keith Wheeler[2], Karen Keenleyside[3], Cheryl Charles[4], Rebecca Koss[5] and Robert Nicoll[6]

* Corresponding author: lopoukhine@gmail.com
[1] Chair Emeritus, IUCN WCPA, Canada
[2] Chair Emeritus, IUCN CEC and President, Paul F-Brandwein Institute, USA
[3] Parks Canada, Canada
[4] CEO Emerita, Children & Nature Network, USA
[5] IUCN Task Force on Intergenerational Partnerships for Sustainability, Australia
[6] New South Wales National Parks and Wildlife Service, Office of Environment and Heritage, Australia

ABSTRACT

Humankind's affinity to nature is threatened. Youth, in particular, are missing out. Without the connection, a love of nature cannot develop. Alienation leads to a loss of support for conservation of nature. Conservation has yielded an extensive network of parks and protected areas that in turn provide the opportunity to connect directly with nature. The opportunity presents itself for parks and protected areas to play an increasing and significant role in connecting people with nature. A next generation leadership, youth for youth, is needed to take up this challenge. Through understanding the needs and values of youth, parks and protected area leaders must offer programmes that connect young people to nature and empower young people to be agents of change. The 2014 IUCN World Parks Congress provides a launch pad for such collaborative efforts. Stream 8: Inspiring a New Generation, is focused on a legacy whereby future generations will develop and nurture life-long relationships with nature and the support for conservation that flows from that connection. Youth, National Park and Protected Area leaders are poised to build on the simple equation that LOVE of Nature + ACTION = CHANGE with the desired outcome of an enduring connection to nature.

Key words: Youth, new generation, protected areas, World Parks Congress

INTRODUCTION

Humans have an affinity for nature. This love of nature termed 'biophilia' was defined by E. O. Wilson (1984, p. 58) as: "the urge to affiliate with other forms of life". We have evolved within and with nature. At the most basic of levels, we learned that plants and animals provided food, fibre and skins and so we tended them and cared for them. Our affiliation, however, goes deeper than addressing the biological necessities of life. Nature has provided spiritual, aesthetic, and philosophical pillars for the growth and expression of human culture (Haenn & Wilk, 2006).

Wilson (1984; 1993) has bemoaned that this historic and evolutionary tie of humans to nature is being eroded. In further work, Wilson (1993) highlighted that the loss of a connection to nature contributes to psychic deprivation and degradation of the human mind. Medical research has clearly identified the restorative values of nature in patient recovery rates. A 2005 survey of eight European cities showed that residents having access to green areas are three times more apt to be active and 40 per cent less likely to be obese (Basaraba, 2012). Koss and Kingsley (2010) found that volunteers engaged in citizen science programmes in marine protected areas in Victoria, Australia not only connected with nature but also reported feelings of mental and physical wellbeing. Further, volunteers felt their monitoring efforts generated personal satisfaction through their contributions and increased feelings of enjoyment by connecting to nature and socialising with others. Further evidence supporting the assertion that contact with nature promotes health was summarised by Maller (2006), and Berman (2012) suggests that the brain relaxes in nature. A simple walk in nature could improve memory and mood in depressed people. In a natural setting the brain enters into a state of contemplative attention that is restorative or refreshing while in an

Chinese school children learning about their environment, Dongzhimen middle school, Beijing, China © Brent Stirton / Getty Images / WWF-UK

urban setting the brain is bombarded with distractions that force attention systems into a state of constant alertness. Experiencing nature has to be real, incorporating all the senses; virtual experiences alone are not enough, but can add to the awareness level of those who experience the real thing.

The rupture of our connection with the natural environment is caused by a number of factors that began with the growth of urbanisation in the world. It is harder for people to get to and experience natural places when the majority of the global population lives in urban settings. Three-quarters of the European population live in urban environments, while in North America and Australia, it is more than 80 per cent and similarly Colombia is over 75 per cent and South Africa is at 62 per cent (US Central Intelligence, 2012). The opportunity to connect with nature is frequently limited to the few city parks and other remnants of green spaces found within or adjacent to the world's urban spaces.

Urbanisation as a cause of disconnection with nature is compounded by permeating attitudes that preach fear of the unknown. The devaluation of nature in the media compounded by doomsday messages around losses of biodiversity and effects of climate change create a conscious and subconscious aversion to the outdoors. Wilderness has become feared as the place where wild beasts roam and is thus avoided (Nelson & Callicott, 2008).

Further, in the developing world, economic breakthroughs are creating a new well-off middle-class with urban values. In the developed world, immigrants are becoming an increasingly large segment of the population. New immigrants often have little experience with nature or certainly the institution of protected areas. On arrival in their new country, their focus is on building up their economic status and providing for the well-being of their families and adjusting to new cultural realities (Buija 2008).

Perhaps the most significant reality that separates humanity from physically connecting and thus understanding and appreciating nature is prolonged screen time. TV, computers, tablets and smart phones, which dominate developed nations' use of the web, are drawing our attention away from the natural world that surrounds us. Estimates in Canada suggest children spend approximately five hours (Pimento & Kernested, 2010) to as much as eight hours per day in front of audio visual screens (Active Healthy Kids Canada, 2010). Medical professionals are suggesting that a limit of around two hours per day or less would assure better health, sleep and social skills. Spending sedentary time in front of a screen occurs at the expense of physical activity and exploration of the outdoors. The domination of screens in our daily lives influences our lifestyles, particularly amongst youth and young people, and has longer term repercussions. Research is linking limited physical activity among youth to increased rates of obesity, mental health disorders and undeveloped motor skills[1].

The challenge of connecting youth to nature due to a paucity of opportunity to experience outdoors activity is further exacerbated by the disturbing trend where earning an undergraduate biology degree no longer

obligates a student to learn anything about actual living organisms (Frazer, 2014). Future natural history teachers may not have the connection and the biophilia for nature to transmit an appreciation of nature, let alone a passion for nature.

The Children & Nature Network (C&NN) has compiled an annotated bibliography listing research and studies that confirm the value and many benefits of connecting to nature. In response, decisions to increase youth connection to nature are being taken by a variety of people and organisations – including individuals, families, agencies, communities and nations – and producing significant results. An example is a New Zealand school that submitted itself to a University of Auckland and Otago University experiment (TVNZ, 2014). School children were given freedom during recess to play, run, slide, jump and climb. Instead of the feared chaos, teachers noted that the children were so engaged with their freedom, it resulted in a marked drop-off of bullying, serious injuries and vandalism (TVNZ, 2014). A further bonus derived was an increased level of concentration in class. This experiment demonstrates that connection to nature is integral to the mental and physical health and well-being of school children with co-benefits including social cohesion.

Although this paper encourages greater connection of young people to nature, locations available to experience nature are limited. In response to environmental and conservation challenges facing the world, global conventions, national policies, stricter regulations and legislation have all been brought into force over the past few decades. One common response was to establish national parks and other forms of protected areas. By 2020 the world has committed to having 17 per cent of the world's terrestrial and 10 per cent of the marine ecosystems under protection (CBD, 2010). These natural areas provide opportunity for connecting to nature, where a love for nature can be fostered. In addition to managing a growing parks estate, many park agencies are building programmes to encourage more people to visit parks and help build a connection with nature as detailed further in this paper.

However, individuals relate differently to nature's values depending on their culture and segment of society. For example, a common denominator to most of the world's religions is the recognition of the spiritual value of nature. Nevertheless, youth see the world differently from adults and connecting to nature needs to be appealing as well as relevant to them requiring their voice to inform our role as adults in assisting their connection to nature. To communicate the message that nature's values are important must be personal and relevant for each community, be it faith, ethnicity or demographic. The value of nature and the importance of protecting it must be personalised, if not loved, before a constituency of support and connection will develop.

This paper is focused on reviewing the status of efforts in helping youth to connect with nature and exploring opportunities in the future. The IUCN World Parks Congress (WPC) 2014 in Sydney, Australia provides an opportunity to bring together efforts from five continents to focus on how to begin mending our rupture with nature and the specific role of protected areas. More importantly the WPC will serve as a launching platform for a worldwide movement led by youth to inspire, reconnect, and empower the next generation.

STATUS

The global concern regarding the changes to childhood activity, connections to nature, and child safety has yielded the beginnings of a worldwide movement to transform this concern. A noted beginning was Nelson Mandela's opening address of the Durban, South Africa World Parks Congress in 2003 whereby he noted the absence of youth at the Congress and encouraged engagement of youth in nature conservation and protected areas. Subsequently, a few key events can be enumerated that have begun to address the concern:

1. During 2005, the Paul F-Brandwein Institute convened a Conservation Learning Summit (Brandwein, 2006). One of the summit's purposes was to look at these changes in childhood activities and the potential impact on natural resources and protected areas in the future. During the same year, the first edition of Richard Louv's book, *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*, was published and quickly acclaimed. Louv was a keynote speaker at the 2005 Conservation Learning Summit and brought attention to the growing worldwide issue of children's disconnect from nature. Louv had the looming vision of a future in which young professionals were prepared for conservation work by vicarious, not direct, experiences with natural ecosystems and protected areas.
2. In 2006, the World Future Society listed children's 'nature-deficit disorder' as a health threat among its top five trends to watch. "Children today are spending less time in direct contact with nature than did previous generations. The impacts are showing up not only in their lack of physical fitness but also in the growing prevalence of hyperactivity and attention deficit. Studies show that immersing children in

outdoor settings – away from television and video games – fosters more creative mental activity and concentration[2]."

3. Richard Louv and others founded the international public charity, the C&NN in 2006. By the 2008 IUCN World Conservation Congress, a panel titled 'Reversing a Worldwide Trend: Strategies for Solving Nature-Deficit Disorder' was held on international efforts to address nature-deficit disorder among children and to feature global efforts and programmes to help reverse the growing trend. The C&NN has assembled and reviewed the evidence worldwide to support the need to reverse this trend (C&NN, 2012). The review makes clear that everyday experiences in nature throughout childhood provide many benefits to children's health and well-being, and to the Earth itself. Further, evidence has shown that children who have exploratory, meaningful, and direct experiences in science and nature during their childhood tend to be those who commit their professional careers to being scientists and conservationists that are needed now and in the future (Brandwein, 1955; Fort, 2010). To further share this evidence, one indicator for the growth and support of the C&NN movement is reflected by the number of visits to the organisation's website including interest from more than 200 nations, with over 100 nations downloading the free resources3. While attention to addressing this issue is growing, the need remains urgent to globally rally and further collaborative efforts to increase childhood experiences in nature.
4. At the Convention on Biological Diversity (CBD) Conference of the Parties (COP) meeting in Nagoya in 2010, the IUCN Commission for Education and Communication (CEC), through its 'Love-Not-Loss' campaign, demonstrated that the spiritual, economic, aesthetic and health values we attribute to protected areas are all values that build on a love for nature. Developing such a bond strengthens one's desire to commit to experience nature and protecting it (IUCN-CEC, 2012).
5. The effort to increase personal experiences in nature was furthered by leaders of protected areas attending the 2012 IUCN World Conservation Congress (WCC) in Jeju, Republic of Korea. Here, they agreed to embark on a global campaign dedicated to connecting people of all generations to nature. There was unanimous agreement to use their individual assets to make a new and strengthened engagement of people with nature whether at a local, cultural, national, regional, or global level. In addition, Congress Resolution 101 was passed in support of a child's right to nature[4]. Also, to help demonstrate the evidence base for the need for this global movement, C&NN and the IUCN CEC co-released the statement, *Children & Nature Worldwide: An Exploration of Children's Experiences of the Outdoors and Nature with Associated Risks and Benefits* (C&NN, 2012) during the Congress.
6. Further to the above commitments, Parks Canada, with others, sponsored the 2012 WCC Resolution 045, 'Broadening awareness of benefits and relevance of protected areas'[4]. This resolution calls for a broad recognition and appreciation of the central role played by protected areas in conservation. Moreover, the resolution encouraged protected area leaders to make a new and strengthened commitment to connect people with nature by actively collaborating with a full range of partners and stakeholders in order to inspire broad-based awareness, support, engagement and participation in conservation actions. The WPC provides an opportunity for leaders to come together and move these ideas forward, in addition to supporting and empowering up and coming young protected area leaders.

School children celebrating the declaration of a Marine Protected Area in Vanua Levu, Fiji © Brent Stirton / Getty Images

These key events are illustrative of the kind of partnerships leading to action that every protected area agency works hard to create in order to achieve a supportive constituency. The strength of these relationships, and the social capital created, is of benefit during times of adversity, where agencies can rely on this support for their mission and vision. For the most part, the core of this constituency consists of people with a strong affinity for nature and its protection and/or those who have an economic as well as social-cultural dependence on protected areas. However, the growth of this core constituency is being affected by changing global demographics.

The world's population is growing, predicted to reach nine billion by 2040. In the developed world, the mean age is increasing while the opposite is true in developing countries. In both situations, the population is increasingly becoming urban and with it their experience and affinity for nature is being eroded and replaced by technologically-based realities and other daily priorities that detract from spending time in nature.

Protected area agencies have begun to reach out to these new constituencies, readdressing their tools and mechanisms to increase their connection and relationships with those who may not initially consider time in nature to be of priority. However, the rate of change of global demographics presents a challenge that is overwhelming for one agency to tackle alone. By collaborating and cooperating with each other and external partners, agencies could provide a strong force to broaden the public sphere's understanding of nature's values, the critical role that parks and protected areas play in protecting these values and how nature's values provide a range of health and well-being benefits for humans.

GOING FORWARD

Traditionally, supporters of nature and protected areas can trace their commitment to a personal experience with nature that some might call an epiphany. The experience, be it through a family camping trip, or an encounter with wildlife or an engaging interpreter or teacher, opened them to an understanding of the importance of nature to their own life and life in general.

The challenge for all protected areas agencies and others that strive to protect nature is to find ways of stirring this critical human connection with nature. This challenge calls for a major shift from the traditional information-based communication to messages based on values and emotions related to protected areas in general and direct experiences in nature. To inspire people's support of nature and the vision and mission of the world's protected areas, we need to facilitate experiential knowledge that will lead to a personal commitment. Additionally, we need programmes and initiatives that are developed and led by youth for youth. Through understanding the needs and values of youth, we can design in collaboration with them successful programmes that connect young people to nature. Concurrently, there are many engaged, motivated and knowledgeable young professionals within the IUCN Commission groups and beyond who are trailblazing initiatives that include running organisations, researching and implementing programmes often in a voluntary capacity with little funding and support. It is important here to highlight that support and resources, financial and human, are needed for young people to create change in the long term and to become future protected area leaders.

The above areas have considerable growth potential and opportunity and will be discussed and explored at the WPC. The following outlines the approach being taken by organisers of the Stream 8: Inspiring New Generations at the Congress and thereafter to support initiatives and programmes for young people and young professionals.

1. 'Inspiring a New Generation' (ING) – Stream 8

This stream is focused on a legacy whereby future generations will develop and nurture life-long relationships with nature. The goal is to empower the growth and expansion of the emerging worldwide movement by inspiring people, especially young people, around the world to experience, connect with, love, value, and conserve nature. The stream will bring voices of young people to the Congress. It will broaden the ability of park agencies to reach children, youth and urban audiences through partnerships, new media and innovative programming. Through the inclusion of young people at this Congress, this stream will build a legacy of youth leadership and intergenerational partnerships for parks, people and planet.

This initiative will also deliver on CBD Aichi Target 1, 'people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably' (CBD, 2010). Further, consistent with IUCN WCC 2012 Resolution 008, the IUCN has committed to promoting and empowering a diverse new generation of young leaders from around the world through intergenerational partnerships that can meet the complex challenges we are facing in cultivating 'a just, sustainable and peaceful world'[4].

Park agencies, conservation organisations, along with proactive youth are well positioned and prepared to take a leadership role in many ways – including inspiring a new generation. Protected area managers, in particular, with their responsibility for the protection of areas with exceptional natural values and a mandate and expertise to reach the public, are best placed to set out a path of discovery by which the next generation can experience, learn about, and care for nature.

To achieve this Stream's goal of 'Inspiring a New Generation', the following objectives will be met at the conclusion of the Congress[5]:

- Establish and lay the groundwork for growing a global community of organisations that share an interest, capacity and mandate to connect people to nature.
- Release a global action plan with examples of cross cutting tools ranging across communications including social media, technology, citizen science, urban gateways to nature, tourism and innovative partnerships that can help direct the growth of this global movement.
- Bring the voice of young people and participation across the entire Congress programme.
- Build capacity and share innovative best practices in connecting people with nature, including engaging new partners and sectors of society.
- Engage young people from around the world to share knowledge, experiences and perspectives, build capacity, take leadership and inspire others to connect with nature through protected areas, together and through intergenerational partnerships.
- Demonstrate, using evidenced-based information, the vital need, barriers and motivators to connect people to nature, and support the social science community to build this knowledge base.
- Develop and deliver a *Young Peoples Pact* and an Internship Charter by young people as part of the greater Congress legacy, *The Sydney Promise*.

2. Opportunities to connect – citizen science

Personal connections are critical to a better understanding of nature but such connections can also lead to global contributions and a better understanding by others. Citizen science (i.e. scientific research conducted, in whole or in part, by amateur or nonprofessional scientists) is one tool that crosses over to include use of technology, social media and innovative partnerships through which contributions can be made and one's experience and knowledge of nature expanded. Examples include:

- eBird (ebird.org). Launched in 2002 by the Cornell Lab of Ornithology and National Audubon Society, eBird provides rich data sources for basic information on bird abundance and distribution at a variety of spatial and temporal scales. It is a real-time, online checklist programme, that has revolutionized the way that the birding community reports and accesses information about birds. eBird is amassing one of the largest and fastest growing biodiversity data resources in existence. In March 2012 alone, participants reported more than 3.1 million bird observations across North America! In time these data will become the foundation for a better understanding of bird distribution across the western hemisphere and beyond.
- Encyclopedia of Life (eol.org/). The Encyclopedia of Life is an easy-to-search and freely available compendium of natural history information with over 1.3 million pages on thousands of species from around the world. The contents are contributed by members, including the lay public, and reviewed by curators.
- FeederWatch (feederwatch.org). Project FeederWatch is a winter-long survey of birds that visit feeders at backyards, nature centres, community areas, and other locales in North America. FeederWatchers periodically count the birds they see at their feeders from November through early April and send their counts to Project FeederWatch. FeederWatch data help scientists track broad-scale movements of winter bird populations and long-term trends in bird distribution and abundance.
- FishBase. (www.fishbase.org/). FishBase is an international online database of the world's fishes. This collaborative effort bridges ecological, genetic, zoological, biogeographical, conservation, and commercial information. It is commonly cited in peer-reviewed literature and used as a management tool.
- Map of Life. (www.mol.org/). The Map of Life is a global collection of species-distribution data, currently housing over 365 million records from almost 800,000 species and providing mapping tools and area-specific species lists for anywhere on the globe. The Map of Life is designed to provide a platform and tool set for the development and analysis of species-distribution maps across all taxa.
- Vital Signs. (vitalsigns.org/). Integrating ecosystem service and biodiversity monitoring from an agricultural perspective at local to continental scales, Vital Signs uses standardised, targeted collections of natural history information to build

New Canadians participating in Parks Canada's Learn to Camp programme. Fort Beauséjour-Fort Cumberland National Historic Site of Canada, New Brunswick © Parks Canada.

explicit links between biodiversity and human well-being.

- USA National Phenology Network. (www.usanpn.org/). The USA National Phenology Network is a national clearinghouse for data sets focused on the timing of events in nature, from blooming times in plants to migration timing in animals. The platform hosts citizen science projects, curates global data on phenology, and organises phenological research for a wide range of applications.
- Youth Learning as Citizen Environmental Scientists (YLACES). Youth Learning as Citizen Environmental Scientists aims to assist and reward the implementation of inquiry-based, experiential science education where students do science and contribute to understanding of our natural world.
- Sea Search. (www.parkweb.vic.gov.au/get-involved/volunteer/sea-search). Parks Victoria, Australia works with community and school groups to monitor Victoria's Marine National Parks and Marine Sanctuaries. Using scientific methods trialled with community groups, data collected aids the Agency in managing their marine front yards.
- Reef Life Survey. (www.reeflifesurvey.com). This programme brings scientists and experienced and motivated recreational SCUBA divers together to scientifically survey rocky and coral reefs. The aim of this programme is to improve biodiversity conservation and the sustainable management of marine resources across 40 countries.
- iNaturalist. (www.inaturalist.org). iNaturalist is a place where one can record what one sees in nature, meet other nature lovers, and learn about the natural world. From hikers to hunters, birders to beach-combers, the world is filled with naturalists. INaturalist provides a space for all those observations to be shared online.
- Questabird. (www.questabird.com). QuestaBird is an outdoor adventure game based in Australia where players compete by photographing birds in the wild. Participants can join quests, earn gold, buy supplies, gain levels, build collections and help document and protect Australia's biodiversity.
- Atlas of Living Australia. (www.ala.org.au). The Atlas of Living Australia contains information on all the known species in Australia aggregated from a wide range of data providers: museums, herbaria, community groups, government departments, individuals and universities.
- Great Nature Project. (www.greatnatureproject.org). One of the largest initiatives National Geographic has ever undertaken, inviting people from around the world to appreciate nature by taking pictures of plants and animals and then sharing those pictures with the world.

Discovering the old oak woodlands of the Quantock Hills, Area of Outstanding Natural Beauty, England © Equilibrium Research

3. Opportunities to connect – social media

Although new technologies have been described in this paper as one cause for a disconnect with nature, we are also increasingly seeing social media being used as one mechanism to connect people with nature. One example is the youth-led '#NoWallsOutHere'[6], which promotes the sharing of personal experiences in nature through social media. Protected area managers and agencies acknowledge that social media is one powerful tool and mechanism out of a suite of tools and mechanisms that can be applied to reach out to new constituencies. However, how to best message a mission, vision, actions and images needs an understanding of how best to operationalise social media to ensure efforts are targeted and effective. To address this need, this Stream will provide the following learning and development opportunities to all Congress participants:

- Social Media Capacity Development Workshop: Social media professionals will deliver this interactive workshop that includes describing different social media applications and their purpose, how to create targeted and effective messaging and assessing the impact of your communication.
- Young Social Media Coalition: This group of 20 young people attending the Congress will focus on disseminating the young peoples' voice across all Congress streams and cross-cutting themes through social media.
- iAct Dialogues for Sustainability: This is a series of global webinars where 'I' stands for intergenerational, interactive, insightful and inspirational with a focus on action, literally 'I act for sustainability'. There will be a series of iAct Dialogues, pre-Congress, during Congress and post-Congress. This series of webinars will allow young people to share their ideas and experiences related to nature and protected areas. It allows those who are not able to make it to Congress to connect and create action[7].

4. Role of protected areas and agencies

Outside of the work taking place at the WPC, the world's protected areas and the agencies/organisations which represent them are an essential part of the solution, which is, connecting people of all ages to nature. Protected areas presently encompass some 15 per cent of the globe and, according to the commitment of Aichi Biodiversity Target 11, this is projected to increase to 17 per cent of terrestrial systems and 10 per cent of marine systems by 2020.

Protected areas conserve intact natural areas and governing agencies along with community and indigenous managers encourage visitation and offer interpretive services that provide the opportunities, particularly for urban countries, to come into contact with nature, experience the wonders of nature, and develop an appreciation for nature. The protected areas of the world provide the space and opportunity for families to bond, children to play, and communities to meet. They lie at the heart of all efforts to forge a renewed relationship with nature.

Many protected area agencies and organisations have understood this need and implemented programmes of work to address their responsibility in connecting people of all ages to nature. Some examples of actions and programmes currently taking place include:

- Parks Canada: has launched a 'learn to camp' initiative to introduce urban dwellers to camping as an activity through which connections with nature can develop.
- Korea Parks Service: reached an agreement in 2012 with Nonghyup Bank to cooperate in building awareness of nature through protected areas.
- US National Park Service: is cooperating with medical professionals in a Washington, DC programme prescribing parks to patients as a means of improving their well-being while also beginning to appreciate the value of nature.
- South Africa's SANParks: has launched a 'Kids in Parks' Programme that provides a unique opportunity to visit a national park and learn a lot about natural and cultural heritage.
- EUROPARC: participated in the European Union 'Youth in Action' programme aimed to enhance opportunities for young people to participate in Junior Ranger activities and new youth environmental education programmes in protected areas.
- Australia's New South Wales National Parks and Wildlife Service: have an extensive range of programmes designed to engage new audiences, young people in particular, in nature. The 'Wilderquest' website[8] and phone app is designed to establish a lifelong connection to nature through taking kids on a journey from the digital environment to the natural world.
- Australia's Parks Victoria: conducts Discovery Programs where rangers interact with the public through hands on interpretation and activities in the parks. The Junior Ranger Program is specifically for 6-12 year olds and is all about having hands-on fun outdoor activities while learning about nature and how parks protect native animals and plants and bring well-being to people.

5. Role of the IUCN Commissions

IUCN CEC pioneered the concept and practice of the Intergenerational Partnership for Sustainability (IPS), launched at the UNESCO Tbilisi+30 Conference in Ahmedabad, India in 2007. In 2008, the CEC Steering Committee took leadership for the meaningful engagement of young professionals across all Commissions. A joint CEC and WCPA Steering Committee meeting in Ecuador in 2009 solidified the concept for a cross-Commission Task Force, where CEC and WCPA young professionals were instrumental in pushing for representation of a young professional, Grace Mwaura, in the IUCN Council.

IUCN WCPA recognizes the importance of protected areas as conduits to nature for visitors; including virtual visitors. Tourism and protected areas form a symbiotic relationship that is fostered by the IUCN WCPA Tourism Specialist Group. However, WCPA only began to focus on the need to reconnect the next generation to nature shortly after the joint CEC WCPA meeting in Ecuador. Subsequently, WCPA and a dozen World Protected Area Leaders met in Colombia which launched the process leading up to the WPC Stream 8: Inspiring a New Generation. Along the way, WCPA and CEC collaborated with Futerra and the Korea Parks Service to deliver the Jeju Declaration noted above that commits attendees to a global campaign dedicated to connecting people of all generations to nature.

At the 2012 IUCN World Conservation Congress, the Council formalised the Task Force on Intergenerational Partnership for Sustainability (IPS) with a mandate to increase youth engagement and intergenerational partnerships vertically and horizontally across the IUCN. Titled Resolution 008: *Increasing youth engagement and intergenerational partnership across and through the Union*, ensures there is a platform for the young voice and support for their new and emerging ideas and actions[4]. The IPS Task Force supports the efforts,

Giving an outdoor environmental lesson to a group of village children at the Environmental Education Centre at Lake Malawi National Park © Sandra Mbanefo Obiago / WWF-Canon

activities and work of existing IUCN Commission Young Professional groups, such as the WCPA Young Professionals (WCPA YP) who are co-leading the Inspiring a New Generation Stream.

CONCLUSION

Although global efforts are currently in motion to connect youth to nature, greater momentum is needed for there to be a large shift in which youth value and connect to parks. What is often missing from this conversation is the youth voice, an essential requirement for change to happen at a large scale. By collaborating and empowering the youth and young professionals of the world in decision making and planning through open and transparent dialogue, park agencies and organisations, protected area managers and the IUCN Commissions will be able to catalyze a critical mass of youth in the public sphere to engage with nature and embrace and support successful initiatives that help them do so.

By supporting, participating and investing in initiatives that are relevant to and led by youth, park and protected area leaders along with their supporters can build on the simple equation that LOVE of Nature + ACTION = CHANGE with the desired outcome being connected to nature in every way.

NOTES

The Inspiring a New Generation Stream of the 2014 IUCN World Parks Congress is being co-led by Parks Canada, the IUCN Commission on Education and Communication (CEC), the IUCN World Commission on Protected Areas (WCPA), the IUCN WCPA Young Professionals, the IUCN Task Force on Intergenerational Partnership for Sustainability, and the New South Wales Office of Environment and Heritage.

ENDNOTES

[1] See for example: www.takethemagicstep.com/coaching/families/training-exercise/benefits-of-exercise-for-children/
[2] www.wfs.org/node/569
[3] www.childrenandnature.org/
[4] cmsdata.iucn.org/downloads/resolutions_and_recommendations_2012.pdf
[5] worldparkscongress.org/programme/stream_inspiring_a_new_generation.html
[6] www.facebook.com/hashtag/nowallsouthere
[7] www.sustainabilityleadersnetwork.org/iact-dialogues-for-sustainability/
[8] wilderquest.nsw.gov.au/aboriginal/

ABOUT THE AUTHORS

Nikita (Nik) Lopoukhine, retired in 2005 as Director General of National Parks, Parks Canada. He subsequently served for eight years as Chair of IUCN WCPA. Nik was recently honoured with the Golden Leaf and J. B. Harkin Awards for his life-long commitment to Canadian conservation.

Keith Wheeler is Chairman and CEO ZedX Inc. and President of the Board of Directors of the Paul F-Brandwein Institute. He served as Chair of IUCN Commission on Education and Communication from 2006-2012 and has been an active member of the IUCN WCPA.

Karen Keenleyside is a National Science Advisor at Parks Canada and is the Agency's lead on the delivery of Stream 8: Inspiring a New Generation of the IUCN World Parks Congress 2014.

Cheryl Charles is co-founder and served as President and CEO of the Children & Nature Network, www.childrenandnature.org, from 2006-2013, now Emerita. She is a member of the IUCN Commission on Education and Communication, and served as a member of its steering committee for eight years. Author, educator, consultant, public speaker and non-profit executive.

Rebecca Koss is Post-Doctorate Research Fellow at Deakin University, Australia. Rebecca is co-leading the delivery of Stream 8: Inspiring a New Generation and the Pre-World Parks Congress Young Professional Capacity Development Workshop for the IUCN Task Force on Intergenerational Partnership for Sustainability .

Robert Nicoll is Senior Programme Coordinator, IUCN World Parks Congress with the NSW National Parks and Wildlife Service, Office of Environment and Heritage (OEH), co-lead for delivery of Stream 8: Inspiring a New Generation. A high seas protected area expert, Rob previously led the World Wide Fund for Nature's Antarctic programme and is a member of IUCN WCPA.

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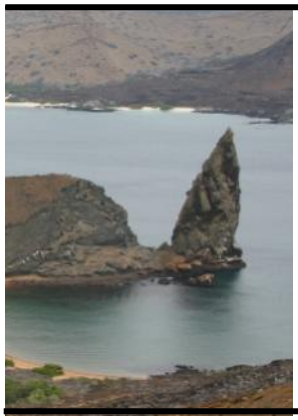
RESUMEN

La afinidad de la humanidad con la naturaleza se encuentra amenazada. La juventud, en particular, la está perdiendo. Sin la conexión, es imposible desarrollar el amor por la naturaleza. La desafección conduce a una pérdida de apoyo para la conservación de la naturaleza. La conservación ha dado lugar a una extensa red de parques y áreas protegidas que a su vez brindan la oportunidad de conectar directamente con la naturaleza. Los parques y las áreas protegidas pueden desempeñar un papel cada vez más importante para conectar a las personas con la naturaleza. Para afrontar este reto es necesario el liderazgo de la siguiente generación, de los jóvenes para los jóvenes. A través del entendimiento de las necesidades y los valores de la juventud, los responsables de los parques y las áreas protegidas deben ofrecer programas para conectar a los jóvenes con la naturaleza y empoderarlos para convertirse en agentes de cambio. El Congreso Mundial de Parques 2014 de la UICN proporciona una plataforma para impulsar estos esfuerzos de colaboración. El tema 8, "Inspirar a una nueva generación", se centra en un legado gracias al cual las generaciones futuras desarrollarán y cultivarán relaciones de largo plazo con la naturaleza y con el apoyo a la conservación que se deriva de esa conexión. Los jóvenes líderes de los parques nacionales y las áreas protegidas están preparados para construir sobre la simple fórmula en base a la cual el AMOR por la Naturaleza + ACCIÓN = CAMBIO a favor de la conexión permanente con la naturaleza.

RESUME

L'affinité de l'humanité avec la nature est menacée. Les jeunes particulièrement en sont exclus. L'amour de la nature ne peut se développer sans une relation avec elle. Cette lacune conduit à une défaut de soutien à la conservation de la nature. La conservation a engendré un vaste réseau de parcs et de zones qui fournissent à leur tour la possibilité de se rapprocher de la nature. L'occasion se présente pour les parcs et les aires protégées de jouer un rôle croissant et significatif dans l'établissement d'une relation entre l'homme et la nature. Une nouvelle génération de leaders, des jeunes s'adressant à d'autres jeunes, est nécessaire pour relever ce défi. Grâce à une meilleure compréhension des besoins et des valeurs de la jeunesse, les gestionnaires des parcs et des aires protégées doivent offrir des programmes qui relient les jeunes à la nature et leur permettent de se faire des acteurs du changement. Le Congrès mondial sur les parcs de l'UICN en 2014 fournit un tremplin pour ces efforts mutuels. Le 8ème thème du congrès, intitulé «Pour inspirer une nouvelle génération», est centré sur un héritage grâce auquel les générations futures pourront développer et entretenir des relations durant toute leur vie avec la nature, et sur le soutien à la conservation qui en découle. La jeunesse, les gestionnaires des parcs nationaux et des aires protégés sont prêts à se fonder sur cette simple équation : AMOUR de la nature + ACTION = CHANGEMENT obtenant ainsi l'effet souhaité d'un lien durable avec la nature.



GEOCONSERVATION IN PROTECTED AREAS

Roger Crofts[1*] and John E. Gordon[2]

*corresponding author: roger.dodin@btinternet.com

[1] WCPA Emeritus and WCPA Geoheritage Specialist Group, Scotland
[2] WCPA Geoheritage Specialist Group, Scotland

ABSTRACT

Formal recognition of the geodiversity component of protected areas was made in 2008 in the revised *IUCN Guidelines for Applying Protected Area Management Categories*. This article argues the importance of this addition and states the case for geoheritage conservation in protected areas, both in its own right and for its wider value in supporting biodiversity and ecosystem services. The article summarises some of the key issues which protected area managers will need to address in ensuring that geoconservation is adequately reflected in protected area development and management. Preliminary guidance on the development of geoconservation in protected areas and the relevance of the six management categories is provided.

Key words: geodiversity, geoheritage, geoconservation, protected area management

INTRODUCTION

The revision of the IUCN definition of a protected area brought about a fundamental change in the primary focus from biodiversity to the broader concept of nature (Dudley, 2008). The contrast between the previous definition and the current one is clear from the following texts:

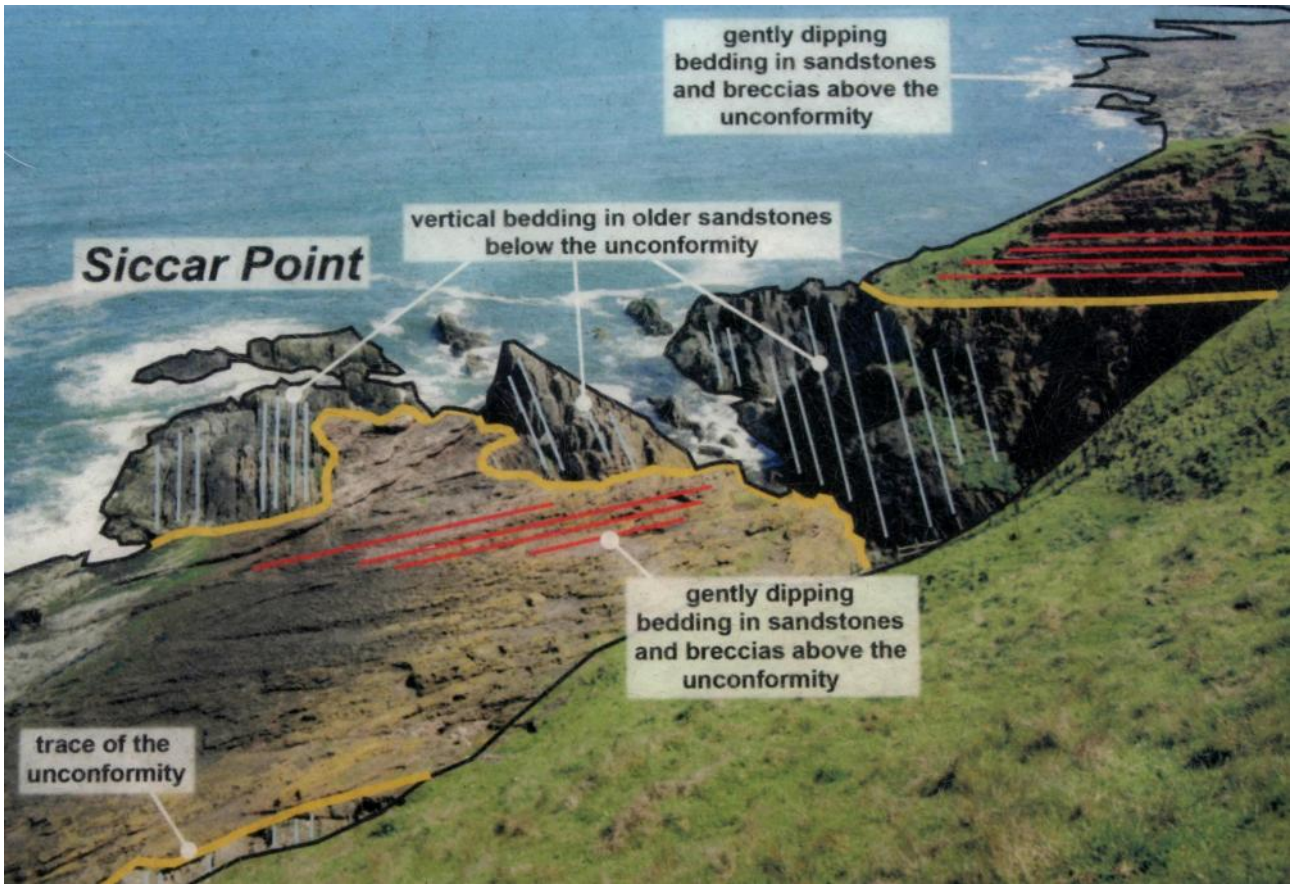
- 'An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means' (IUCN, 1994).
- 'A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values' (Dudley, 2008).

This crucial broadening of the definition of 'diversity' was debated and agreed at the IUCN Protected Areas Categories Summit in Almeria, Spain, in May 2007. It is reflected in the summary of proceedings by the statement that 'protected areas should address a full range of issues associated with "diversity", including the need for protection of geological and soil diversity' (Dudley & Stolton, 2008, p.194). The 2008 Guidelines elaborate the point further by explaining that 'nature *always* refers to biodiversity, at genetic, species and ecosystem level, and often *also* refers to geodiversity, landform and broader natural values' (Dudley, 2008, p.9).

The critical issue is how to ensure that geodiversity is adequately reflected in protected area development and management. To aid this process, IUCN WCPA has established the Geoheritage Specialist Group[1] chaired by Professor Kyung Sik Woo which has, among other tasks, to produce a best practice guideline on the management of protected area geodiversity and develop IUCN background protected area geoheritage guidance material[2]. In the interim, generic guidance has been produced as part of the protected area governance and management handbook being released at the 2014 World Parks Congress (Crofts & Gordon, 2015).

DEFINING GEODIVERSITY AND GEOCONSERVATION

Readers will be familiar with the definition of biodiversity, but perhaps less so with the definition of geodiversity and its component parts. It was described in the IUCN Management Guidelines as: '[g]eodiversity is the variety of rocks, minerals, fossils, landforms, sediments and soils, together with the natural processes which form and alter them' (Dudley, 2008, p.66). In more detail, geodiversity is: 'the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landforms, topography, physical processes) and soil and hydrological features. It includes their assemblages, structures, systems and contributions to landscapes' (Gray, 2013, p.12). Basically, therefore, geodiversity is the abiotic equivalent of biodiversity.



Siccar Point, Berwickshire, Scotland: a key locality in the development of ideas about the age of the Earth, where James Hutton in 1788 identified a huge gap in geological time represented by the unconformity between the steeply dipping lower rocks and those at a more gentle angle on top © Roger Crofts

Unpacking the definition a little further to be of relevance to protected areas requires two further terms to be defined.

Geoheritage comprises those elements of the Earth's geodiversity that are considered to have significant scientific, educational, cultural or aesthetic value (Díaz-Martínez, 2011; ProGEO, 2011; Geological Society of America, 2012). Put in everyday language, 'our geoheritage is the story of the Earth; a narrative through time preserved in its rocks, landforms, fossils, minerals and soils that provides a strong case for geoconservation' (Crofts & Gordon, 2015). There is a responsibility to ensure this inheritance from the past is passed on to future generations. In practice, a site or area of high geoheritage significance can comprise a single feature of value, and does not need to have a diversity of features present.

How these interests are managed is encompassed by the term *geoconservation*, defined broadly as: '"he conservation of geodiversity for its intrinsic, ecological and (geo)heritage values" (Sharples, 2002, p.6). More specifically, it has been defined as 'action taken with the intent of conserving and enhancing geological, geomorphological and soil features and processes, sites and specimens, including associated promotional and awareness raising activities, and the recording and rescue of data or specimens from features and sites threatened with loss or damage' (Prosser, 2013, p.568).

It should be clear from these definitions that geoconservation essentially involves the care, management and promotion of geoheritage in protected areas (ProGEO, 2011). In addition, it includes the conservation of geodiversity in a broader sense to ensure the functioning of healthy ecosystems and the services they provide. Geoconservation embraces individual features and collections of features, and also the past and present natural processes of landscape evolution and change. And, in the case of dynamic features and sites, it requires consideration of abiotic processes at the larger, ecosystem scale. For example, conserving the features of a river valley because of the biodiversity and geodiversity interest and importance cannot be sustained without ensuring that the water regime upstream of the protected area is not radically changed unnaturally or significantly damaged by human activity. So geoconservation is broad ranging, and not, as sometimes thought, just about preserving individual features at the site level.

To be clear, the term geoconservation used in this paper embraces both the specific conservation of geoheritage assets and the wider conservation of the processes, functions and features which constitute geodiversity.

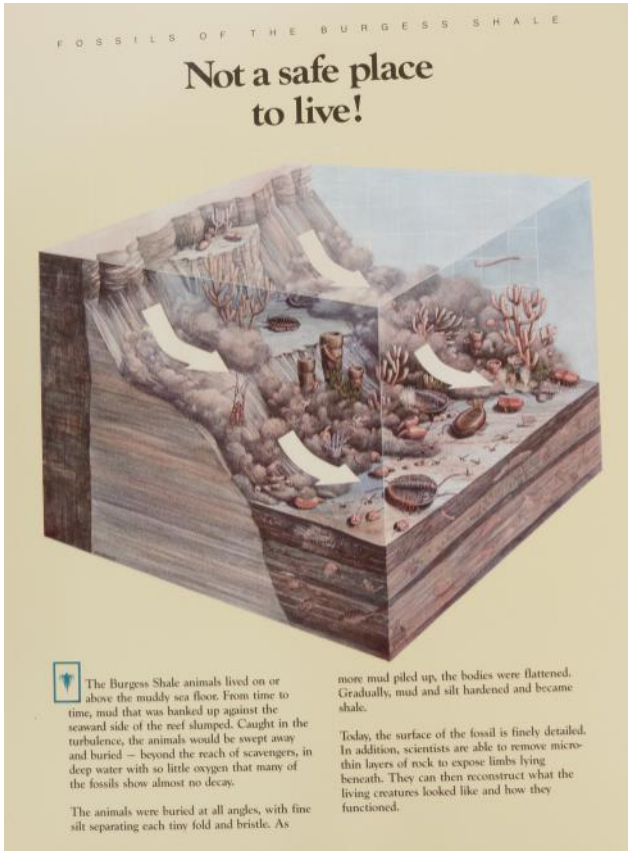
The importance of geoconservation and its integration into the management of protected areas, as part of the Ecosystem Approach (as defined by the CBD), that recognises the values and integrity of both abiotic and biotic processes in nature conservation, has been approved by successive IUCN World Conservation Congresses. IUCN Resolutions 4.040 at Barcelona (IUCN, 2008) and 5.048 at Jeju (IUCN, 2012) both clearly state that geodiversity is part of nature and geoheritage is part of natural heritage.

STATING THE CASE FOR GEOCONSERVATION

Having settled the definition of terms, the question then arises 'why is geoconservation necessary?' There is a popular view that rocks and landforms are reasonably robust and not liable to change or damage by human activities and therefore do not need special measures for their conservation. But this is not the case (see threats below). There are five basic reasons for the conservation of geoheritage and geodiversity: 1) for their own sake, 2) as a scientific and educational resource, 3) for their cultural and aesthetic values, 4) as the abiotic equivalent of biodiversity and 5) for the provision of environmental goods and ecosystem services.

Conserving nature because of its intrinsic value is vitally important. Too often in the recent past the focus has been exclusively on the usefulness of diversity to society. Now is the time to recognise that, despite the fact this is currently the Anthropocene period of geological time, there is ample justification for protecting our geoheritage just because it is there: for its own sake and for life's sake (see Crofts et al., 2008).

Protecting geoheritage as a scientific and educational resource is the second reason. There are many sites that have proved to be formative in our knowledge of the evolution of the Earth. Two examples suffice to point out their importance. Hutton's unconformity at Siccar Point, Berwickshire, Scotland, is one of the key sites where James Hutton, 'the father of modern geology', advanced his theory of the Earth encapsulated in the timeless statement that 'we see no vestige of a beginning, - no prospect of an end' (Hutton, 1788, p.304). The Burgess Shale in Yoho and Kootenay National Parks, British Columbia, Canada, provides exceptional insights into the evolution of complex life forms on Earth over 500 million years ago during the Cambrian period[3].



The great diversity of fossils present and their remarkable degree of preservation in the Burgess Shale, British Columbia, Canada, have allowed new insights into the evolution of life on Earth. Site management includes restricted access to the site to protect the fossils, accompanied by excellent interpretation at the Yoho National Park visitor centre in Field © Roger Crofts

Related to this second reason is the fact that there will be some aspects of Earth systems and features which our current knowledge does not recognise or does not understand. We should be aware of leaving an inheritance to future generations to research and explore as part of our educational and cultural resources. At the very least, sites and features which have proved to be controversial in their interpretation or resulted in important or new insights into the evolution of the Earth and life upon it are likely to be worthy of protection.

A third reason for geoconservation in protected areas is its important cultural heritage role. For example, in Slovenia the mountain, Triglav, in the national park of the same name, is represented on the national flag (see overleaf). Similarly, there are many sacred sites, such as groves in India, and many cultural history sites such as the caves with early paintings of life in Kwa-Zulu Natal, South Africa, that demonstrate the close connection between geoheritage and cultural heritage. Some sites, such as Yosemite and Yellowstone National Parks in the USA, have a cultural importance because of their role in the development of protected areas thinking and action,

Triglav, the highest mountain in Slovenia, at the heart of the Triglav National Park, is also the key symbol on the national flag of the new state formed in 1990 © Roger Crofts

Thermophilic plants represent biotic dependency on the nutrients provided by hydrothermal activity in Waimangu volcanic valley, Rotorua, New Zealand © Roger Crofts

while many others have significant value for aesthetic reasons and for recreation and tourism activities (Coratza & Panizza, 2009; Dowling & Newsome, 2010).

As geodiversity is widely regarded as the abiotic equivalent to biodiversity (Gray, 2013; Crofts, 2014), it has equal justification for being a key element in protected areas as an integral part of nature and natural heritage: the fourth reason. By definition, geodiversity is a vital component of ecosystems in which biotic and abiotic components form an interacting system (Tansley, 1935; Convention on Biological Diversity, 1992). The linkages and interdependencies between abiotic and biotic nature are clear across a wide range of scales from global to local (e.g. Soukupová et al., 1995; Barthlott et al., 2005; Alexandrowicz & Margielewski, 2010). The substrate of rocks and soils provides the rooting zone and much of the nutrient supply for plant growth and survival. The specific characteristics of the substrate and soil – acidity/alkalinity, moisture retention capacity, chemical composition, and others, determine its capacity to host plants and animals. So, in some cases, the chemical composition of the rocks will determine particular plant types which are so unusual that they justify protection, as for example those growing on the serpentine rocks of the Keen of Hamar in Shetland, UK[4], and the thermophilic plants dependent on the enriched chemical cocktail in the Waimangu volcanic valley, Rotorua, New Zealand[5]. Equally important are the dynamic processes (e.g. soil formation, biogeochemical and water cycling, stream flows, erosion and sedimentation) that provide nutrients and maintain habitat condition and ecosystem health. Hence, in many environments the complex and dynamic patterns of micro- and meso-scale topography, soils and geomorphological processes provide mosaics of habitats, corridors and topographical variations for high species richness (Thorp et al., 2010; le Roux & Luoto, 2014).

This biotic-abiotic relationship can also be described in a different way. The recently coined term 'conserving the stage' is based on flora and fauna being the actors and geodiversity as the stage on which they thrive. In this approach, the conservation of biodiversity is seen as best achieved by conserving the stage, particularly in times of climate change when having a range of habitats for plants and animals to relocate to may be crucial to their survival (Anderson & Ferree, 2010).

And, finally, geodiversity provides many environmental goods and ecosystem services (Figure 1) (Gray et al., 2013). This provision means that working with nature, rather than against it, and seeking to maintain the natural systems and processes is a fundamental role of protected area management.

Three specific examples illustrate the case for geoconservation.

Joggins Fossil Cliffs, Canada: This World Heritage Site (WHS) on the shores of the Bay of Fundy, Nova Scotia, Canada, represents the conservation of a key site for Earth history because of the knowledge gained from analysis of the fossil flora and fauna in the rock strata. It is the finest example in the world of a fossilised terrestrial tropical ecosystem and its associated plant and

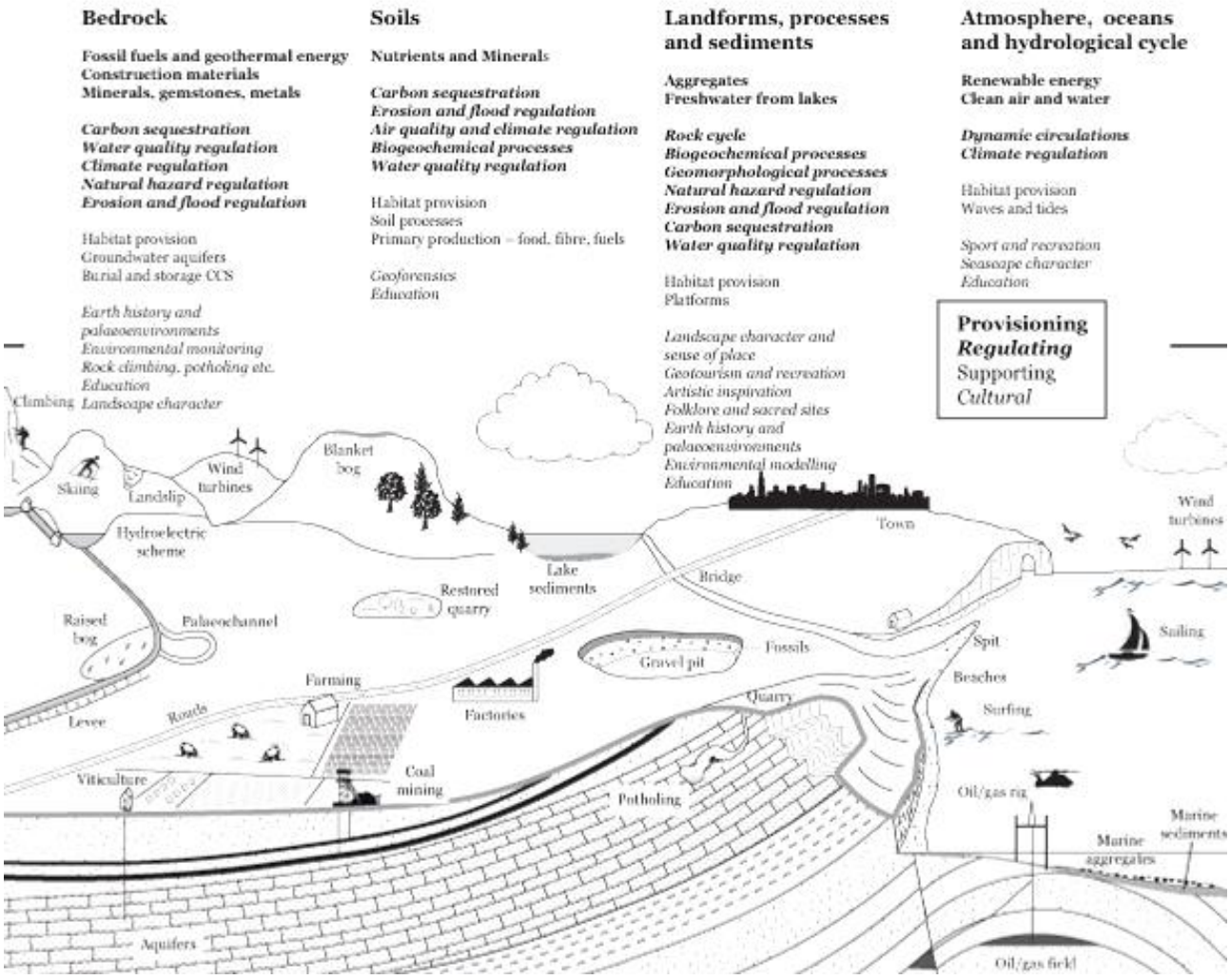
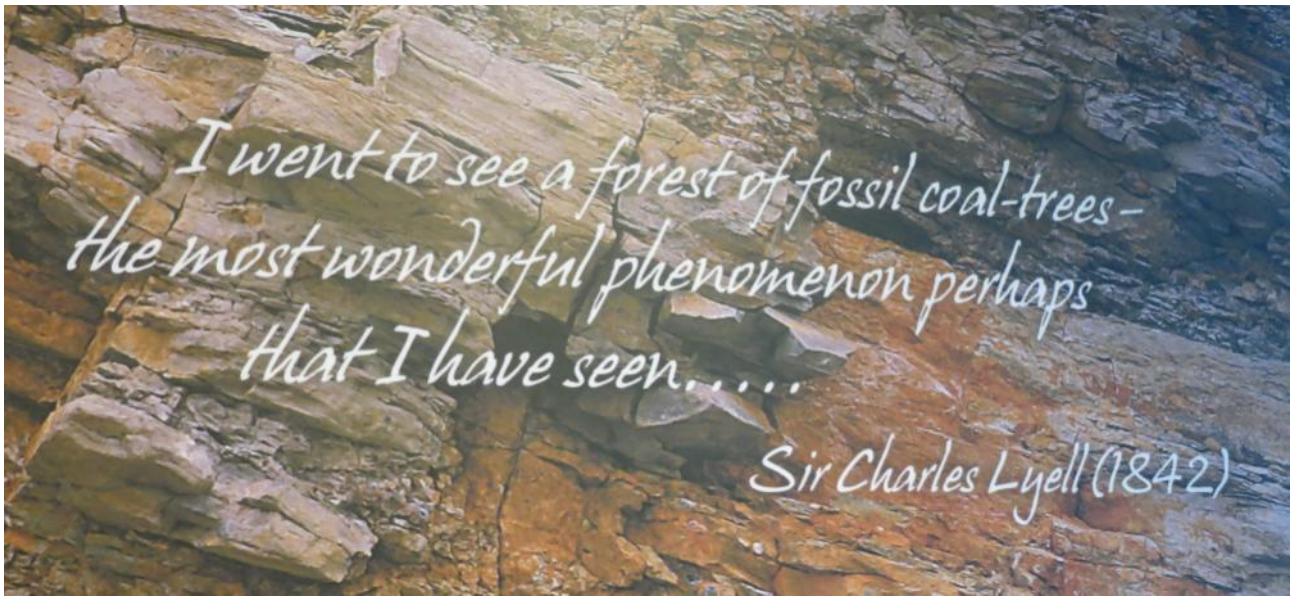


Figure 1: Schematic illustration of the goods and services derived from geodiversity. Reprinted from *Proceedings of the Geologists' Association* 124, M. Gray, J.E. Gordon & E.J. Brown, 'Geodiversity and the ecosystem approach: the contribution of geoscience in delivering integrated environmental management', 659-673, Copyright (2013), with permission from Elsevier <http://www.sciencedirect.com/science/journal/00167878>

animal remains dating from around 310 million years ago during the Carboniferous period. The first reptiles known were discovered here and the fossils represent the evolution of life from amphibians to reptiles. Joggins Fossil Cliffs also provides the possibility of discovering new species and of new interpretations of plant and animal history by future generations of scientists, especially as it is subject to shoreline erosion by the high-energy tidal currents and waves in the Bay of Fundy exposing new sections continually. The site was also important in the development of ideas about the evolution of life on Earth through the visits of scientists in the mid-19th century – including Charles Darwin and Sir Charles Lyell, who discovered new amphibian fossils at Joggins Cliffs and whose ideas on the geological evolution of the Earth over vast time periods helped to underpin Darwin's theory of biological evolution. Most importantly, there is interpretation and education of the highest quality provided for visitors of all ages and abilities in the visitor centre and along the shoreline through the trained official guides[6] (see photo overleaf).

The site is protected under conservation legislation of the provincial government of Nova Scotia, backed up by the WHS designation and the monitoring process associated with it. Surprisingly, in a country where major conservation sites and areas are under federal ownership and jurisdiction through Parks Canada, the site is privately owned and run by an NGO, albeit financially supported from public sources.

Vatnajökull National Park, Iceland: There are many reasons for the protection of Iceland's, and Europe's, largest ice cap and its outlet glaciers, meltwater streams and sandur plains. It is underlain by a tectonic plate boundary with active subglacial volcanoes, such as Grímsvötn, and surface fissure belts, such as Laki. These sites are important in understanding the interaction



Joggins Fossil Cliffs World Heritage Site, Nova Scotia, Canada, is an exemplary geoheritage site for discovering biological evolution during an important period in the Earth's history. Continual coastal erosion of the cliffs provides new exposures for scientific study and for public viewing. An excellent interpretation centre is located discretely on the cliff top © Roger Crofts

between subglacial volcanic eruptions and ice caps, producing high-magnitude floods that shape the existing sandur plains and build the land out into the adjacent ocean. The rivers flowing from the ice margin provide nutrients to support plant growth and the sandur plains provide food and habitat for breeding arctic animal species, such as the Great Skua (*Catharacta skua)* and the Red-throated diver *(Gavia stellata)*. The arctic environment adjacent to the ice cap is ideal for the formation of periglacial forms such as palsas (low mounds formed by ice lenses just below the ground surface). It also provides informal recreational opportunities, including the ascent of Iceland's highest mountain, and snow scooter tours in winter. Cultural history is also significant, particularly in the many folk tales and legends, the grazing of sheep on the upland heaths and sandur plains, and the skills of local people in navigating their way across the highly hazardous sandur plains with their shifting channels and sinking sands. There is access by the public to the edge of some of the outlet glaciers and ice-dammed lagoons, as well as to the ice cap and the surrounding land. Interpretation facilities explain the geoheritage significance of the protected area, especially at Skaftafell in the south (Guttormsson, 2011)[7].

The national park is protected under a specific Icelandic Act of Parliament. There are remaining threats which, without the existence of the park, would be significantly higher. The park helps to protect the main river systems from exploitation for hydro-electric power, although what legitimately should have been areas protected within the park have now been dammed for hydro-electric power production.

The Giant Mountains, Czech Republic-Poland: The Giant Mountains, located astride the Czech-Polish border, are part of the Sudetes mountain belt formed in the late Carboniferous during the Hercynian orogeny. They are the highest and most northern mountain massif in central Europe. They are outstanding for inter-related geodiversity, biodiversity and cultural interests. The area has been described as 'an arctic-alpine island' in the middle of Europe, forming a 'biogeographical crossroads' with affinities to the Alps to the south and the Scandinavian mountains to the north (Soukupová et al., 1995; Štursa, 1998). Exceptionally for the middle mountains of Central Europe, the summits and plateau surfaces rise above the alpine tree line and display a remarkable assemblage of relict and active periglacial features, including tors, cryoplanation terraces, blockfields, blockslopes, solifluction features, nivation hollows and patterned ground. Of particular interest is the so-called 'arctic-alpine tundra' zone and the close associations between plant distributions, topography, geomorphology and climatic factors (Soukupová et al., 1995; Jeník, 1997). Three aspects are of particular significance (Soukupová et al., 1995; Štursa, 2013): 'lichen tundra' developed on the blockfields of the higher summits; alpine grassland with vegetated patterned ground, scattered stands of dwarf pine (*Pinus mugo*) and subalpine mires on adjacent etchplains; and short- to long-lying snowbeds with related hydrological systems and snow avalanche-related plant and animal communities in the leeward of glacial cirques and valley heads. The Giant Mountains have a long history of human activity and today face a range of human pressures, including those from high visitor numbers in summer and winter.

The Skeiðarársandur outwash plain and river systems emanating from the Skeiðarárjökull, Vatnajökull National Park, Iceland: an intensely dynamic environment with rapid changes in water discharge and velocity, such as occurred in 1996 when a subglacial eruption melted the overlying ice and caused a major flood © Roger Crofts

The Giant Mountains: lichen-covered blockfields and cryoplanation terraces occur on the higher summits, with vegetated patterned ground, stands of dwarf pine (*Pinus mugo*) and subalpine mires on the plateau slopes below. The adjacent glacial corries support a great diversity of plants on the leeward slopes associated with snow avalanche paths and snow beds © Kamila Antošova/KRNAP

Protection and management are co-ordinated under the cross-border Czech-Polish Krkonoše/Karkonosze National Parks and the Krkonoše/Karkonosze Transboundary Biosphere Reserve. Management recognises the importance of maintaining natural geomorphological processes as the driving force for supporting diversity in the mountains (Štursa, 2013). Popular publications and material for visitors also emphasise the links between geodiversity, biodiversity and cultural heritage in an exemplary manner[8].

IDENTIFYING SITES AND AREAS FOR GEOCONSERVATION

The basic approach recommended by IUCN WCPA for identification of protected areas rests on the categorisation of biogeographical regions (Davey, 1998) and key biodiversity areas (Langhammer et al., 2007). However, a somewhat different approach is required for the identification of sites for geoconservation. A staged approach is suggested both for the identification of the

Table 1: Key scientific elements of a geoheritage protected areas system. Source: Crofts & Gordon (2015)

Key elements	Specific aspects
Key stages in Earth history	Stratotypes (type sections) and type localities designated as the standard reference sections and geographic localities for named stratigraphic units (rock strata defined according to their lithological characteristics, the time intervals they represent or the fossils they contain) or the boundaries between them.
Major structural features	Tectonic events and episodes associated with plate movements. Examples include features associated with plate collisions resulting, for example, in formation of mountain chains, accompanied by thrusting, folding and compression of strata. Other examples associated with the convergence of plates include the formation of island arcs, central volcanoes, and extensive lava flows.
Formation of minerals	Rare and representative mineral deposits and locations of specific minerals.
Evolution of life	Fossils and fossil assemblages representing stages in the evolution of life and gradations and interruptions in life sequences in the fossil record reflecting, respectively, evolutionary trends and catastrophic events, such as meteorite strikes and eruptions of supervolcanoes.
Modern Earth processes	Features representative of active processes particularly associated with tectonic plates, such as different types of volcanoes and other eruptive forms, and those associated with coastal, fluvial, arid, tropical, glacial and periglacial environments.
Representative surface and sub-surface features	Features representative of particular periods of Earth history, or particular rock formations or Earth processes, or that are unusual or distinctive (e.g. cave systems, earth pillars, domed and other upstanding rock formations).
Records of past environments	Rocks, fossils, landforms and sedimentary deposits indicative of past environments and environmental changes from all periods of Earth history (e.g. the glacial and interglacial phases of the Quaternary ice ages).

geoheritage aspects of existing protected areas that might require conservation and for places of importance for geoconservation that have not been formally identified and protected. In both cases, the first stage is to systematically identify the key components of geoheritage that should be protected. A simple schema is shown in Table 1 to aid this process.

The second stage is survey work to identify key aspects of value to geoheritage using the framework in Table 1. This should result in the identification of target areas for protection. Depending on the purpose of the assessment, additional non-scientific criteria may be incorporated such as educational, cultural, aesthetic and ecological values (Reynard, 2009).

The third stage is to take a step-by-step approach to identify specific sites and areas for protection. A very useful practical tool to use at this stage is the *Geoheritage Tool-kit* (Brocx and Semeniuk, 2011) (Figure 2). An intrinsic part of this third stage is to review the need for site networks rather than just individual sites. These are important since it is often the case that multiple sites are necessary to represent the essential characteristics of a particular phenomenon or event in a country (e.g. the range of glacial landforms in Great Britain). In the case of major Earth features and processes, a purely national approach will not result in adequate representation. Take, for example, the opening of the North Atlantic Ocean arising from the separation of the Eurasian and North American tectonic plates, a major event in the Earth's history. Transnational collaboration is required to establish a network of protected sites fully representative of the key features and processes, incorporating key sites in each country around the Ocean and important sub-sea features in international waters.

The final stage is to use established national legal processes for formally protecting an area. Formal statutory protection is the preferred mechanism, but it is recognised that this cannot always be achieved for political or practical reasons. There are alternatives such as ownership by NGOs or communities; there are cases, for example in Britain, where this has occurred and the Joggins Fossil Cliffs case, highlighted above, is another. In addition, when communities and NGOs are developing new protected areas or reviewing the scope of existing ones, it is hoped that they will consider opportunities for protecting geoheritage.

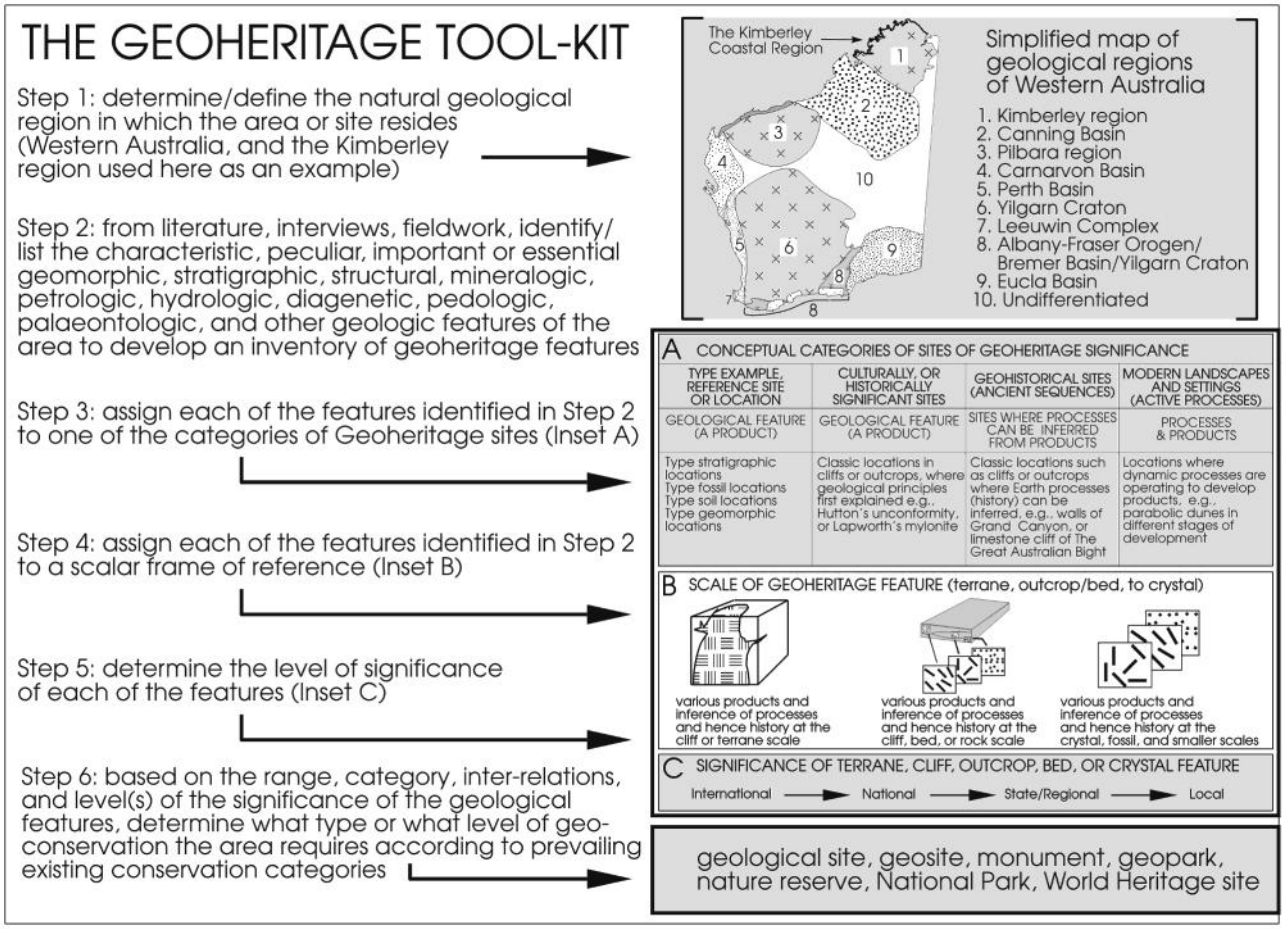


Figure 2: Steps in the use of the Geoheritage Tool-kit to identify and assess sites of geoheritage significance.
Source: Brocx & Semeniuk (2011), reproduced by permission of the authors and the Royal Society of Western Australia

The Geological Conservation Review in Great Britain is a good example of a systematic assessment of nationally important geosites (Ellis, 2011). The underlying rationale is that sites are selected for their scientific interest through a process of expert review, and must make a special contribution to the understanding and appreciation of Britain's geoheritage. Over 3,000 sites have been selected and most are designated as Sites of Special Scientific Interest (SSSIs) and have statutory protection.

GUIDING PRINCIPLES FOR GEOCONSERVATION IN PROTECTED AREAS

Identification and designation of protected areas is an essential first step in the conservation of features and processes of geoheritage significance. At least as important is the determination of the type of management required in the light of the reasons for protection and both the natural and human activities and events which might affect the integrity of the site or area (see Crofts & Gordon, 2015). A number of guiding principles are provided below to aid this process.

1. **Manage natural systems naturally**: This guiding principle is based on the philosophy of working with nature rather than against it. As far as possible, natural systems and processes should be allowed to maintain natural rates and magnitudes of change and their capacity to evolve uninterrupted across most or all of their natural range of variability. If intervention is essential, mimicking nature and natural processes is more environmentally sustainable and effective than trying to impose engineered solutions that seek to control or halt natural processes. 'Soft' approaches to management should be adopted using natural materials that mimic nature as far as possible, rather than 'hard' engineering solutions that can wreck the features and processes of the protected area (e.g. Scottish Natural Heritage, 2000; River Restoration Centre, 2013). Good examples are along the coast where the emplacement of fixed structures to stem sediment loss might result in starving adjacent dynamic landforms and associated habitats; instead, alternative approaches including beach nourishment, managed realignment or use of 'green infrastructure' to enhance natural forms of defence such as sand dunes or salt marshes are recommended. For example, removal of mangroves, that serve as a natural form of protection of the coastal edge and are protected for their biological interest, and replacing them with solid structures such as concrete walls should be avoided.

2. **Natural systems and processes should be managed in a spatially integrated manner**: Management of part of a natural system in isolation from other elements of the system should be avoided. For example along a coastline or in a mountain area or a river basin, management should seek to achieve complementary objectives, such as geodiversity, biodiversity and landscape diversity conservation, and recognise the effects of connectivity and dependencies between different parts of the system at the landscape scale (e.g. downstream habitat changes arising from changes in sediment transfer between hillslopes and river channels).

3. **The inevitability of natural change should be recognised**: No system or element of a natural system is static forever and change will occur. The traditional approach of maintaining or enhancing the current state to preserve features can remain valid where these are unlikely to be significantly affected by the natural changes, such as iconic mountains and robust rock features, or in the case of some small, high-value sites where protective measures can be effectively implemented. But, in many circumstances, where natural processes are a key element of maintaining or protecting the features of interest, it will have to be recognised that working with natural changes to allow geomorphological processes to adapt to the changed conditions may be the only effective strategy (Prosser et al., 2010; Sharples, 2011). This may mean the loss of some features, changes in their locations possibly outside the boundaries of the protected area, or their realignment. Where protection is deemed necessary, it may mean some form of 'soft' geo-engineering, but this should only be undertaken provided that it is mimicking natural processes rather than seeking to modify them substantially or to destroy them (see above).

4. **The effects of global climate change should be carefully considered**: Climate change is an increasingly important issue and cannot be ignored just because there might remain some doubt about the relative contribution of natural and anthropogenic forcing. The resulting effects will inevitably challenge the management objectives of protected areas. Careful consideration will be needed where, for example, the features are lost and/or processes are lessened or intensified, and so change the basis for protection. It may mean that the protection status can no longer be justified at all or that features elsewhere have developed meriting protection where none previously existed. Site boundaries may also need to be altered to take account of coastal erosion or where dynamic features of interest shift location.

5. **The sensitivity of natural systems should be recognised and they should be managed within the limits of their capacity to absorb change**: It is rarely the case that abiotic systems are robust and can absorb any change imposed upon them. Some will be more able than others to absorb change and others will be very fragile with low thresholds for change. If limiting thresholds are crossed, the conservation effort will be negated as the original features and processes will have been irreversibly changed.

6. **Conservation management of active systems should be based on a sound understanding of the underlying physical processes**: This includes, for example, implementation of coastal cells work in preparation of shoreline management plans; integration of river, soil and slope processes in catchment management plans; and monitoring of active processes.

7. **Make provision for managing visitors at sensitive sites**: Some sites will be very sensitive. For example, sites with rare fossils and minerals need protection from the activities of commercial collectors and irresponsible fossil collecting which can damage the scientific interest and reduce the opportunities for more research. Other sites may be vulnerable to trampling which will damage and perhaps wreck fragile forms such as new lavas. Managing access through permit systems or through accompanied visits are obvious ways of dealing with sensitivity that protected area managers will be well familiar with. Where there is a cultural and/or spiritual interest in a site, consideration needs also to be given to the maintenance of traditional access.

8. **Recognise the interaction and interdependency of geodiversity and biodiversity management**: Many sites protected for biodiversity will have a high dependency on the geodiversity of the sites, and on other sites there will be a significant interrelationship between the biotic and abiotic elements (e.g. on sand dunes). Managers should take into account these interdependencies in managing sites. More details on these interactions are given below.

INTERACTIONS BETWEEN GEODIVERSITY AND BIODIVERSITY CONSERVATION

Interactions between geoheritage and biodiversity conservation can be both positive and negative. The negative elements need to be recognised and solutions found by protected area managers. The essence of the resolution should be recognition of the interconnections between the biotic and abiotic features and the processes that brought them into existence and those processes

Galapágos Islands: volcanic activity and tectonic plate movement have created a succession of new islands, enhancing the geodiversity and providing the abiotic basis for the diversity of species within the archipelago © Roger Crofts

which maintain them. Taking a one-dimensional approach, favouring either geoheritage or biodiversity conservation, is most unlikely to result in a resolution benefiting conservation as a whole. Issues which will need to be addressed include:

- What is the basis of the conflict between the biotic and abiotic interests in and around the protected area?
- Is the conflict capable of resolution without undermining both interests or is it more fundamental?
- If the latter, is one of the interests more important in the long term to national and international nature conservation than the other and needs to be safeguarded and the other sacrificed?

There will also be a series of practical issues to be addressed, such as:

- Is vegetation growth damaging or obscuring the geodiversity interest and would its removal or restraint damage the biodiversity interest? Alternatively, should the geodiversity interest be taken off-site or allowed to be obscured provided that it can be periodically re-exposed for re-examination in the light of new knowledge?
- Are current Earth processes, for example, glacier melt or river erosion, which are important for maintaining the geodiversity interest, having a damaging effect on the biodiversity interest? If so, can manipulation of the processes to have minimal effect on their natural pattern be undertaken to achieve biodiversity conservation benefits?

Sometimes, it will not be possible to achieve a solution at the protected area level, and the wider context of the habitat, ecosystem or biome will need to be considered in determining the relative merits of conserving one element in one place and the other in another place within the biogeographical unit.

Finally, it is important to discourage attempts to maximise habitat/species diversity by landscape modifications that result in the creation of incongruous landforms/landscapes (e.g. through raising the land surface by infill in areas of flat topography or creation of ponds with shapes that are atypical of local natural features) (Gray, 2013).

GEOCONSERVATION AND THE IUCN MANAGEMENT CATEGORIES

The IUCN Management Categories are equally relevant to abiotic sites as they are for biotic sites. But, there has been a working assumption that only Category III 'Natural Monument or Feature' is relevant to geoconservation. This is far from the case. Certainly, Category III is very important and many sites classified

Table 2: Examples of geoconservation protected areas in the IUCN Management Categories
Sources: compiled from various sources and taken from Crofts & Gordon (2015) with updates by the authors

Category	National examples	World Heritage Site examples
Ia Strict nature reserve	Greenland Ice Cap, Greenland: ice cap and nunataks; Geysir valley, Kronotsky Zapovednik, Russia: volcanic features	Macquarie Nature Reserve, Australia: Earth mantle rocks; Surtsey, Iceland: biotic and abiotic processes on new island formed 1963-67
Ib Wilderness area	Maspalomas Dunes Special Nature Reserve, Spain: saltmarshes within Pleistocene dunes; Noatak Wilderness, Alaska, USA: river basin	Putorana Plateau WHS, Russia: basalt plateau
II National park	Giant Mountains, Czech Republic-Poland: periglacial landforms and geodiversity-biodiversity relationships	Dolomit Bellunesi National Park, Italy: karst, glaciokarst and reefs; Grand Canyon National Park, USA: stratigraphic record and arid land erosion; Yoho National Park, Canada: Cambrian fossil beds (Burgess Shale) in landscape protected area
III Natural monument or feature	Jenolan Karst Conservation Reserve, Australia: karst system; Bosques Petrificados, Argentina: petrified forest	Boodjamulla (Lawn Hill) National Park, Australia: terrestrial vertebrate fossils; Joggins Fossil Cliffs, Nova Scotia, Canada: Carboniferous fossils
IV Habitat/species management area	Montserrat Mountain Partial Natural Reserve, Spain: sedimentary rocks, caves and mountain erosion forms; Lord Howe Marine Park, Australia: volcanic seamount	Galapágos National Park, Ecuador: modern geological processes
V Protected landscape/seascape	Cairngorms National Park, UK: Earth history and modern geomorphological processes; Cabo be Gata-Níjar Natural Park, Spain: volcanic and Quaternary history; Lyngsalpan landscape protected area, Norway: alpine mountains with glaciers and associated landforms, geodiversity protection; Vatnajökull National Park, Iceland: subglacial volcanoes and ice cap with associated landforms	Škocjan Caves Regional Reserve, Slovenia: sink holes, caves and underground rivers
VI Protected area with sustainable use of natural resources	Nublo Rural Park, Spain: volcanology, geomorphology; Sečovlje Salina Nature Park, Slovenia: salt extraction	Great Barrier Reef National Park, Australia: coral reef system evolution

around the world are testimony to this. In addition, however, geoconservation can be part of protected area rationales and management objectives for all of the other Categories. Table 2 provides examples for nationally protected areas and for World Heritage Sites to exemplify this point.

Although not a protected area category as such, Geoparks are areas with outstanding geoheritage established primarily to combine conservation of geoheritage with promotion of geotourism to support sustainable local economic and cultural development (McKeever et al., 2010). Geoparks may wholly, or in part, include protected areas and help to ensure their conservation. They may be set up through community-led initiatives or top-down designation. The Global Network of National Geoparks or Global Geoparks Network (GGN), assisted by UNESCO, provides an international framework of accreditation and standards for geoparks (UNESCO, 2010); currently the network comprises 100 national Geoparks worldwide (UNESCO 2014).

THREATS TO GEOHERITAGE CONSERVATION

There are many threats to the protection of geoheritage arising from human activities (Table 3). These need to be systematically considered in protected area management.

Table 3: Principal human-induced threats to geoheritage in protected areas
Source: adapted from Gordon & Barron (2011), Brooks (2013) and Gray (2013)

Threats and pressures	Examples of impacts on geoheritage in protected areas
Urbanisation, construction (including commercial and industrial developments inland and on the coast), infrastructure, renewable energy installations	• destruction of landforms and exposures of sediments and rocks • fragmentation of site integrity and loss of relationships between features • disruption of geomorphological processes • destruction of soils and soil structure • changes to soil and water regimes
Mining and mineral extraction (including extraction from opencast mines, pits, quarries, dunes & beaches, river beds, marine aggregate extraction and deep-sea mining)	• destruction of landforms and exposures of sediments and rocks • fragmentation of site integrity and loss of relationships between features • disruption of geomorphological processes • destruction of soils and soil structure • changes to soil and water regimes
Changes in land use and management (including agriculture, forestry)	• landform damage through ploughing, ground levelling and drainage • loss of landform and outcrop visibility and access to exposures • stabilisation of dynamic landforms (e.g. sand dunes) • soil erosion • changes to soil chemistry and soil water regimes • soil compaction and loss of organic matter
Coastal protection and river management and engineering (including dams and water abstraction)	• damage to landforms and exposures of sediments and rocks • loss of access to exposures • disruption of geomorphological processes • inhibition of erosion allows exposures to become degraded
Offshore activities (including dredging, trawling, renewable energy developments, hydrocarbon exploitation and waste disposal)	• physical damage to landforms and sediments • disruption of geomorphological processes • seabed and sub-seabed surface scour/penetration
Recreation and geotourism	• physical damage to landforms, rock outcrops, processes and soils (compaction) through visitor pressure • fragmentation of site integrity • footpath erosion and other localised soil erosion and loss of soil organic matter
Climate change	• changes in active system processes • changes in system state (reactivation or stabilisation) • loss of key features, such as ice caps and glaciers, glacial lakes and outflows
Sea-level rise (anthropogenic causes)	• loss of visibility and access to coastal exposures and outcrops through submergence • loss of exposures through enhanced erosion • changes in coastal landforms • loss of all or substantial parts of protected areas • new features developed (e.g. from storm surges)
Restoration of pits and quarries (including landfill)	• loss of exposures and natural landforms
Stabilisation of rock faces (e.g. road cuttings) with netting and concrete	• loss of exposures
Irresponsible fossil and mineral collecting and rock coring	• physical damage to rock exposures and loss of fossil record

ESTABLISHING MONITORING AND EVALUATION SYSTEMS

Finally, as with any protected areas, systems for monitoring and evaluating the state of protection are necessary and in particular to determine whether the geoheritage features and forms, and the natural processes operating to ensure retention of the interests, are being protected. In addition to the standard Management Effectiveness Evaluation systems recommended by IUCN WCPA (Hockings et al., 2006), some additional measures relating to site and process integrity are required specifically for geoheritage sites (Table 4, overleaf).

Table 4: Protected area geoheritage attributes to be monitored. Source: adapted from Ellis (2004)

Visibility of features: the degree of concealment from the build-up of vegetation, soil or talus, or from constructions and other human activities
Site integrity: the degree of fragmentation, degradation or physical damage affecting the features of interest
Extent of features: the area of rock face, sediment section or landforms available for study or interpretation, or the quantity of important geological material such as the volume of spoil material in a mine dump
Integrity of dynamic processes: the freedom of geomorphological processes to evolve naturally and unimpeded

ENDNOTES

[1] To apply for individual membership of the WCPA Geoheritage Specialist Group contact the Secretary General, Wesley Hill, whill@geosociety.org
[2] See: www.iucn.org/about/work/programmes/gpap_home/gpap_biodiversity/gpap_wcpabiodiv/gpap_geoheritage/
[3] See: www.pc.gc.ca/eng/pn-np/bc/yoho/natcul/burgess.aspx
[4] See: www.nature-shetland.co.uk/snh/hamar.htm
[5] www.waimangu.co.nz/
[6] See: www.jogginsfossilcliffs.net
[7] See: www.vatnajokulsthjodgardur.is/english
[8] See: www.krnap.cz/en/

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ABOUT THE AUTHORS

Roger Crofts trained as a geographer and carried out geomorphological research in mid and high latitudes. Following work in the Scottish Government, he was the founder Chief Executive of Scottish Natural Heritage 1992-2002, including managing and advising on management of protected areas and the implementation of Natura 2000. He was WCPA Regional Vice-Chair Europe 2000-2008, chair of the IUCN UK Committee 1999-2002, chaired the Durban Working Party for the Vth World Parks Congress and is now a WCPA Emeritus. He has written and lectured on Earth heritage and environmental management, particularly in Scotland, Iceland and other parts of Europe. www.rogercrofts.net

John E Gordon is a geomorphologist who has worked on geoconservation in the UK with the Nature Conservancy Council, Scottish Natural Heritage and currently as an adviser and consultant. He is an honorary professor in the School of Geography and Geosciences at the University of St Andrews and is a deputy chair of the IUCN/WCPA Geoheritage Working Group and a member of the European Federation of Geologists' Panel of Experts on Geoheritage. He has published many articles and books on geoheritage and geoconservation and on his other research interests in mountain geomorphology, glaciers and glaciation.

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RESUMEN

El reconocimiento formal del componente de geodiversidad de las áreas protegidas se dio en 2008 en las Directrices revisadas de la UICN para la aplicación de las categorías de manejo de las áreas protegidas. Este artículo defiende la importancia de esta adición y demuestra la necesidad de la conservación del patrimonio geológico en las áreas protegidas, tanto por derecho propio como por su valor más amplio en el apoyo a la biodiversidad y los servicios de los ecosistemas. El artículo resume algunas de las cuestiones claves que los administradores de áreas protegidas habrán de abordar para garantizar que la geoconservación se refleje adecuadamente en el desarrollo y la gestión de áreas protegidas. Se ofrece orientación preliminar sobre el desarrollo de la geoconservación en las áreas protegidas y la pertinencia de las seis categorías de manejo.

RESUME

En 2008 l'UICN a formellement reconnu l'importance de la composante de géo-diversité dans les aires protégées à travers la révision des Lignes directrices pour l'Application des Catégories de Gestion des Aires protégées. Cet article souligne l'importance de cette révision et présente les arguments en faveur de la conservation du géo-patrimoine dans les aires protégées, à la fois pour sa valeur intrinsèque et pour son importance plus vaste dans la préservation de la biodiversité et des services éco-systémiques. L'article résume certaines questions clés que les gestionnaires des aires protégées devront affronter pour s'assurer que la géo-conservation est bien prise en compte dans le développement et la gestion des aires protégées. Il fournit également une orientation préliminaire sur le développement de la géo-conservation dans les aires protégées et l'importance des six catégories de gestion.

A PRELIMINARY ASSESSMENT OF PROTECTED AREA MANAGEMENT WITHIN THE WWF 'COASTAL EAST AFRICA' PRIORITY PLACE, EASTERN AFRICA

Kathryn Knights[2,] Ivon Cuadros[2], Camilo Zamora[2], Lauren Coad[2,3], Fiona Leverington[2,4], Brian O'Connor[1], Marcelo Gonçalves de Lima[1], Naomi Kingston[1], Fiona Danks[1], Marc Hockings[4], Isaac Malugu[5], Peter Scheren[6], Elizabeth Ngoye[6], P. J. Stephenson[7], and Neil D. Burgess[1,8*]

* Corresponding author: Neil D Burgess
1. UNEP – WCMC, Cambridge, UK
2. Protected Area Solutions, Australia/UK
3. University of Oxford, UK
4. University of Queensland, Australia
5. WWF Tanzania Country Office, Tanzania
6. WWF Coastal East Africa Global Initiative, Tanzania
7. WWF International, Gland, Switzerland
8. Centre for Macroecology, Evolution and Climate, Denmark

ABSTRACT

We studied the effectiveness of protected area management within a Worldwide Fund for Nature (WWF) priority place for conservation investment, located in the coastal areas of Kenya, Tanzania and Mozambique. At least 473 sites in this region have completed Management Effectiveness Tracking Tool (METT) assessments since 2003, often associated with Global Environment Facility (GEF) funded projects, but also through work funded by other donors and WWF itself. We show that community managed reserves score higher using the METT tool when compared with sites managed by the state forest agencies. We situate this within the context of approaches to reserve management in Tanzania, where state-managed Forest Reserves have received little in terms of funding support and score lowest when compared with all other management types in Tanzania. Further, we show that slightly higher average METT scores for sites where WWF are working across Kenya, Tanzania and Mozambique, when compared with all other sites, are most pronounced in elements of the METT tool relating to inputs, process and planning, and are not seen in outputs or outcomes. We discuss the utility of the METT tool for organisations like WWF to evaluate their impact in protected area management, including the issue of systematic bias in data recording (WWF facilitation of assessments) and that more time may be required to see the outcomes and impacts from any management improvements that have been achieved.

Key words: Management Effectiveness Tracking Tool, coast, Kenya, Tanzania, Mozambique

INTRODUCTION

A number of different tools have been developed to systematically assess protected area management effectiveness. The most widely used is the 'Management Effectiveness Tracking Tool' (METT) (Dudley & Stolton, 2009), which was built upon the World Commission on Protected Areas (WCPA) framework for assessment of protected areas (Hockings et al., 2006). Operational in 2003, it is now applied as a mandatory reporting mechanism for all protected area projects funded by the Global Environment Facility (GEF), the World Bank and the Critical Ecosystem Partnership Fund (CEPF), and is additionally used by other international agencies to track protected area management. WWF has adopted the METT as a tool to measure its conservation outcomes across its programmes, through the monitoring of the delivery of the 'Global Programme Framework' within its 35 priority places for interventions around the world (Burgess et al., 2014). It has also been used for global reporting against the Convention on Biological Diversity (CBD) Aichi Biodiversity Target 11 (Leverington et al., 2010a, 2010b; Coad et al., 2013).

One of the WWF priority places that forms a focus for their conservation efforts is 'Coastal East Africa', which includes the globally important species endemism values

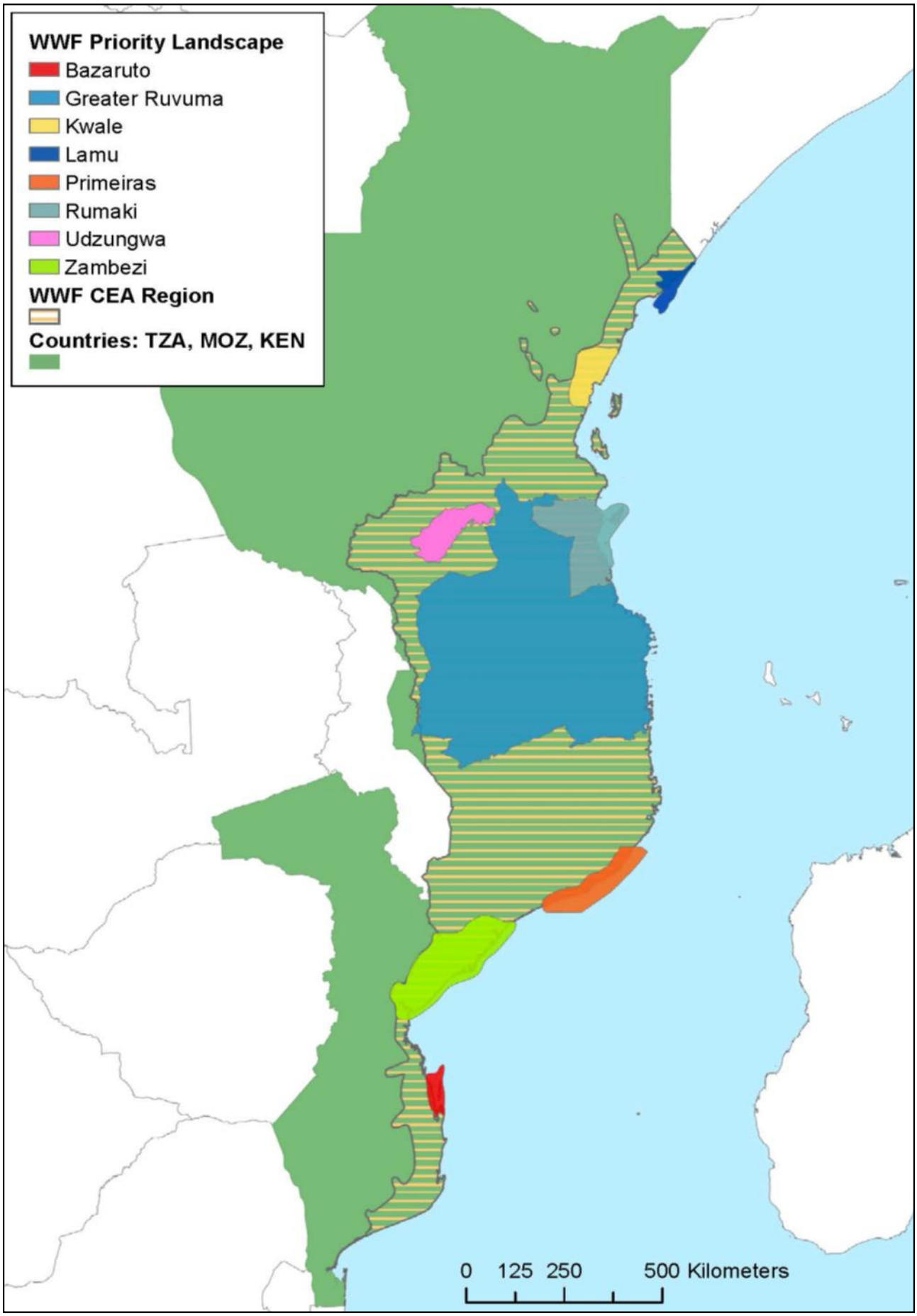

Figure 1: WWF Coastal East Africa Global Initiative (CEA-GI) region and Priority Landscapes within Kenya, Tanzania and Mozambique

Participants at a workshop to introduce the METT in Tsavo East National Park, Kenya © Equilibrium Research

of the Eastern Arc Mountains ecoregion (Burgess et al., 2007), and the eastern African coastal forests ecoregion (Burgess & Clarke, 2000), as well as components of the miombo woodlands ecoregions, with their globally important assemblages of large mammals (Olson et al., 2001; Burgess et al., 2006). The Coastal East Africa region includes marine and terrestrial elements, although there are few marine sites included in the dataset addressed for this paper. WWF has been working in Coastal East Africa for many years, an element of this work since the 1990s has been supporting the development of state managed and community managed conservation areas. There has been a wide application of the METT tool in the region, often through the GEF and WWF funded projects (some GEF funded projects are also implemented by WWF in Kenya and Tanzania), but also through other conservation projects with various combinations of partners including state bodies and other international NGOs. This dataset allows preliminary analyses of the utility of this tool, within the context of a regional conservation programme coordinated through an international conservation NGO, and within the setting of three different nations and a number of different protected area management regimes.

This paper presents an analysis of protected area management in the Coastal East Africa WWF priority places within Eastern Africa, using data from all available METT assessments from the countries of Tanzania, Kenya and Mozambique. Specifically we investigate:

1. To what extent has the METT tool been applied in the region?
2. How does protected area management, as measured by the METT tool, vary with management type, both in broad terms and in more detail for Tanzania?
3. Can we measure the impact of WWF presence or absence in a protected area, as measured by the METT tool, on improvements to protected area management?

METHODS

Study location

The study area comprises a nested set of overlapping regions (Figure 1): a) the country boundaries of Tanzania, Kenya and Mozambique; b) the WWF Coastal East Africa Global Initiative (CEA-GI) region which comprises the coastal regions of these countries and aims to cover the most critical biodiversity values within a coherent region (WWF, 2008); and c) the WWF Priority Landscapes for conservation activity within the broader CEA-GI region (WWF, 2008).

Preparation of datasets

- **METT assessment data**: The METT tool (last updated in 2007[1]) consists of three datasheets: the first contains information on protected area context (e.g. legislation, ownership and governance), protected area management inputs (e.g. budget and staff numbers), and protected area objectives and management activities. The second datasheet focuses on protected area threats, and the third comprises a series of 30 questions scored between 0 and 3 (four ranks) and covers various elements of site

management (Belakurov et al., 2009; Hockings et al., 2006) covering the six components of the WCPA framework: context, planning, inputs, process, outputs and outcomes.

For this study we compiled all METT data from the region from 2003 onwards, as collected by several different agencies; NGOs such as WWF, national governments, GEF and CEPF funded projects etc. The majority of the 473 assessed sites from this region were associated with GEF project investments, with over 150 sites assessed during a GEF project focused on the Eastern Arc Mountains in Tanzania and an additional c. 150 assessed during two different GEF projects focused on coastal forests in Kenya and Tanzania. The remaining sites were assessed by a mixture of agencies and projects, including around 100 by WWF itself. Across the set of sites where WWF is working, their staff have been present together with either government or community members when METT assessments were completed. Across the sites where WWF is not working, but METT assessments are available, there has been no WWF facilitation or involvement when the sheets were completed. In our analysis we compare protected areas where WWF has been working against all other possible options for protected areas combined, including state-only, other national organisations, other international NGO involvement and funding from international organisations. We initially identified assessments for the region already compiled in the January 2014 version of the Global Database on Protected Area Management Effectiveness (GD-PAME). From January to June 2014 we gathered new METT data from WWF country contacts and other protected area managers in the region. These new data were added to the GD-PAME from June to September 2014. The September 2014 version of the METT data from this database was used for all analyses reported here. Where possible, we linked METT assessment data to the World Database on Protected Areas (WDPA) (June 2014 version), assigning a WDPA code to each assessment, using the protected area name given in the METT assessment. Where more than one METT assessment had been completed for a protected area, the most recent assessment was used in the analyses, unless otherwise stated.

- **Spatial protected area data**: We used boundary data for protected areas in Tanzania, Kenya and Mozambique from the June 2014 version of the WDPA. The spatial location of assessed protected areas was determined by linking the boundary data from the WDPA to the METT assessment data, by WDPA code. Assessment data could then be analysed by 1) Country, 2) CEA-GI region, and 3) Priority Landscape, using ArcGIS mapping software to extract the protected areas within each of these three study locations.

  We identified those protected areas where WWF is working through a process of contacting all project managers in the region, and developed a list of their intervention sites (protected areas) that was then checked in terms of names and locations and linked to the WDPA. As a number of sites where WWF is working were not matched to the WDPA (due to the lack of a polygon for the protected area in the WDPA or possibly problems of matching names), the list of WWF intervention sites matched to the WDPA is only around half of the sites where WWF is working in the region. This list of sites where WWF is working was then also used to develop a list of sites where WWF is not working, which comprised all other sites in the WDPA within the regions of interest. There are some sites where WWF is not working that have the involvement of other NGOs, but this number is small compared with the number of sites with WWF involvement.

DATA ANALYSES

Application of the METT tool within the study regions

For each of the three study areas we calculated the percentage of protected areas (by both number of protected areas and area coverage) that had conducted METT assessments.

Analysis of METT scores

For each of the three study areas, we calculated the total METT score as a percentage of the total possible score. We then compared the average percentage METT score by:

1. Country (Tanzania, Kenya and Mozambique);
2. Protected area management type derived from the data given in the METT assessments (central government, local government, local communities, and private/other where the management type was too few in number to warrant a separate category);
3. WWF project presence or absence in a particular protected area where there has been a METT assessment.

We also calculated METT component scores, creating average scores for questions pertaining to the six different WCPA framework elements of management: context, planning, inputs, process, outputs and outcomes. We then compared average component scores for protected areas with and without WWF projects.

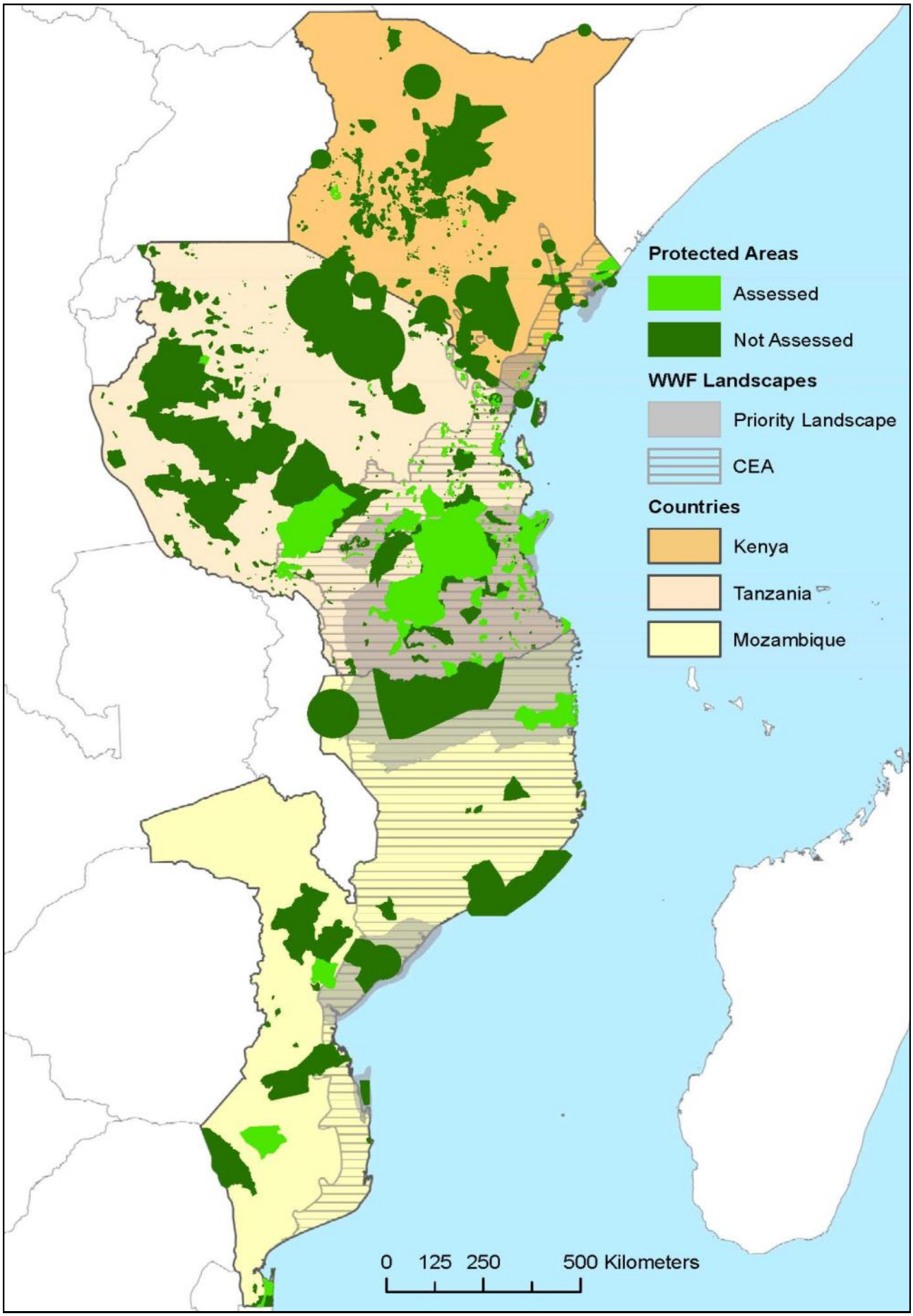

Figure 2: METT assessments by country within the CEA-GI region

Table 1: Numbers of sites included in the spatial analysis of METT scores within the three study areas: Country (Tanzania, Kenya and Mozambique), CEA-GI region and Priority Landscape. For sites not held in the WDPA we have no additional information on their location, so it is not possible to know how many sites fall within the CEA and Priority Landscape boundaries

	Country	CEA	Priority Landscapes
Number of sites in WDPA	1,076	457	216
Number of sites in WDPA that have been assessed using METT (% of total)	222 (21%)	209 (46%)	112 (52%)
Area of sites held in WDPA in km^2	617,527	257,811	191,193
Area covered by METT assessed sites in km^2 (% of total)	119,886 (19%)	112,607 (44%)	83,231 (44%)
Number of sites assessed using METT not in WDPA	251		
Total number of sites with METT assessments	473		

RESULTS

Application of the METT tool

Overall 21 per cent of the protected areas held in the WDPA for Tanzania, Kenya and Mozambique have been assessed using METT, which represents 19 per cent of the total area under protection (Figure 2 and Table 1). Of the total METT assessments for the three countries, only 47 per cent are included in the WDPA. This difference in numbers of sites where METT has been applied and sites in the WDPA is largely due to the numerous community-owned 'Village Land Forest Reserves' assessed in Tanzania, and community managed 'Kaya forest' sites assessed in Kenya. These are sites that: a) may not conform to the IUCN definition of a protected area, and are therefore not added to the WDPA; or b) conform to the IUCN protected area definition but no boundary or attribute data has been provided to UNEP-WCMC by government. The latter is often because clarity on applying the new IUCN protected area definitions has only recently been developed and many governments have previously only been providing data to the WDPA on state-managed protected areas.

Within the smaller area covered by the WWF broad intervention area (CEA-GI), 46 per cent of the protected areas held in the WDPA have been assessed using METT, representing 44 per cent of the total area under protection. For the Priority Landscapes targeted intervention region, the percentage of protected areas held in the WDPA that have been assessed using METT rises to 52 per cent, or 44 per cent of the total area under protection (Table 1).

Management of METT-assessed sites

Half of the total number of assessments for protected areas in the region reported that they were being managed by national government at the time of assessment (Figure 3). Assessments report that local communities were managing the protected area in 16 per cent and 31 per cent of assessments in Kenya and Tanzania respectively. Too few assessments have been collected for Mozambique to provide a breakdown.

Analysis of average METT scores

- **Average scores by country**: The mean percentage METT score for protected areas in the countries of Kenya, Tanzania and Mozambique for which spatial data was available was 41.9 per cent (±SE 1.0, n = 217). Protected areas in Kenya achieved higher scores than those in Tanzania (44.0 ± SE 2.7 and 41.4 ±1.1 respectively; Figure 4). There were not enough protected areas assessed in Mozambique to produce a meaningful mean score. The average METT score for the CEA-GI region was 41.8 per cent (±SE 1.0, n = 206). The average METT score for the Priority Landscapes was 42.9 per cent (±SE 1.6, n = 111).
- **Average scores by management type**: Within all of the three study areas (Country, CEA-GI and Priority Landscapes), METT scores were higher for community-managed sites than for government-managed sites (Figure 5). A Kruskal-Wallis rank-sum test conducted at the spatial level of 'Country', comparing mean percentage scores of central government managed, local government managed and community managed sites indicates that this difference is significant (central government managed sites mean percentage score =40.3 ±SE 1.1 n=168, local government =40.3 ±SE 2.5 n=19, community managed =51.6 ±SE 1.9 n=22; $X^2_{(2)} = 19.1$, $p<0.001$). Tukey's HSD post-hoc test on mean rank differences shows that the difference between community and central government managed sites, and difference between community and local government managed sites, are significant at $p<0.01$.
- **Average scores by Tanzania-specific reserve types**: To elaborate on this analysis, we were able to access more detailed information on protected area types in Tanzania, allowing the comparison of METT

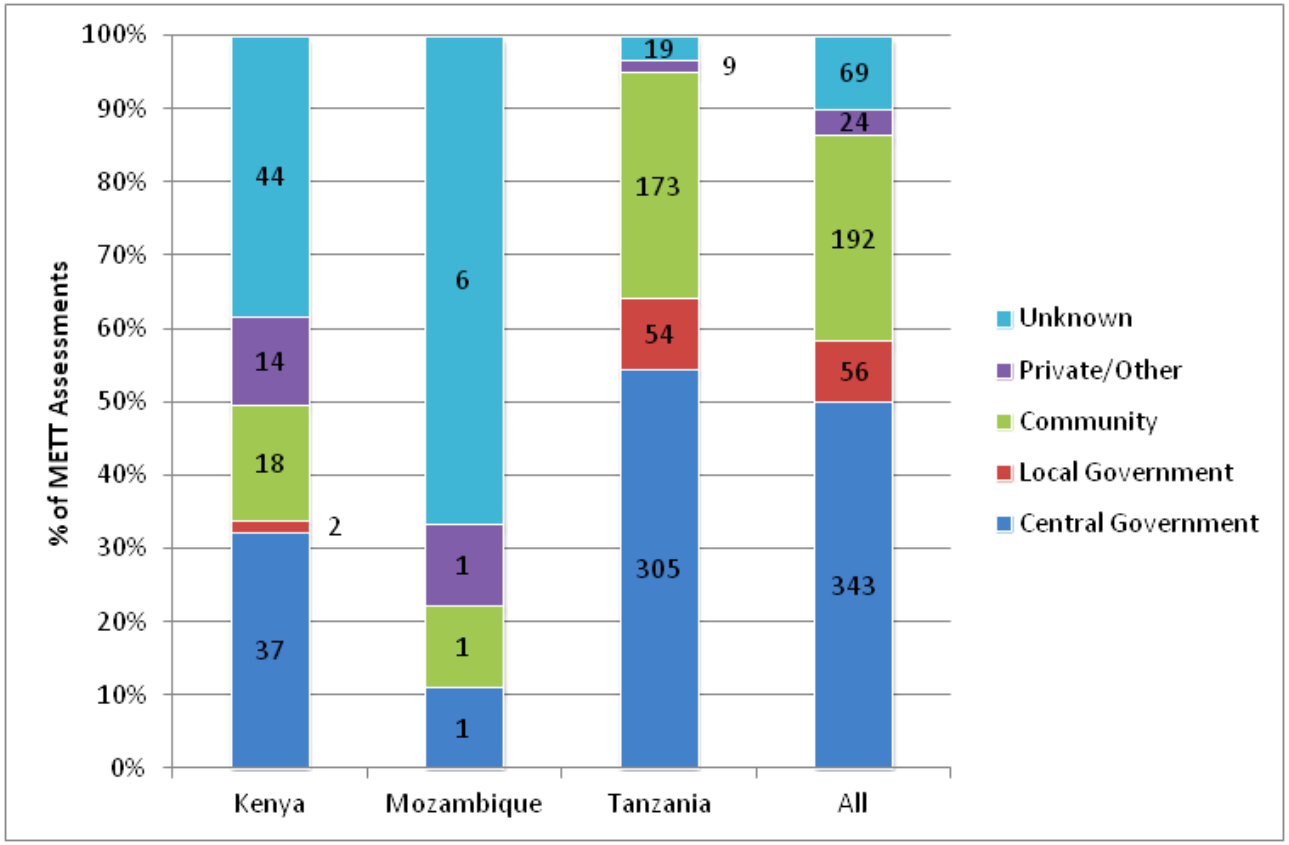

Figure 3: Governance of METT assessed sites, by country (actual numbers of METT assessments are given by numbers in the appropriate bar). Colours represent the various management types

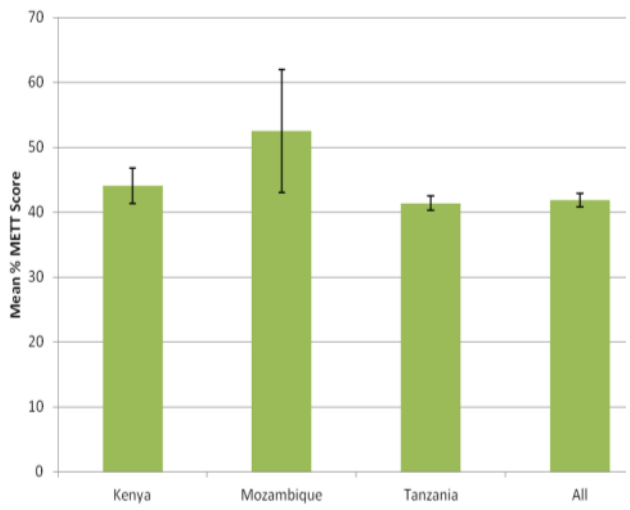

Figure 4: Mean percentage METT scores by Country for sites held in the WDPA. Error bars show standard error of the mean. Sample sizes per country: Kenya n=21; Mozambique n=4; Tanzania n=192

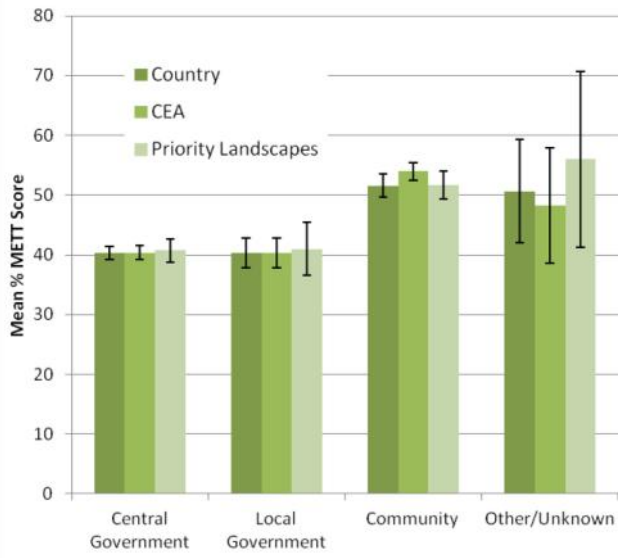

Figure 5: Mean percentage METT scores by management type at Country, CEA-GI Region and Priority Landscape scale. Error bars show standard error of the mean

scores between central government managed sites of different types (Forest Reserves, Game Reserves and National Parks), Local Authority Forest Reserves and community managed sites (Village Land Forest Reserves and Wildlife Management Areas) (Figure 6). All sites with METT assessments for Tanzania were used in this analysis. The central government managed sites show a polarisation of METT scores, with National Parks and Game Reserves scoring highest overall (National Parks n=7, mean percentage score =67.0 ±SE 5.0; Game Reserves n=5, mean percentage score=65.8 ±SE 8.4), and the Forest Reserves scoring the lowest overall (n=192, mean percentage score=37.4 ±SE 0.9). This indicates that the broader grouping of 'central government' managed sites (Figure 5) effectively swamps the

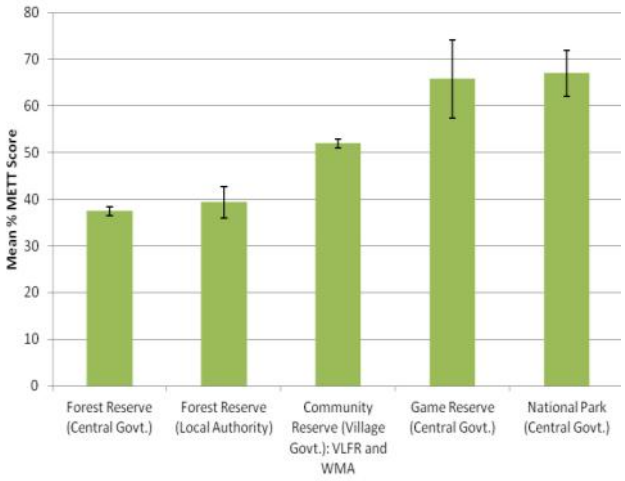

Figure 6: Breakdown of percentage METT scores by reserve type for all sites in Tanzania for which reserve type information was available. Error bars show standard error of the mean. VLFR: Village Land Forest Reserve, and WMA: Wildlife Management Area

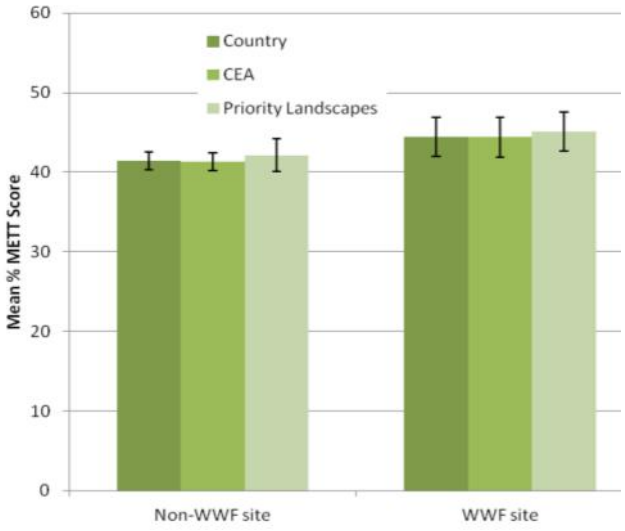

Figure 7: Mean METT scores by WWF presence/absence (at country, CEA-GI Region and Priority Landscape scale). Error bars show standard error of the mean

higher scoring reserve types due to the large number of Forest Reserves. Community-managed sites still score higher when compared with forest reserves managed by central or local government (Village Land Forest Reserves and Wildlife Management Areas n=151, mean % score =51.9 ±SE 1.0; Local Authority Forest Reserves n=14, mean % score=39.4±SE 3.4). Sample size limitations do not allow statistical comparisons between these categories.

- **Average scores by WWF presence or absence**: Of the 95 sites where WWF works within the CEA-GI region, 67 (71 per cent) have been assessed using the METT tool, and 132 assessments have been conducted. Overall, sites with WWF presence score slightly higher than sites without WWF presence

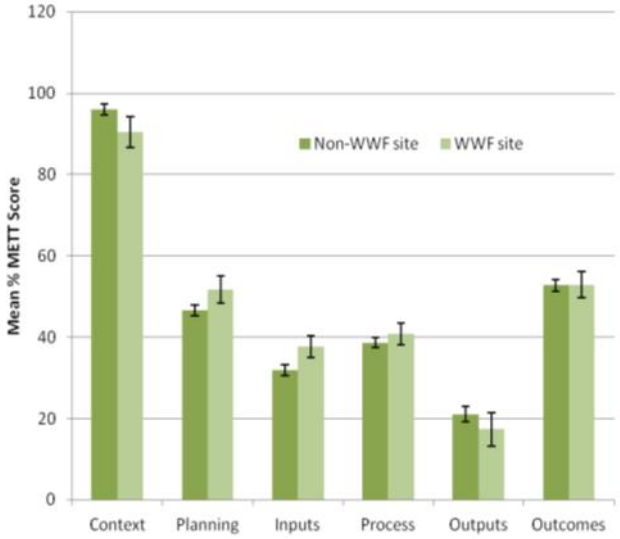

Figure 8: Mean percentage METT scores broken down by WCPA framework components of management effectiveness (Hockings et al., 2006), according to WWF site involvement (using data from Tanzania, Mozambique and Kenya for sites within the WDPA at the spatial level of the WWF CEA-GI region). Error bars show standard error of the mean

(Figure 7), but this difference is not statistically significant (Mann-Whitney U test of mean per cent score ranks; WWF sites (n=31)= 44.4 per cent, non-WWF site (n=175)= 41.3 per cent, W=2352, pns). When METT scores within the CEA-GI spatial dataset – comparing sites with and without WWF presence within the CEA-GI region – are broken down by the six components of management effectiveness, the difference in scores is greater in the 'design, appropriateness and adequacy' components of the METT tool (planning, inputs and process) with the exception of context (Figure 8; mean percentage scores for context, WWF site =90.4 ±SE3.8, non-WWF site = 96.0 ±SE 1.3; planning, WWF site =51.8 ±SE 3.4, non-WWF site = 46.6 ±SE 1.4; inputs, WWF site = 37.7 ±SE 2.7, non-WWF site =31.9 ±SE 1.3; process, WWF site =40.8 ±SE 2.7, non-WWF site = 38.7 ±SE 1.2). Mann-Whitney U tests of difference in mean percentage score ranks, between sites with and without WWF presence, in each of the six components of management effectiveness show a statistically significant difference in the inputs component only (WWF sites n=31, non-WWF sites n=175, W = 2073, p< 0.05). For the 'delivery' components (outputs and outcomes), sites with WWF presence scored either slightly lower than sites where WWF are not working or fractionally higher (Figure 8), but these differences are not statistically significant (mean percentage scores for outputs, WWF site = 17.4 ±SE 4.1, non-WWF site =21.0 ±SE 1.9; outcomes, WWF site =52.9 ±SE 3.3, non-WWF site =52.8 ±SE 1.4).

House of spirits: Mijikenda elders undertaking a sacred ceremony at Chizia Cha Nyere, Kaya forests, Kenya © E. Obel-Lawson / WWF-Canon

DISCUSSION

This study compiled and analysed protected area METT data for Tanzania, Kenya and Mozambique, investigating protected area management by country, WWF CEA-GI region and WWF Priority Landscape. There has been a wide application of the METT in the region, largely through past GEF funded projects working with government, and NGOs working together with government and communities in the region. METT application has been most frequent in the priority landscapes/seascapes for WWF; 52 per cent of protected areas in the CEA-GI Priority Landscapes had been assessed, compared to 46 per cent in the wider CEA-GI Region, and 21 per cent within Tanzania, Kenya and Mozambique overall. There is a marked difference in the application of METT between countries; numerous sites have been assessed in Tanzania, some in Kenya, and very few in Mozambique. Balancing this effort by increasing the number of assessed sites in Mozambique and Kenya would enhance the utility of the available METT data for the region.

Analysis of METT scores show that sites managed by, or in collaboration with, local communities, achieved higher overall METT scores than Forest Reserves managed by national or local government. These findings warrant further analysis to investigate whether community managed reserves are performing better than government managed sites in certain elements of site management (for instance management inputs, process, outputs or outcomes), or over all facets of management. In Tanzania the central and local government state-managed forest reserves have received very little funding support for decades, unless there has been a project providing funding support. The main funder in recent years has been the GEF and different NGOs, with WWF support (often with GEF funding) to community reserves being significant (Burgess et al., 2013).

A more detailed analysis within the Tanzanian coastal forests shows that forest reserves run by local communities (Village Land Forest Reserves) have higher mean METT scores than those managed by the central government Tanzania Forest Service and the forest reserves managed by the local authorities, and that both National Parks and Game Reserves score higher than all types of forest reserves. In the coastal regions of Tanzania, the central government devolved responsibility for the management of all forest reserves to the districts in the 1980s, but provided no funding, which has placed severe restrictions on protected area management planning, process and management actions (Burgess et

Lake Manyara National Park, Tanzania © Equilibrium Research

al., 2013). Similar patterns have also been seen in the Eastern Arc Mountains where village reserves and private reserves score better than local authority or central government managed forest reserves, and proposed reserves score the worst (Madoffe et al., 2005). This may be a general pattern and is worth further exploration and analysis within the region.

Because the METT tool has been widely applied in the CEA-GI region it has the potential to be a useful impact evaluation tool for all protected area managers and their supporters in the region. We found slightly higher METT scores in sites that had WWF presence than those that did not, although these differences were not statistically significant. WWF staff have facilitated the completion of the METT questionnaires in many cases, which may have led to a systematic bias in the data. In addition, the differences in scores may reflect a choice by WWF to work in areas that already had basic management structures in place. There may be a positive impact of WWF support, but to truly understand the impacts of WWF involvement on protected area management, baseline and time series data (repeat METT assessments over a number of years) are required, and the quality and objectivity of the assessment process should be considered (i.e. where possible assessments should be carried out with a range of stakeholders, including PA managers, local government and local community representatives). Time-series analysis and the ability to gather consistent data to track management over time is one of the key functions, and a central original intention, of the METT tool. Currently, time-series analyses are not possible due to the limited number of repeat assessments. The utility of the METT for organisations like WWF to measure their impacts will improve as the size of the dataset increases and more repeat assessments become available.

The slightly higher scores in sites supported by WWF are skewed in favour of the design side of protected area management (planning, inputs and process). On the results side, there are marginally negative results for outputs and almost neutral ones for outcomes. It should be noted that the METT as an evaluation tool is less strong on evaluating the 'delivery' components of management effectiveness, and was not really designed as an outcomes measurement tool. For WWF and other conservation organisations, their interventions and investments in protected areas have been biased towards the design side, with most resources available in the early stages of projects (Burgess, pers obs.). Continuing to assess changes in management over time would allow managers and funders to track how different elements of protected area management change, and investigate how long it takes (if at all) for changes in protected area inputs and planning to result in positive conservation outcomes.

In the future, there is a need to assess the relationship between METT scores and conservation outcomes as measured using independent datasets. Suitable data could come from analysis of forest cover changes over time, or species population trends, within and outside protected areas. The purpose of such analyses would be to assess whether improved management of different reserves has prevented the loss of forest cover and species. Data available for this exercise include the forest change data from the University of Maryland together with the World Resources Institute and Google (Hansen et al., 2013). Similarly, it should be possible to get relevant species data, at least for the larger mammals in some of the savannah parks. We expect further use of METT data with biodiversity data to enhance our understanding of the links between protected area management and conservation impact in East Africa.

ENDNOTE

[1] See: assets.panda.org/downloads/mett2_final_version_july_2007.pdf

ABOUT THE AUTHORS

Kathryn Knights is a consultant with Protected Area Solutions. Her research interests are centred on the effectiveness of protected area management and the sustainable use of wild food resources.

Ivon Cuadros is a junior consultant with Protected Area Solutions, and an MSC student at the Technische Universität München. Her research interests are centred on monitoring the effectiveness and management of protected areas.

Camilo Zamora is a junior consultant with Protected Area Solutions, and an MSC student at the Technische Universität München. His research interests are focused on the design and establishment of marine protected areas, and their effectiveness in biological conservation.

Lauren Coad is a member of the Forest Governance Group at the University of Oxford, and the WCPA, and a consultant with Protected Area Solutions. Her research focuses on the effectiveness of protected area management and the impacts, and potential management, of the wild meat trade in Central Africa and South East Asia.

Fiona Leverington is a Director of Protected Area Solutions and an adjunct senior fellow at the University of Queensland (UQ). Together with Marc Hockings, she led the project investigating the global picture of management effectiveness at UQ between 2006 and 2010. Her research interests also include reserve planning, management planning and community relations.

Marc Hockings is Professor and Program Director in the School of Geography, Planning and Environmental Management at the University of Queensland. His research covers broad aspects of protected area management with a focus on management effectiveness. Marc is Vice-Chair for Science for WCPA and a member of the Commission's Executive Committee.

Brian O'Connor, **Marcelo Gonçalves de Lima**, **Naomi Kingston** and **Fiona Danks** work in the Science and Protected Areas programmes at UNEP-WCMC where they are involved in various kinds of spatial analysis and protected areas work.

Isaac Malugu, **Peter Scheren**, **Elizabeth Ngoye** and **P. J. Stephenson** work for WWF in Eastern Africa and Switzerland and are supporting conservation actions on the ground and looking at how to measure impacts at the protected area and regional scales.

Neil D. Burgess runs the UNEP-WCMC Science Programme and has been involved with GEF and WWF projects in the Eastern African region for many years, working together with government agencies and communities.

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RESUMEN

Examinamos la eficacia de la gestión de áreas protegidas en un lugar prioritario del Fondo Mundial para la Naturaleza (WWF) para inversiones de conservación, situado en las zonas costeras de Kenia, Tanzania y Mozambique. Al menos 473 sitios de esta región han completado evaluaciones para monitorear la eficacia de la gestión (Management Effectiveness Tracking Tool-METT) desde 2003, a menudo relacionadas con proyectos financiados por el Fondo para el Medio Ambiente Mundial (FMAM), aunque también mediando proyectos financiados por otros donantes y por el propio WWF. Demostramos que las reservas forestales gestionadas por la comunidad obtuvieron una puntuación más alta con la herramienta METT en comparación con los sitios gestionados por los organismos forestales estatales. Situamos esto dentro del contexto de enfoques basados en la gestión de las reservas forestales en Tanzania, donde las reservas administradas por el Estado han recibido poco en términos de apoyo financiero y obtuvieron la puntuación más baja con respecto a todos los demás tipos de gestión en Tanzania. Demostramos, asimismo, que los puntajes de METT, ligeramente más altos en promedio para los sitios donde WWF está trabajando en Kenia, Tanzania y Mozambique, en comparación con todos los demás sitios, son más acusados en los elementos de la herramienta METT en términos de insumos, procesos y planificación, y no así en términos de productos o resultados. Debatimos la utilidad de la herramienta METT para organizaciones como WWF para evaluar su impacto en la gestión de áreas protegidas, incluido el sesgo sistemático en el registro de datos (evaluaciones facilitadas por WWF) y la posibilidad de que se necesite más tiempo para determinar los resultados e impactos de las mejoras logradas en materia de gestión.

RESUME

Nous avons étudié l'efficacité de la gestion des aires protégées au sein d'une zone d'investissement prioritaire pour le Fonds mondial pour la nature (WWF), située dans les régions côtières du Kenya, de la Tanzanie et du Mozambique. Depuis 2003, au moins 473 sites dans cette région ont complété des évaluations d'efficacité, grâce à un outil de surveillance de l'efficacité de la gestion (Management Effectiveness Tracking Tool - METT), souvent associées aux projets financés par le Fonds pour l'environnement mondial (FEM) ainsi qu'aux travaux financés par d'autres bailleurs de fonds ou par le WWF. Nous montrons que selon les mesures de l'outil METT, les réserves gérées par les communautés obtiennent de meilleurs résultats que les sites gérés par les organismes forestiers de l'Etat. On doit tenir compte ici de la politique de gestion des réserves en Tanzanie, où des réserves forestières gérées par l'Etat reçoivent très peu de soutien financier et obtiennent les résultats les moins élevés parmi toutes les modes de gestion en Tanzanie. En outre, nous montrons que les scores METT légèrement plus élevés que la moyenne obtenus par les sites où travaille le WWF au Kenya, en Tanzanie et au Mozambique, sont les plus prononcés pour les indicateurs liées aux intrants, à la gestion des processus et à la planification, que pour celles relatives aux sorties ou aux résultats. Nous examinons l'utilité de l'outil METT pour des organisations telle le WWF dans l'évaluation de leur impact sur la gestion des aires protégées, en tenant compte de la question du biais systématique dans l'enregistrement des données (les évaluations étant menées par le WWF) et du fait qu'il faudrait plus de temps pour voir les résultats et les impacts des améliorations obtenues.

CONSERVATION TRUST FUNDS, PROTECTED AREA MANAGEMENT EFFECTIVENESS AND CONSERVATION OUTCOMES: LESSONS FROM THE GLOBAL CONSERVATION FUND

C. Bonham[1*], M.K. Steininger[1], M. McGreevey[2], C. Stone[2], T. Wright[1], and C. Cano[1]

*Corresponding author: cbonham@conservation.org
[1] Betty and Gordon Moore Center for Science and Oceans, Conservation International, Arlington, Virginia, USA
[2] Ecosystem Finance Division, Conservation International, Arlington, Virginia, USA

ABSTRACT

The Global Conservation Fund (GCF) is a global programme intended to address the problems associated with protected areas that lack sufficient resources to function effectively. In operation since 2001, GCF has built a global portfolio of over 65 protected area investments linked to a comprehensive integrated data set on protected area management effectiveness and conservation outcomes. With data collected over the last six years (2008-2013), this paper attempts to answer two questions: 1) What is the relationship between conservation investments and the enabling conditions needed to achieve conservation outcomes? 2) Does stable funding correlate with a stable or improving deforestation rate? Results from analysis of this data suggest that regular, sustained investment in protected area management resulted in a statistically significant decline in deforestation rates in and around these protected areas. Additionally, we find that higher scores on management effectiveness were associated with lower deforestation rates. This suggests that monitoring the enabling conditions for effective protected area management provides a reasonable proxy for conservation outcomes as measured by changes in deforestation rates. These results make a compelling argument that Conservation Trust Funds are valuable tools to help protected areas deliver on their objectives and contribute to global conservation targets.

Key words: Global Conservation Fund, protected area investments, conservation outcomes, deforestation

INTRODUCTION

The lack of long-term investment in conservation has historically been a key limitation to the effective management of protected areas and the success of conservation interventions (CFA, 2003). Due to the nature of the conservation process, which is a long-term endeavour that often requires social change, improvements to civil society, and capacity building, conservation goals often cannot be fully achieved by short-term grants alone (Ferraro, 2001) in the typical grant-making cycle of 2-5 years. This inherent limitation of traditional grant financing mechanisms has led to the emergence of Conservation Trust Funds (CTFs).

At their core, Conservation Trust Funds are long-term financing mechanisms which provide grants to conservation projects. These institutions are structured in a variety of ways, from sinking funds to endowments; and directly invest in protected areas, indigenous- and community-conserved areas, and other conservation programmes. Despite this variability, their goal is usually the same: to provide sustainable financing for the conservation of nature.

Since the 1990s, when the first CTFs were established, the number has grown to encompass over 70 world-wide (Mathias & Victurine, 2012). In a review of 36 CTFs, Mathias and Victurine (2012) reported that US$672 million were under management. However, despite the growth in CTFs, donors and governments remain sceptical of the appropriateness and impact of CTFs (Bladon et al., 2014; CFA, 2013; GEF, 1998).

One of the concerns of donors and governments is the degree to which investments from CTFs have resulted in tangible impacts on biodiversity. Adams and Victurine

In Madagascar, remnant forests provide the last refuge for threatened endemic species and protect the headwaters of watersheds important for the production of subsistence crops. However protected areas alone cannot ensure healthy ecosystems © Conservation International/photo by Curan Bonham

(2011) have noted that, in addition to the primary benefits of CTFs (namely, a regular and reliable source of funding to cover recurrent protected area management costs), a number of important secondary benefits become apparent over time. These include increased continuity in project management and community engagement, sustained investment in rural communities that can lead to increased employment and human development benefits, and the building of civil society institutions that can develop strategic partnerships, attract new sources of investment, and expand their financial and project management expertise to have impacts in other areas of importance to local communities.

Nevertheless, CTFs have historically put less emphasis on measuring impact and evaluating their contribution to maintaining biodiversity (Spergel & Taieb, 2008) or other potential outcomes. Without proper verification of the impacts resulting from CTF investments, further financial support may be at risk. Recently, there has been an increasing interest in biodiversity monitoring by CTFs, but substantial evidence of their effectiveness is still largely anecdotal in the absence of detailed studies of their effectiveness (Spergel & Mikitin, 2013; RedLAC, 2012; Adams & Victurine, 2011).

Despite the nascent data collection efforts by CTFs, one global portfolio of CTFs in particular provides a case in which substantial impact data already exist. The Global Conservation Fund (GCF) was established in 2001 by a 10-year US$ 100 million grant from the Gordon and Betty Moore Foundation (GBMF) to Conservation International (CI) to support the establishment and sustainable financing of protected areas. The GBMF grant to GCF has enabled GCF to become a leading global source of technical expertise for designing CTFs. It has also allowed it to compile one of the most comprehensive integrated global data sets on protected area management effectiveness and conservation outcomes.

Most GCF protected area investments target the establishment of a sustainable financing mechanism as their ultimate outcome, and, because GCF frequently supported the recurrent management costs of these protected areas at a level similar to that provided by the investment returns of the CTFs that are eventually established, GCF's data set on management effectiveness and conservation outcomes can serve as a proxy of CTF effectiveness. Additionally, GCF continues to collect monitoring data on conservation outcomes after CTFs are established, and some of this data is incorporated

Figure 1. GCF impact pathway

into the analysis below while additional data will be used in a forthcoming publication.

With data collected over the last six years (2008-2013), this paper attempts to answer two key questions: 1) What is the relationship between conservation investments and the enabling conditions needed to achieve conservation outcomes? 2) Does stable funding (i.e. regular GCF contributions or CTF support) correlate with a stable or improving deforestation rate?

THE CASE OF GCF

GCF is a global programme intended to address the problems associated with protected areas (both newly-created and long-established) that lack sufficient funding to function effectively. GCF invests in projects developed by other international and national NGOs in addition to projects developed or implemented by CI, while also providing technical assistance and leading the design and establishment of CTFs for each protected area project in the portfolio. GCF allocated most long-term financing (LTF) funds to be used as capital for endowments to finance the long-term management of protected areas in GCF's portfolio, but GCF has also allocated LTF funds for strategic land purchases, contributions to debt for nature swaps, and payments for environmental services (PES). GCF has established 18 protected area endowments in 16 countries supporting at least 34 protected areas, and co-financed five US Government debt-for-nature swaps. By early 2014, GCF had 10 LTF transactions remaining in its original pipeline to be concluded before the end of 2015, while also developing new projects in additional geographic regions.

GCF was created with a focus on the creation and expansion of protected areas in the biodiversity hotspots, high-biodiversity wilderness areas, and key marine areas. Project selection favoured proposals seeking deep engagement with communities living in and around protected areas and with the potential to generate multiple benefits for biodiversity, ecosystem services and human wellbeing. The resulting portfolio includes diverse intervention styles ranging from government-sponsored protected areas to indigenous peoples' and community conserved territories and areas (ICCAs) and from privately-managed nature reserves to areas protected with voluntary conservation agreements. Ultimately, GCF investments were approximately evenly split by area between forest and marine ecosystems. Generally, GCF support began with a scoping/planning exercise to determine the potential for the establishment of a new or expanded protected area, continued to protected area establishment, implementation, and improved management phase, and concluded with the development of a sustainable financing mechanism to support the continuation of these efforts in perpetuity.

As of 30 June 2013, GCF had awarded grants with GBMF funding totalling US$ 30 million for preparatory and start-up ('implementation') grants, and US$ 35 million for 26 LTF grants (mostly contributions to capitalise the endowments of conservation trust funds). GCF's overall investments (both implementation and LTF funds) include US$ 11 million for Africa and Madagascar, US$ 20 million for Asia and the Pacific, and US$ 35 million for the Americas (including Seascapes). Out of GCF's combined total of US$ 65 million in grants for implementation and LTF (as of 30 June 2013), US$ 35 million were invested in CI biodiversity hotspots, US$ 17 million were invested in high-biodiversity wilderness areas, and US$ 13 million was invested in Important Marine Regions (Wells & Spergel, 2014). GCF's grants have financed the protection of over 80 million hectares of new protected areas[1].

Although a simplification of more complex and context-specific processes, a logic model for GCF's impacts is illustrated in Figure 1. Effectively managed long-term financing mechanisms (CTFs) with appropriate levels of capitalisation provide the enabling conditions for the

Aerial view of Sovi Basin, 20,700 hectare of pristine forest and river habitat © Conservation International/photo by Haroldo Castro

generation of regular financial resources (whether through investment returns or other means) to support protected areas. Once generated these financial resources enable the maintenance and continuity of the institutional and physical structures needed for effective management of protected areas (including staff, infrastructure, community benefits programmes, etc.). Effective management of the protected area in turn supports the delivery of conservation outcomes.

Funding can be provided to the management of a site, but if there is no effective management of these funds they are at risk of not having an impact (Bruner et al., 2004). Until the time at which a CTF is established and operational, GCF functions as a de facto CTF for each protected area in its portfolio, providing regular funding to support core management costs at approximately the same level as the CTFs to be established at a later time. However, effective management of funds is not by itself sufficient to improve site management, if funds are not deployed appropriately. Effective management requires sufficient resources to enable, inter alia, development of the management team, on-the-ground patrols, engagement plans with local communities who may affect the site, and the possible direct payment or other incentives to encourage stewardship by local communities. Providing sufficient, stable, and targeted funding to a protected area creates the conditions needed for effective management of the protected area, which in turn facilitates the achievement of identified conservation outcomes.

METHODS

In order to effectively assess the performance of GCF-supported protected areas, CTFs and the relationship between them, GCF established a monitoring and evaluation framework that all projects participate in. The GCF monitoring framework is built upon two core principles: generation of sufficient financing and maintenance/improvement of biological status at site-level. For each of these core principles, GCF measures outcome metrics and the enabling conditions that underlie the achievement of those outcomes. The overall metric of success for GCF's portfolio of protected area investments is a combination of two types of outcomes: financial and biological; and two types of enabling conditions: site level (protected area management effectiveness) and fund level (fund management effectiveness). These four pillars are core to the GCF model of support to protected areas and accordingly our monitoring structure is built around them.

OUTCOMES

Financial outcomes are measured annually through investment performance. The annualised investment return of each established CTF was tracked quarterly and summarised annually from 2008-2013 via investment reports provided by each fund's investment manager. These data were verified through GCF's monitoring and reporting requirements for long-term financing mechanisms, which include regular submission of investment reports, a narrative report on the state of the

fund's financial management, and other information related to disbursement of grants. To enhance our understanding of the flow of financial support to protected areas, we have also collected estimates of financial support from non-GCF sources.

The primary indicator of the biological status of sites is the rate of loss of natural habitats, and among those forested sites, specifically deforestation. Using the extent and rate of loss of natural habitat as an indicator for biodiversity, is a product of three assumptions related to species:

1. that many globally threatened species are primarily threatened by habitat loss (deforestation);
2. that the globally threatened species GCF is concerned with at a site are forest obligates (are restricted to forest habitat);
3. that globally threatened species need viable habitat in order to persist, and measuring the area of primary habitat remaining provides a proxy for the potential area of occupancy for a given species.

Two-date change detection analyses over three time periods were conducted for all terrestrial sites using Conservation International's standard deforestation mapping methodology (Conservation International, 2014). Time periods of analysis were chosen to represent three distinct periods that approximately track the course of a GCF investment: 1990-2005 (baseline, pre-GCF investment), 2000-2005 (transition, initial GCF investment), and 2005-2010 (post-GCF investment). These time periods allow us to track forest cover change and assess the effect of GCF investment on forest change trends. Additionally, a 20-km buffer zone surrounding each site was assessed for deforestation. Any neighbouring protected areas in bordering countries were excluded from the buffer zones. This allows a contextual comparison of the set of sites as well as of the entire portfolio.

Deforestation estimates were based on Landsat image analysis, the image source chosen for its no-cost availability and high quality for monitoring deforestation. The spatial resolution of the imagery is 30 m, and final products are filtered to a minimum-mapping unit of one hectare. When interpreting the spectral data in the images, only areas believed to be mature, natural forest were included in the forest class. Secondary forest fallows and plantations were considered non-forest. Secondary forests older than approximately 15 years can appear similar to mature forest, and thus any such areas may be included in the forest class. Selectively logged forest that leaves a mostly closed-canopy remains in the forest class, and thus deforestation in this study refers to clear-cutting events of primary forest and secondary forest (15 years or older) greater than one hectare in size.

Images were co-registered to an error of less than one pixel to minimise the potential for erroneous changes estimated caused by image shifts over time period. Supervised classification was done using maximum-likelihood or decision-tree algorithms, both of which produce similar results when carefully applied, with the latter being more efficient. Two dates of images were classified in a single process in order to directly estimate change, rather than comparing classification results of individual dates. This was first done for the 1990 to 2000 period, then the 2000 to 2005 and finally the 2005 to 2010 periods, with the final results combined in a GIS. Each time period actually may vary by plus or minus two years, as cloud-free images in many sites are scarce. For some sites with images that were especially cloud-contaminated, multiple images of each date were used and the results merged. The average cloud cover among all sites and dates is less than 10 per cent. While validation was not done for these particular classifications, it has been done for several national-level assessments, with accuracies for the estimation of forest cover being consistently over 92 per cent (Conservation International, 2014).

ENABLING CONDITIONS

While outcomes indicators such as deforestation and investment performance, as discussed above, apply to the impact of GCF investment, management effectiveness indicators assess the conditions on site which should be met in order to achieve those positive outcomes. Management effectiveness indicators were collected annually from 2008-2013 for each site in the GCF portfolio with the assistance of project managers, protected area managers, and others who were knowledgeable about each site. These indicators are based on a modified form of the Management Effectiveness Tracking Tool (METT) developed by the World Bank/WWF Alliance (Stolton et al., 2007). The data for these indicators are periodically verified through site visits by GCF staff. The protected areas management effectiveness indicators describe the current state of management at the sites in the GCF portfolio and can be compared across six years. These 24 indicators are organised around five themes: Legal Recognition, Governance, Management Plans, Minimum Resources, and Research and Knowledge. Specific indicators include questions related to the following topics: gazettement, land tenure, staff capacity, reporting, local input, stakeholder engagement, management plan implementation, species action plans, education and

Table 1. Sample descriptives of mean annual deforestation rate inside protected areas and buffer zones using t-tests for equality of means

	Mean	Standard Deviation	t	df	P
Paired t-tests					
In Site					
1990-2000	0.58%	1.20%	-2.12	52	0.04**
2005-2010	0.22%	0.52%			
20-km buffer zone					
1990-2000	1.30%	1.53%	-0.49	51	0.00**
2005-2010	0.42%	0.52%			

*significant at p<.05
**significant at p<.01

awareness, monitoring and evaluation, financial plans, business plans, periodic review, biodiversity targets, adequate staff, appropriate budget, minimum infrastructure, boundary demarcation, biodiversity research, and socioeconomic research (Conservation International, 2008).

At the time when GCF was created, widely-accepted monitoring tools to measure the management effectiveness of CTFs were not available. Using a definition of CTFs as an efficient, effective and durable long-term financing mechanism, GCF developed indicators to assess CTF management effectiveness. Based on accepted 'best practices' for CTFs, these indicators measure credible and transparent operational procedures, effective checks and balances within decision -making processes, appropriate asset management, and a governance structure representing a variety of sectors (government, NGOs, business, academia, community). Fund management effectiveness data were collected annually from 2008-2013 through a self-reported survey instrument designed by the GCF and completed by CTF managers. The data provided through this assessment are verified by GCF staff through meetings to discuss any year-to-year inconsistencies. The fund management effectiveness indicators describe the performance of funds based on two themes: Governance and Financial Management. These 19 indicators include questions concerning the following topics: operational procedures, stakeholder participation, composition of board, government support, fund leadership/management, flow of funds, communication, reporting, fund learning, external audits, administrative costs, strategic planning, investment policy, financial management, financial capacity, financial returns, sufficient finances, and financial plan implementation (Conservation International, 2008).

RESULTS

This report presents six years (2008-2013) of management effectiveness data for 65 actively monitored sites in the GCF portfolio. Additionally, data are provided about the biological status of these sites (vis-à-vis analysis of deforestation rates). The report also examines data on enabling conditions (fund effectiveness) for 15 of the funds to which GCF has disbursed long-term financing and funding rates (annual budget allocations) to all 65 sites actively monitored.

Biological outcomes

A paired samples t-test was conducted to examine whether there was a significant difference between deforestation rates both inside GCF supported sites and within a 20-km buffer area surrounding the site during the baseline period pre-GCF investment (1990-2000) and during the period after GCF investment (2005-2010). The test presented in table 1 revealed a statistically significant difference in deforestation rates before and after investment, both inside sites (t^2=-2.12, df^3= 52, p^4 <.05) and within the 20-km buffer zone around the sites (t= -0.49, df= 51, p <.000). Deforestation rates inside sites during the period from 1990-2000 (M^5=0.58 per cent, SD^6=1.20 per cent) were lower than deforestation rates in the buffer during the same period (M= 1.30 per cent, SD= 1.53 per cent) and decreased significantly after GCF investment, (in site, M=0.22 per cent, SD= 0.52 per cent vs. in buffer, M=0.42 per cent, SD= 0.52 per cent). These results suggest that GCF investment had a measurable effect on reducing deforestation rates in protected areas as well as their buffer zones. Specifically, our results suggest that when GCF investment is present, not only does the annual rate of deforestation within protected areas decrease, but also the annual deforestation rate within the 20-km buffer zone decreases.

Table 2. GCF Summary Financial Outcomes as of 30 June 2013

Total GCF Contribution to CTFs*	Total Funds Leveraged from Non-GCF sources*	Total Fund Capitalisation of GCF supported CTFs*	Average Annual Return on Investment	Estimated Future Average Annual Disbursement**
US$ 31.1M	**US$ 115.1M**	**US$ 146.2M**	**5.30%**	**US$ 7.3M**

* includes CTFs only and no other GCF deals such as debt for nature swaps
** assumes an annual spend down of no more than 5 per cent of principal

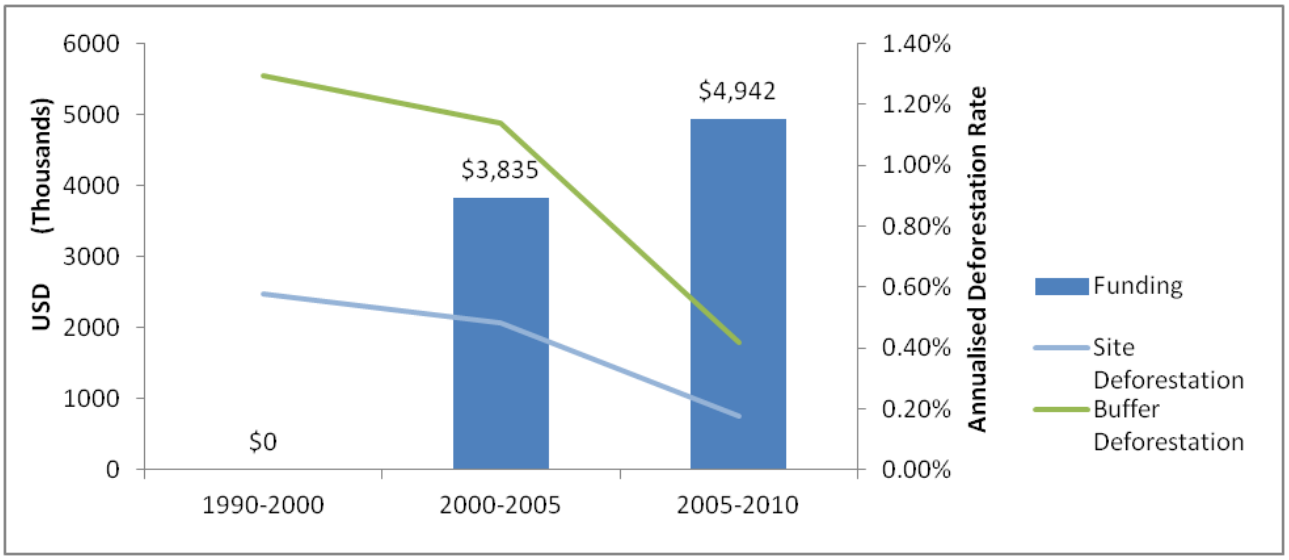

Figure 2 Funding levels and annualised deforestation rates for 65 GCF supported sites over three time periods

Financial outcomes

The average size of GCF's LTF grants is just under US$ 2 million dollars, and the average size of the resulting endowments (including contributions from other sources) is around US$ 7 million. GCF's LTF grants range in size from around US$ 750,000 for each of two endowments that benefit very small private or community managed PAs in Peru and Colombia and that were matched roughly 1:1 by other donors (meaning that the total capital of these endowments is around US$ 1.5 million)[7], to the largest five GCF LTF grants which were for around US$ 3 million each and leveraged contributions from other donors of between 1.5 and 50 times the amount of GCF's LTF contribution (meaning that the size of those endowments ranges from US$ 5 million to more than US$ 50 million).[8]

GCF has calculated that its CTF investments alone have leveraged a total of US$ 115.1 million in funding for protected areas from other donors through June 2013 (Wells & Spergel, 2014).

By contrast, GCF's implementation grants (i.e. project preparation and start-up grants) had a greater range in size, from US$ 25,000 to US$ 2 million, including seven such grants for over US$ 1 million each, although leverage funding for these implementation grants was not recorded. The first of these grants were disbursed in 2002 and average annual outlays between 2002 and 2013 were approximately US$ 700,000. Figure 2 shows the relationship between total funding levels and annualised deforestation rates in the portfolio during three five-year periods. This figure indicates that at a portfolio level, increased financial support to protected areas corresponds with a subsequent decrease in annualised deforestation rates. The relationship between funding and deforestation rate inside the site was evaluated using a linear regression model. A regression was performed between total funding and deforestation rate, as continuous variables. This regression had a negative slope (i.e. higher levels of funding, lower deforestation rate), although it was not significant at the 0.05 level. Although this data set does not demonstrate a causal relationship between funding levels and deforestation rates, a time-series analysis (Figure 2) provides preliminary evidence that increased financial support follows a similar trend in decreasing deforestation in site and in the 20-km buffer zone surrounding sites.

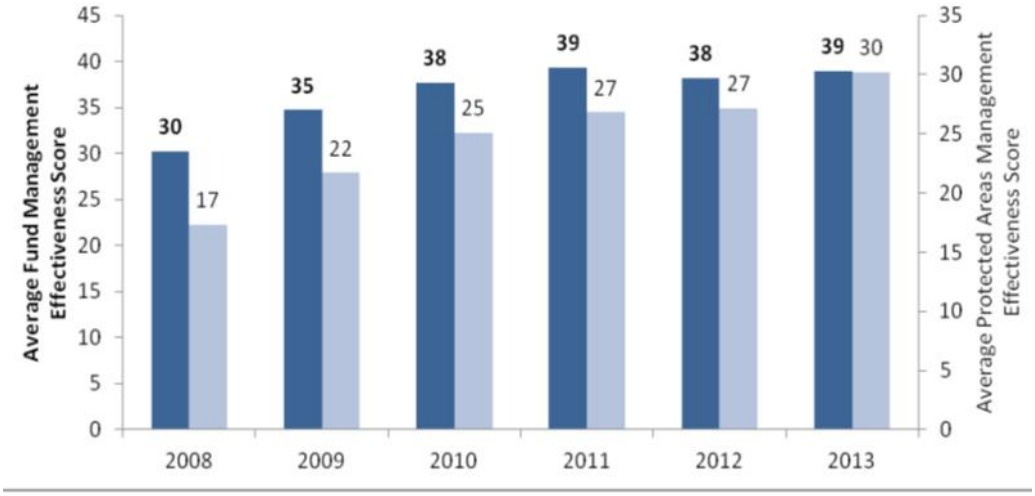

Figure 3. Evolution of management effectiveness scores from 2008-2013
Note: Dark blue bars on left correspond to mean annual fund management effectiveness scores averaged across all funds, light blue bars on right refer to mean annual protected area management effectiveness scores averaged across all sites. The maximum score possible for both the Fund Management Effectiveness and the Protected Area Management Effectiveness Survey is 50.

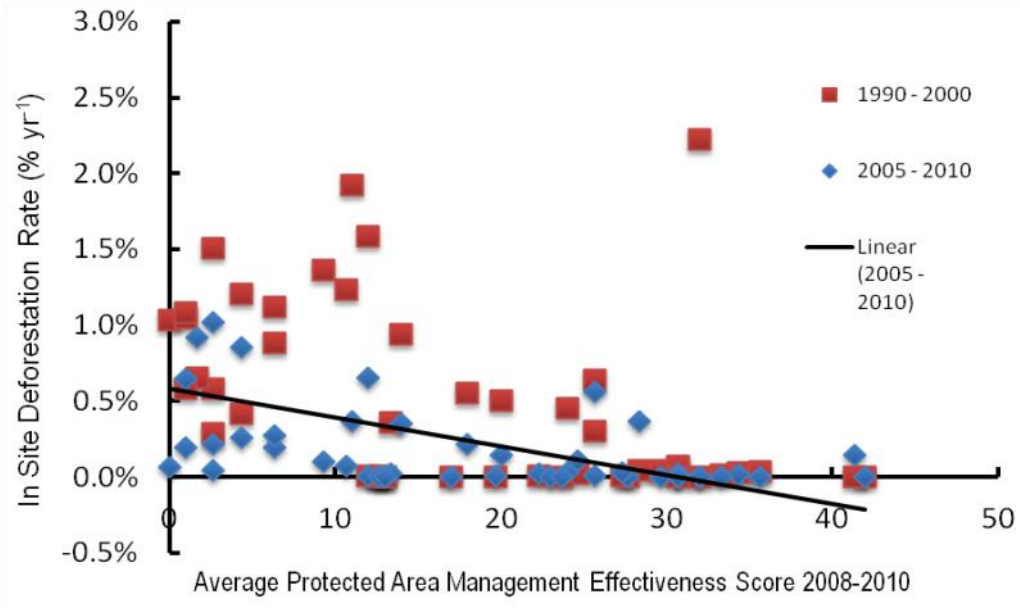

Figure 4. Relationship between Post Investment Deforestation (2005-2010) and Post Investment Management Effectiveness (2008-2010) in GCF sites.
Note: Regression for the 2005 to 2010 period is: y = a + bx, df = X, r2 = y, p<Z.

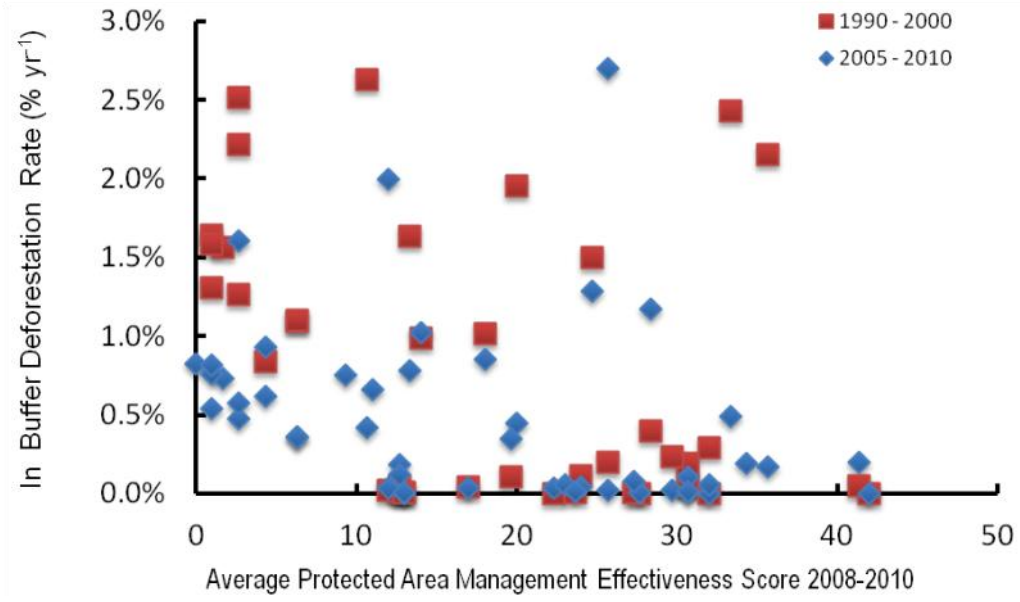

Figure 5. Relationship between Post Investment Deforestation (2005-2010) and Post Investment Management Effectiveness (2008-2010) in 20-km buffer around GCF sites.

Management effectiveness

In order to further explore the relationship between the elements of GCF's conceptual model, Figure 3 shows the change in management effectiveness both at the fund and the protected area level over six years. Since the inception of management effectiveness monitoring in 2008 average management effectiveness scores have steadily increased, as might be expected with a regular stream of funding for management costs. As protected area management effectiveness scores increase, deforestation rates correspondingly decrease showing an inverse relationship (Figure 4).

Prior to GCF investment, in the 1990 to 2000 monitoring period, deforestation inside all sites in the portfolio averaged 0.58 per cent per year (Figure 2). This slowed to 0.48 per cent per year during the transition period, 2000 to 2005, and to 0.22 per cent per year during the post-investment period, 2005 to 2010. For the set of 20-km buffer zones around each site, a similar declining trend is found, although with overall higher rates that declined from 1.30 per cent per year to 1.10 per cent per year to 0.42 per cent per year.

Deforestation rates among project sites in the pre-investment period varied substantially, from 0 per cent per year to over 2.5 per cent per year (Figure 4). Seventeen sites had deforestation rates over 0.5 per cent per year, a rate close to estimates of the global average for tropical forests (Hansen et al., 2013). Among the set of buffer zones around each site, rates varied within the same range, although were skewed higher (Figure 5). While 17 buffer zones also had rates of over 0.5 per cent per year, most of these were over 1.5 per cent per year in the post-investment period, 2005 to 2010.

Deforestation tended to be higher both before and after investment for protected areas that had effectiveness scores of less than 25. This is less apparent in the buffer-zone rates. Within the protected areas, during the post-investment period, deforestation rates were significantly correlated to effectiveness score (Figure 4; $y = a + bx$, df = X, $r2 = y$, $p<Z$).

DISCUSSION

The urgent need for increased conservation of biodiversity and ecosystem services in the context of global climate change is well understood. International commitments reflect these global priorities, as can be seen in the Aichi targets under the UN Convention on Biological Diversity: scaling up global protected area coverage is identified as an essential strategy for protecting biodiversity and ecosystem services, ultimately benefitting humanity.

However, it is also well understood that not all protected areas are equally effective in achieving their purported outcomes. Ineffective management, lack of financial resources, and other deficiencies can undermine the ability of protected area strategies to achieve their desired outcomes and fulfil global commitments. Better understanding of the factors that lead to effective protected area management for biodiversity, ecosystem service and even human development outcomes is therefore of critical importance as governments, NGOs and communities seek to secure the many benefits that natural ecosystems provide.

As noted above, the onset of regular investment in GCF-supported protected areas resulted in a statistically significant decline in deforestation rates. This investment had benefits beyond the borders of individual protected areas, as significant declines were also seen in the buffer zones. Among the many possible explanations for these are 1) the sites are in areas that would have experienced a regional declining trend regardless of investments, and 2) the GCF activities, which in many cases feature conservation strategies that favour positive engagement with local communities, who have traditionally used the land inside and outside the sites, had an effect on rates in the surrounding areas, not just inside the sites. On the latter point the data suggest that at least the site-level investments did not cause leakage of deforestation to the surrounding areas. We intend to disaggregate this data by intervention style, regional context, and other factors in future analysis.

The results of the basic time-series analysis described above also provides evidence that deforestation declined as funding levels increased both within protected areas and in their buffer zones. However, a statistically significant causal relationship was not supported by the data. This suggests that many global challenges relating to deforestation and habitat loss can be effectively addressed when sufficient funding is paired with effective management. The particular land-use dynamics and impacts of investments are actually site-specific, despite some portfolio-wide trends being apparent. This and similar studies could be furthered by both additional statistical analyses of sets of sites of conservation investments and case studies to explain the particular dynamics in sites, especially those with particularly high rates or changes in rates. For example, the dates of both when deforestation occurred and conservation investments occurred varied within the three five-year time periods of this study, and in both cases were gradual. We expect a more detailed analysis of this trend using annual data on deforestation and total funding (both from conservation trust funds and other sources)

would reveal differences by intervention style, ecosystem type, and perhaps thresholds below which or above which effects are less prominent.

Additionally, we find that management effectiveness of the protected areas in the GCF portfolio, as measured by relevant indicators, steadily increased over time. While there could be other factors at work in creating this effect, this suggests the importance of funding continuity and predictability (as well as the availability of technical assistance) in efforts to improve protected area management.

Finally, the results indicate that higher scores on management effectiveness were associated with lower deforestation rates. This suggests that measuring and monitoring these enabling conditions for protected area management effectiveness provide a reasonable proxy for conservation outcomes in the 65 protected areas assessed by this study and may have more broad implications on protected areas as a whole. Despite evidence contrary to these findings (Nolte et al., 2013), this study contributes to the growing body of evidence that associates management effectiveness scores with conservation outcomes such as have been found using the Management Effectiveness Tracking Tool (METT) developed by the WWF/World Bank partnership (Dudley et. al., 2007). The low costs associated with collecting annual survey data make it an attractive option to otherwise more expensive remote sensing analysis to evaluate deforestation rates.

The example of GCF, taken as both a proxy for CTFs and as a key factor in creating many of these funding mechanisms, indicates that steady investment in protected areas can stimulate improvement in management effectiveness and lead to concomitant reductions in deforestation. Importantly, improvements in management effectiveness can accumulate over time with regular financial support, which is also associated with parallel improvements in deforestation rates. Taken together, we believe these results make a compelling argument that CTFs (or other regular long-term funding sources) are a valuable tool to complement existing protected area strategies and for achieving global conservation commitments.

ENDNOTES

[1] However, it should be noted that approximately one half of the total number of hectares just cited represents a single large uninhabited marine protected area in the South Pacific which has become a no-take zone: the Phoenix Islands Protected Area in the Republic of Kiribati.
[2] T statistic
[3] Degrees of freedom
[4] P value
[5] Mean
[6] Standard deviation
[7] These were the endowments for an indigenous community managed protected area near Cusco in Peru which is known as the Vilcanota Polylepis project, and the AZE trust fund (also called Serrania de las Quinchas) for six small private protected areas totaling around 7,000 hectares that are managed by the Colombian bird conservation NGO, Pro Aves.
[8] These five funds are the legally independent and national-level Guyana Conservation Trust; the Kayapo indigenous protected area trust fund sub-account managed by the Brazilian national-level environmental trust fund FUNBIO; the Malpelo marine protected area (MPA) trust fund established as a sub-account of Colombia's national level environmental fund, Fondo Acción; the Harapan Rainforest Endowment established as a sub-account of a new UK charity to finance an NGO-managed conservation concession in Indonesia; and the legally independent Caucasus Protected Areas Fund to support government-managed protected areas in Armenia, Azerbaijan and Georgia.

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ABOUT THE AUTHORS

Curan Bonham is the Director of Project Monitoring and Evaluation, responsible for impact evaluation of investments within the portfolio of funds in Conservation International's Ecosystem Finance Division. Curan holds an MS in Forestry and International Conservation and Development from the University of Montana and a BS in Natural Resources from Cornell University.

Marc Steininger is Senior Director of Ecosystem Analysis and Geomatics in Conservation International, leading CI's work on habitat monitoring. He received his PhD from the University of Maryland and since then has conducted research on methods and applications in monitoring and modeling tropical habitats in the context of biodiversity conservation and climate change mitigation.

Michael McGreevey is Senior Manager of the Global Conservation Fund at Conservation International. He is responsible for design, management and sustainable financing of a global portfolio of conservation investments. Michael holds a BA from Reed College and MS from Johns Hopkins University.

Christopher Stone is the Managing Director for Conservation International's Global Conservation Fund. Chris has been employed by CI for 15 years, with a career focus on project design, programme development and conservation grant-making. As GCF Director, Chris has helped oversee the strategic allocation of over US$ 60 million in project grants over a 12-year period.

Timothy (Max) Wright is a Spatial Modeling and Remote Sensing Specialist at the Betty and Gordon Moore Center for Science and Oceans in Conservation International. He completed his post-graduate studies at Clark University and works on project monitoring, methodologies in remote sensing, and land-use modelling in the context of habitat conservation.

Carlos (Andres) Cano is Manager of Monitoring Systems for the Betty and Gordon Moore Center for Science and Oceans, Conservation International (CI). He received his BA in Geography and a minor in GIS from George Mason University. In CI he provides technical assistance on multiple land-cover change analysis projects. He also leads the production of near-real time suspected encroachment alerts in Indonesia.

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RESUMEN

El Fondo Mundial para la Conservación (GCF) es un programa destinado a abordar los problemas relacionados con las áreas protegidas que carecen de recursos suficientes para funcionar eficazmente. En funcionamiento desde 2001, el GCF ha construido una cartera global de más de 65 inversiones en áreas protegidas vinculadas con extensos conjuntos integrados de datos sobre la eficacia y los resultados de conservación de la gestión de áreas protegidas. Con base en los datos recogidos durante los últimos seis años (2008-2013), este trabajo trata de responder a dos preguntas: 1) ¿Cuál es la relación entre las inversiones en conservación y las condiciones necesarias para lograr resultados de conservación? 2) ¿Se correlaciona la financiación estable con un índice de deforestación estable o que mejora? Los resultados de los análisis de estos datos sugieren que la inversión periódica y sostenida en la gestión de áreas protegidas produjo una disminución estadísticamente significativa en las tasas de deforestación en y en los alrededores de estas áreas protegidas. Constatamos, asimismo, que a mayor puntuación en eficacia de la gestión, menor tasa de deforestación. Esto sugiere que el monitoreo de las condiciones necesarias para la gestión eficaz de las áreas protegidas proporciona un indicador aproximado razonable acerca de los resultados de conservación, medidos en términos de los cambios en las tasas de deforestación. Estos resultados apoyan de manera convincente el argumento de que los fondos fiduciarios para fines de conservación son herramientas valiosas para ayudar a las áreas protegidas a cumplir los objetivos perseguidos y contribuir a las metas mundiales de conservación.

RESUME

Le Fonds pour la Conservation Globale (GCF) est un programme destiné à répondre aux problèmes liés aux aires protégées qui manquent de ressources suffisantes pour un fonctionnement efficace. En activité depuis 2001, le GCF a mis en place un portefeuille mondial de plus de 65 investissements dans des aires protégées liés à des objectifs de gestion efficace et aux résultats de la conservation. En rassemblant les données recueillies au cours des six dernières années (2008-2013), ce document tente de répondre à deux questions : 1) Quelle est la relation entre les investissements et les conditions favorables à l'obtention de résultats positifs de conservation? 2) Est-ce qu'un financement stable correspond à un déboisement stable ou en réduction? Les résultats de l'analyse indiquent qu'un investissement régulier et soutenu dans la gestion des aires protégées a provoqué une réduction du déboisement statistiquement significative dans ces aires protégées et dans leur proximité. En outre, nous constatons qu'un degré plus élevé d'efficacité dans la gestion des parcs correspond à un taux de déboisement plus bas. Ainsi, en se fondant sur la mesure du taux de déboisement, on peut déduire que le fait d'assurer des conditions favorables de gestion aboutit à des résultats positifs de conservation. Ces conclusions constituent un argumentaire de poids permettant d'affirmer que les fonds de conservation sont des outils efficaces pour aider les aires protégées à obtenir les résultats attendus et pour contribuer aux objectifs globaux de la conservation.

CONSERVING BIODIVERSITY IN THE DEMOCRATIC REPUBLIC OF CONGO: A BRIEF HISTORY, CURRENT TRENDS AND INSIGHTS FOR THE FUTURE

Bila-Isia Inogwabini

Corresponding author: bi4@kentforlife.net or inogwabini.bila-isia@slu.se
Visiting Researcher, Swedish University of Agricultural Science
Department of Aquatic Science and Assessment, Uppsala

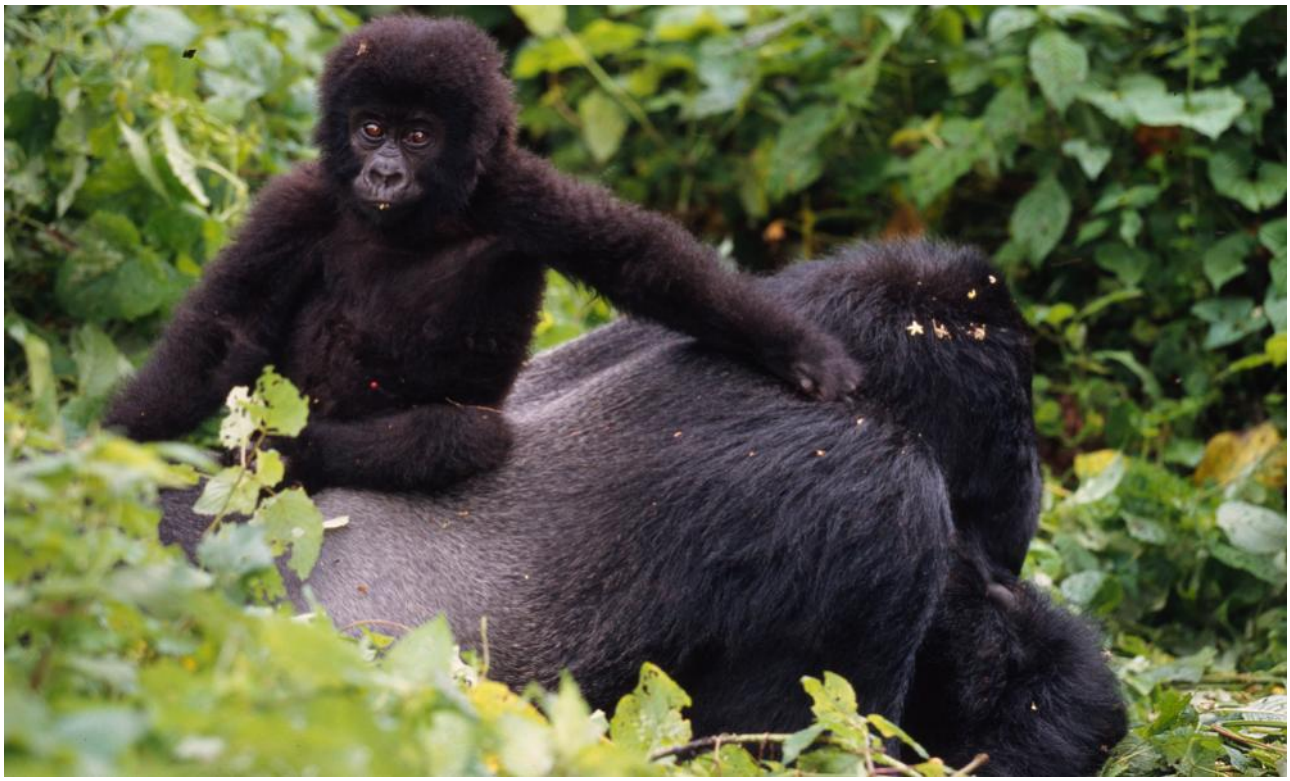
ABSTRACT

The history of biodiversity conservation in the Democratic Republic of Congo (DRC) runs in parallel with the story of alienation of land and natural resources which began in early colonial times. There is a legacy of undemocratic laws promulgated in the time of Leopold II that still govern land rights and the conservation of biodiversity. Numerous conflicting pressures are currently exerted on the DRC Government to lease more lands and create more protected areas. I argue that while conserving biological diversity is good, there is a need to reflect deeply on how to make the management of protected areas effective and reconciled with the needs expressed by communities. I also argue that preserving biodiversity is not and should not be equated with creating more new state-owned protected areas. There are other ways to conserve biodiversity, including privately protected areas, devolution of law enforcement to local communities, and downgrading some protected areas to IUCN Category VI, with proper zoning to reflect the reality of management. This is a complex process and involves strong political decisions and should be supported by a thorough assessment of the entire protected area network. I suggest that the key to success in preserving biodiversity in DRC is a proper land rights system and local law enforcement, which will make local communities allies rather than opponents to conservation.

Key words: Democratic Republic of Congo, protected areas, local communities, land rights

INTRODUCTION

The Democratic Republic of Congo (DRC), the second largest country in Africa, harbours a variety of ecosystems: including nearly half the African rainforests (IUCN, 1992), forest-savannah ecotones, savannahs, afro -mountainous forests, large and small lakes, rivers and swampy forests (Inogwabini et al., 2005*a*). Since the colonial era, efforts to preserve this biological diversity have been concentrated on protected areas. However, methods used to create these protected areas have been essentially top-down. Protected areas were created without the local communities' consent and their management has been more enforcement-oriented than inclusive of stakeholders. Because of this paradigm, protected areas are often not accepted by local communities and symbolise the ruling elite. Viewed as political institutions, the foundations on which protected areas rest are fragile for long-term survival. In the early 1990s, conservationists (Hart & Hall, 1996) felt that those fragile foundations were crumbling as the political regime that led the country for three decades was ending. The persistent political instability in DRC since 1996 increased fears of dismantling protected areas. The ability of central government to assert its authority decreased in large parts of DRC; the delivery of public services greatly diminished and it was difficult for DRC to honour its commitments. Insecurity and changes in the political system since the 1990s affected conservation activities and strategies. However, the DRC government pledged that 15 per cent of its territory would become protected areas. There is a need to strategically address that pledge. Only an examination of available knowledge on demographic, economic, political, social and cultural trends combined with knowledge on biodiversity will provide an effective strategy for conservation in DRC. Setting the framework for such a broad reflection is the intent of this essay, which examines these changes to determine their impacts on biodiversity and how to address the long-ignored local community problem. The essay also discusses elements of the conservation law promulgated on 11 February 2014, for which the proclaimed main aim is to correct issues related to the



Mountain gorilla (*Gorilla beringei beringei*), Virunga National Park © Martin Harvey / WWF-Canon

definition, creation and management of protected areas in the country (Government of DRC, 2014). The new law will be used to support the argument being developed here because a in depth analysis of this law deserves its own paper.

DRC CONSERVATION 1925 – 1960: LAND GRABBING BY KING LEOPOLD II FOR PROTECTED AREAS

Congolese elites are proud to proclaim that the first African Park was created in DRC. The Virunga National Park (NP) was created in 1925 in eastern Belgian Congo. The creation of Virunga NP confirmed the new land tenure system, which broke down the local traditional tenure. It epitomised the emerging land tenure law of February 1885 when DRC became the dominion of King Leopold II. On 1 July 1885 a land tenure ordinance was passed to confirm that lands acquired by Stanley on behalf of King Leopold II would be used by the Belgian Crown but indigenous people would continue to own their properties (Jeal, 2008). Before this, the land tenure system was that communities communally owned lands that were used by their members. Despite the fact that there were physically unoccupied lands, these were not legally empty or vacant lands since they were owned one way or another by communities. However, decrees of 22 August 1885, 14 September 1886 and that of 3 June 1906 unilaterally ended the agreements with indigenous people. These three decrees instituted the *registration* of all lands, which meant that non-registered land became vacant though indigenous people would continue using lands they collectively owned. These decrees confused physically unoccupied lands with vacant (or ownerless) lands, a notion that continued to be used throughout the history of the country. The royal decree of 1 August 1906 nullified preceding decrees (Musafiri, 2008), and injected the notion of *empty land,* which meant unused land. All empty lands became the property of the Crown (Musafiri, 2008). This decree enforced the ascendance of the state over communities. This situation was maintained throughout the colonial period by the decree of 11 April 1949, which governed land tenure until 2002 (Tshikengela, 2009). The tenure also favoured traditional political elites and encouraged forms of patrimony policies that held the majority dependent on the elite (Bruce, 1988) but *de facto* lands were commonly owned (Tshikengela, 2009). These decrees set the precedent for all that followed regarding land rights and the creation of protected areas in DRC.

In 1889 King Leopold II created the first African reserve: the Albert NP later renamed Virunga NP (Rorison, 2012). It is through the denial of land rights to local communities that the celebrated creation of the Virunga NP has to be viewed despite the fact that this event appears laudable given the sobering trends of biodiversity losses worldwide. As in other countries (Jepson & Whittekar, 2002), the denial of land rights for creating protected areas proceeded unchallenged over a long period; in the case of DRC until 1960 when the country became independent.

DRC CONSERVATION 1960 – 1995: THE LEGACY OF LAND GRABBING BY KING LEOPOLD II

Land law reforms were needed in the early 1960s because the 1960 constitution did not clarify land laws. Efforts began with the 1964 constitution, but this was vague on land tenure as it deferred land tenure to a national law to rule on land attributions and concessions acquired before 30 June 1960. The most important reform was the Bakajika law of 1968, which was modified in 1970, 1997 and 1980 (Leisz, 1998; Musafiri, 2008). The political objectives of the Bakajika law were to change the colonial land laws that gave the best cultivable lands to colonists (Leisz, 1998; Musafiri, 2008) and to provide the land tenure regime instituted by the 1964 constitution. Socially, the Bakajika law aimed to repair the injustices felt by traditional communities. Ironically, the Bakajika law confirmed that '*the soil and anything beneath it belong to the state*'; the 11 April 1949 decree remained unabrogated (Tshikengela, 2009), maintaining land denial for communities.

It is against this background that all DRC's protected areas created in 1960 – 1995 were born. It is also this history that in 1960 first led politicians seeking election to argue that protected areas were colonial relics (IUCN, 1992); and yet successive Congolese regimes continued to dichotomously pledge increasing protected areas to preserve the biodiversity of the DRC. The position of the Congolese leadership on protected areas is not uncommon in the history of protected areas across the world; politicians seeking election will say one thing, but once elected, they feel compelled to please the international community for their own prestige (Jepson & Whittekar, 2002). The 15 per cent pledge, confirmed by the provisions of article 26 of the new conservation law, has been active for several decades without a critical analysis of its impact on the growing population and need for land.

DRC CONSERVATION: LACK OF PARTICIPATION HEIGHTENED COMMUNITY REACTIONS AGAINST PROTECTED AREAS

Lack of local community's participation in the process of creating protected areas resulted in the lack of acceptance of the existence of protected areas. Poaching has many correlates that may seem tricky to disentangle, including commercial pressures, banditry and lawlessness; but lack of acceptance of protected areas clearly contributed to intensifying hunting within protected areas as a measure of defiance. Hunting as an expression of defiance happens in almost all protected areas, though all poaching cannot be attributable to this single factor. The Bakumu Faunal Reserve (FR) was established in 1949 (becoming the Maiko NP in 1970) and included the homelands of the Bakumu (Hart & Kiyengo, 1994). In 1994 the Bakumu were still within Maiko and intensive hunting continued with the support of the Bakumu despite its legal conservation status (Hart & Kiyengo, 1994). In the 1970s people were evacuated from the Salonga National Park (NP) (Marcot & Sidle, 2007) but the Yaelima people refused and remained within the park despite its fully protected status (UICN, 2010). Since then, claims over land rights by evacuated communities abound (D'Huart, 1988); most communities refused the compensation that the government gave for loss of lands (Tshikengela, 2009); they keep returning to their lands (Colom & Steel, 2006) and rivers (Monsembula, 2007). These claims make any surveillance effort for Salonga very tenuous. In 1996, unresolved land use issues precluded any practical solution on the fate of the corridor that once linked the mountain sector and the lowland part of the Kahuzi-Biega NP (Inogwabini, 1997) and human activities due to high population densities and claims over land rights isolated the mountain sector (Inogwabini et al., 2000*b*).

Garamba NP and Okapi Wildlife Reserve (WR) show, at some points in their history, that acceptance of protected areas by communities increases protection. In these two areas wildlife populations increased while hunting diminished as a consequence of increased acceptance of conservation boosted by international investment in improved livelihood of community villages adjacent to the protected areas (Tshombe et al., 2000). Similar patterns emerge from other African countries (Roe & Jack, 2001), including CAMPFIRE (Zimbabwe) that demonstrated the potential for community acceptance and involvement in the management of protected areas to improve protection of wildlife. Direct causality between wildlife conservation and incentives given to local communities is difficult to establish (Oates, 1999; Roe et al., 2000; De Merode et al., 2004) but these examples indicate that acceptance of protected areas has the potential to make them work better.

DRC CONSERVATION 1995 – 2013: THE WAR'S TOLL AND THE ROLE OF THE DRC GOVERNMENT

With a population density of *ca.* 700 individuals/km^2, Eastern DRC where war broke out in October 1996 ranks among the most densely inhabited areas of the world (Hart, 1997). This region in the Western Albertine Rift, has high biological diversity (Plumptre, 2004; Brooks et al., 2004; Plumptre et al., 2009). The area has four NPs (Kahuzi-Biega, Virunga, Garamba and Maiko) and several reserves such as the Itombwe Natural Reserve and Luama-Kivu. Kahuzi-Biega, Virunga, Garamba,

A graveyard for fallen Rangers at the Mutsora Ranger station in Ruwenzori, Virunga National Park. © Brent Stirton / Reportage by Getty Images / WWF-Canon

Maiko and Itombwe put together total 4,105,800 ha, nearly the size of Switzerland (4,128,500 ha). Resident species include the eastern lowland gorillas (*Gorilla berengei graueri*), mountain gorillas (*Gorilla berengei berengei*), okapi (*Okapia johnstoni*) and Congo peacocks (*Afropavo congensis*), striped hyenas (*Hyaena hyaena*), and Prigogine's owls (*Glaucidium albertinum*). Until recently, Garamba held the last wild population of the northern white rhinoceros.

Following the 1994 war in Rwanda, thousands of refugees crossed to DRC aided by international agencies. The refugees settled in different camps along the eastern border of DRC for several months before the first invasion of DRC by an international coalition led by the regular Rwandan Army, which destroyed refugee camps and sent millions of people into the forest to seek refuge. Four protected areas suffered from their proximity to the Rwandan border; refugee camps provided space for more than two million refugees between July 1994 and October 1997 (Hart & Hart, 1997; Inogwabini et al., 2000*b*). An indication of the effects of the war is shown by the fact that the four World Heritage Sites in DRC were included in the category of World Heritage Sites in Danger by 2002.

Chronicles describing the side-effects of the war on DRC's protected areas abound (Biswas & Tortajada-Quiroz, 1996; Saegusa, 2000; Sato et al., 2000; Kalpers, 2001; Draulans & Van Krunkelsven, 2002) but a snapshot of events is worth emphasising. All the areas suffered in one way or another during the period 1994 – 2013. The eastern belt of the DRC protected areas network, ranging from the sources of the Nile down to the sources of the Zambezi, was the most seriously devastated. Hundreds of thousands of Sudanese refugees invaded Garamba NP; they lived within the game reserves adjacent to the core park (Farmer & Nicholson, 1996), and armed groups decimated the herds of large mammals (De Merode et al., 2007). Refugee camps were also located within and adjacent to Virunga and Kahuzi-Biega. In the neighbourhood of Kahuzi-Biega refugee camps housed 1,000,000 residents who fetched wood directly from the park for fuel; 50 per cent of the western lowland gorillas inventoried by Hall et al. (1998) before the war were reported missing by 2003 (Yamagiwa, 2003; McNeely, 2003). In 1994 about 850,000 refugees lived around Virunga deforesting some 300 km² of the park in search of food and firewood; up to 40,000 people entered the park and took out 410 – 770 tonnes of forest products daily (McNeely, 2003). After the official end of the 1996 war, confrontations between park wardens and rebellious factions continued in forests of the eastern DRC, including in protected areas. The price to preserve biodiversity was high; between 1996 and 2003, 80 park staff were killed in Virunga alone (McNeely, 2003) and gorillas were slaughtered in Virunga for no apparent reason (Jenkins, 2008).

Between 1995 and 2013, the role of the DRC Government in biodiversity conservation was seriously weakened both politically and financially. The governmental budget for

biodiversity conservation declined sharply (Inogwabini et al., 2005*a*); biodiversity conservation resources came from bilateral and multilateral international donors such as the UNF, UNESCO, FAO, EU and GTZ. International conservation NGOs such as the Wildlife Conservation Society, Gillman Investment, African Wildlife Foundation, Zoological Society of Milwaukee, Zoological Society of Frankfurt, and World Wide Fund for Nature also contributed (Draulans & Van Krunkeslven, 2002; Inogwabini et al., 2005*a*). Low government budgets for biodiversity conservation during this period were understandable as priority was given to ending the war. However, this shift in priorities despite the pledge to increase protected areas highlights the conflicting policies in DRC.

Nevertheless, after 2002 DRC created new reserves because of its over-dependence on donors for biodiversity conservation. These include Itombwe (South Kivu), Lomako and Ngiri (both in Equateur) and Tumba-Lediima (between Equateur and Bandundu). An advanced project to create the Lomami-Lualaba NP (Maniema and Province orientale) also exists. These new protected areas are mainly reserves, a sign that even conservation organisations are aware that strict protected areas (i.e. NPs) are accepted only with difficulty by Congolese communities. Some genuine work to get informed consent from local people was done in the creation of these new protected areas, but the gazetting processes were plagued by the reality of the traditional land tenure, which gives more power to chiefs. The informed consent received was only of those chiefs who had received token rewards; thus consents did not necessarily reflect the views of communities as they emerged from processes that were far from democratic. Recently gazetted protected areas thus suffer from the same deficiencies as the old ones. In Itombwe, local communities rejected the creation of the natural reserve (De Failly & Bantu, 2010) and increased hunting within the reserve (UICN, 2010). In Lomako Reserve the northern communities hardly accepted the reserve and resorted to violent conflicts with wardens (Bourgeois, 2009).

In Tumba-Lediima a different type of conflict emerged; logging companies opposed the reserve. Logging companies went against the will of communities, who in this case wanted to create the reserve, they opposed its presence and used subterfuge to gain political support and influence the conservation organisations to maintain their concessions in the reserve. The Tumba-Lediima case shows how daunting it is to get all stakeholders to agree.

DRC CONSERVATION AFTER 2013: LEOPOLD II, MOBUTU AND KABILA OR MORE LAND STILL TO BE LOST?

Local populations ask about the material benefits yielded by conserving biodiversity. In response to this sensible question, conservationists need to clarify that preserving forest does not necessarily mean locking all forests within protected areas. There are other conservation paradigms that need to be explored, including agro-forestry, low impact logging, intensified conservation agriculture, multiple use forests, community-managed areas, etc. These concepts have been poorly examined in DRC; the push for the classical type of protected areas is enshrined in the promise by DRC Governments to set aside 15 per cent of the country for its protected area network. Leopold II, Albert I and Mobutu thought that protected areas were the best way to preserve forests. They held no consultations with local communities; laws creating protected areas were passed without informed consent of even parliamentary representatives. By promising to expand the network without a general consultation of the nation, current politicians are following a similar path.

While increasing the protected area network seems to be a laudable goal in itself, the reality of making that network function properly is daunting given the insufficient resources to maintain it. Classifying forests as protected areas does not necessarily mean protecting the biodiversity they shelter; the empty forest syndrome across Africa speaks against that view (Nasi et al., 2011). The cost of preserving biodiversity in the context of increasing human populations, deepening underdevelopment, wars and other social difficulties is the most important determinant among diverse factors. Extending the protected area network is a global good but benefits the interests of others rather than the people residing in areas being proposed for protection. Non-acceptance of protection represents the greatest risk for protected areas in DRC, so it follows that extending the network without proper general consensus will jeopardise the protected areas at their very inception.

WAYS FORWARD?

The time has come to reflect on how conservation can be undertaken sustainably and without being adversarial to local communities; other conservation models have to be looked at and tried. Firstly, to make conservation sustainable DRC needs to solve the long-standing issue of land use and tenure. This will be a long and difficult process but, as was demonstrated in Kenya (Kameri-Mbote, 2005), it can be done if genuine effort is invested. Secured property rights will give more incentives to

Women and children fetch water from a newly constructed tap system on the outskirts of Virunga National Park © Brent Stirton / Reportage by Getty Images / WWF-Canon

people to protect the land of their ancestors (Wells et al., 1992). Conservationists should help with this process rather than narrowly focusing on requesting more protected areas. Land tenure in DRC has traditionally been through common tenure whereby tribes had a common space that was used by different tribe members. This system prevailed *de facto* throughout the history of DRC even though *de jure* land and everything it contains belongs to the state. The consideration here is to identify options for people to acquire legal ownership over lands they possess *de facto*. Reviewing land tenure is essential now that competing interests are emerging and most cultivable land is likely to be allocated to commercial agriculture. Land acquisition by multinationals will push communities to exert further pressures on existing protected areas. Hence, sorting out the global issue of land tenure is a crucial step in ensuring sustainable protected areas in the long run. Also, to secure cultivable land, multinationals will want to invest only if land rights are legally affirmed and enforced; hence there is a shared interest here.

The quest for an inclusive process for creating new protected areas has been debated over many years and has culminated in the inclusion of several concerns raised above throughout the DRC into a new conservation law passed early in 2014 whereby local communities are not only to provide their informed consent prior to creating new protected areas (preamble point 3 and article 32) but also are allowed to sustainably use resources located within protected areas for food security (article 20 (2)).

Secondly, DRC should look constructively at alternative ways of conserving biodiversity (Salafsky et al., 2001), such as allowing people to create privately protected areas. The sustainability and effective protection of protected areas in the DRC should be analyzed using national strategic interests, cultural values and other economic tools. DRC should consider the cost of maintaining protected areas under the current regime (state-owned) versus the cost of fully protecting these areas through a different regime. The private sector should be allowed to supply conservation activities, including making income from conserving biodiversity. This can be done either by putting some protected areas under private management or by allowing those who can afford to buy land to create their own protected areas. In order for that to happen, as suggested by proponents of effectiveness and the efficiency of protecting biological diversity (Balmford et al., 2002; Stem et al., 2005) the current legal framework will need to be challenged. This has been done, to some extent by the new conservation law. The provisions of articles 24 and 38 of this law

introduced the notion of private and public-private joint ventures for management of protected areas though this transfer is limited to a 25 year renewable period (article 24). This can work only within a stable and democratic state, that has the means to enforce the law (Inogwabini, 2007) and to ensure that all the implementation decrees (articles 13, 16, 23, 24, 31, 33, 52, 59, 60 and 67) that are indicated in the law are produced and implemented. The success of the conservation project for the periphery of Noubalé-Ndoki NP in Congo (Stokes et al., 2010) testifies to the potential of achieving biodiversity conservation using other models. The conservation success story of the gorillas of Tayna Gorilla Reserve in Kivu (Mehlman, 2008) shows that conservation activities can be implemented by local communities and benefit biodiversity. Tayna succeeded while Kahuzi-Biega lost its gorillas, indicating that conservation can be done in different ways and that state-owned protected areas are not necessarily the best option to preserve biodiversity.

Thirdly, it must be acknowledged that DRC protected areas are already illegally and extensively used by adjacent communities and other stakeholders. Law enforcement alone is unable to provide the protection needed for biodiversity to sustainably persist over the long term. Even the smallest protected areas such as N'sele NP (34.4 km^2) and Mabali Scientific Reserve (1,900 ha), for example (Inogwabini et al., 2005b; Twagirashyaka & Inogwabini, 2009) have suffered. DRC has to become realistic in its approach to conservation, which would imply adjusting the law to the reality existing in most areas: that they are all already multiple use areas. No DRC park can claim to be fully protected; each of them is exploited in one way or the other. Chief Wardens allow communities to enter the parks to fish at their own will in Salonga NP (Inogwabini et al., 2000*b*) and in Virunga NP (UNESCO, 2010); hunting is widespread in Salonga NP (Reinartz et al., 2006), in Virunga NP (Kenfack, 2013) and in both Kahuzi-Biega and Maiko (UICN, 2010); collecting wood for fuel by local communities in all of these areas is widely acknowledged (Crawford & Bernstein, 2008). These few illustrations among many call for a review of the legal categorisation in order to adapt to the reality. Given the certainty that there will be insufficient means to ensure an optimum level of conservation in most protected areas, it would be wise to downgrade most protected areas in DRC to IUCN Category VI, which they are *de facto*. It was very courageous of the DRC Government to introduce the possibility of declassifying protected areas (article 35), which is an extreme end of the process being proposed here. The protected area downgrading exercise has to be combined with other tools, including participatory land use planning for zoning of protected areas to delineate different functional areas and the devolution of legal law enforcement instruments to local leadership. This process requires the emergence of an effective democracy in DRC (Inogwabini, 2007) and should be encouraged because DRC does not have the means to fence all protected areas and its population is still very poor yet burgeoning with increasing need for land. These steps are also needed because the struggle over land and natural resources in DRC is evident through the intensive lobbying of DRC by large economic multilateral actors (Trefon, 2007); the sword of Damocles is hanging over biodiversity but more dramatically over human communities. As the case in Tumba-Lediima testifies, the best conservation allies in the current context of DRC might be local communities (Inogwabini &Leader-Williams, 2013).

CONCLUSION

Inogwabini et al. (2005*a*) advised that to increase protected areas in DRC, an assessment of the entire network was necessary before making political decisions. The biological viability analysis is currently ongoing yet that alone is not sufficient and would need cultural, economic, political, social and strategic analyses of protected areas to make decisions that would serve as foundations for the global good. The economic analysis of protected areas will lead to the establishment of privately protected areas as one efficient way to ensure both economic benefits and biodiversity conservation. For those protected areas that will remain state-managed, their legal category should be reassigned to IUCN category VI, there should be properly zoned core conservation areas, seasonal use areas and controlled use areas; and part of their legal management should be devolved to local community leadership. This combination will ensure a more coherent and tangible law enforcement that will be both economically and ethically justifiable. People are part of the conservation equation and must own it to succeed (Adams & McShane, 1997; Bawa et al., 2004); success in conservation will not endure unless there are institutional capacities to democratically manage DRC natural resources (Inogwabini, 2007). In turn, this will have to be reconciled with people's interest in development to produce desired conservation outcomes. This requires proper transfers of rights and obligations to local people to conserve biodiversity through local authorities.

ABOUT THE AUTHOR

Bila-Isia Inogwabini holds a PhD in Biodiversity Management and is currently a visiting scholar at the Swedish University of Agricultural Sciences, Uppsala (Sweden). His research interests are varied and include topics such as protected areas, large mammals, forest and freshwater habitats. He has worked with several conservation projects and programmes across the Congo Basin and has, subsequently, published a significant number of peer-reviewed papers and trained several dozens of conservation practitioners across the Congo Basin.

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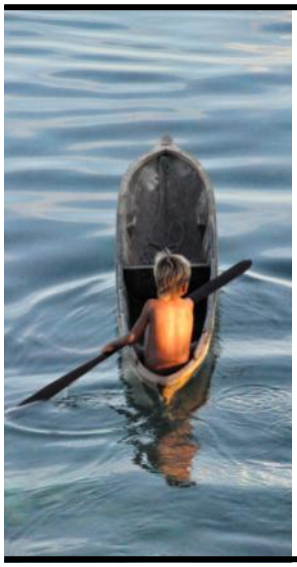
RESUMEN

La historia de la conservación de la biodiversidad en la República Democrática del Congo (RDC) se desarrolla en paralelo con la historia de la enajenación de tierras y recursos naturales que se inició en la época colonial. Hay un legado de leyes antidemocráticas promulgadas en la época de Leopoldo II que todavía rigen los derechos sobre la tierra y la conservación de la biodiversidad. El Gobierno de la RDC está siendo objeto de numerosas presiones contrapuestas para arrendar más tierras y crear más áreas protegidas. Aduzco que, si bien la conservación de la diversidad biológica es buena, es preciso reflexionar profundamente sobre la manera de hacer que la gestión de las áreas protegidas sea eficaz y acorde a las necesidades expresadas por las comunidades. También alego que la protección de la biodiversidad no debe interpretarse como la creación de más nuevas áreas protegidas de propiedad estatal. Hay otras maneras de conservar la biodiversidad, incluyendo las áreas protegidas privadas, la devolución de la aplicación de la ley a las comunidades locales y la reclasificación de algunas áreas protegidas en la categoría VI de la UICN, con una zonificación adecuada que refleje la realidad de la gestión. Este es un proceso complejo que supone decisiones políticas enérgicas y debe sustentarse en una evaluación a fondo de toda la red de áreas protegidas. Sugiero que la clave del éxito en la conservación de la biodiversidad en la República Democrática del Congo descansa sobre un adecuado sistema de derechos sobre la tierra y el cumplimiento local de la ley, lo que convertirá a las comunidades locales en aliados en vez de adversarios de la conservación.

RESUME

L'histoire de la conservation de la biodiversité en République démocratique du Congo (RDC) se déroule en parallèle avec l'histoire de l'aliénation des ressources naturelles, qui a commencé au début de l'époque coloniale. Il existe un héritage de lois anti-démocratiques promulguées à l'époque de Léopold II qui régissent encore les droits fonciers et la conservation de la biodiversité. De nombreuses pressions contradictoires sont actuellement exercées sur le gouvernement de la RDC en vue de louer plus de terres et de créer davantage d'aires protégées. Bien qu'en faveur de la conservation de la diversité biologique, je soutiens que l'on doit réfléchir en profondeur sur la façon de rendre plus efficace la gestion des aires protégées et de la réconcilier avec les besoins exprimés par les communautés locales. Je soutiens également que la préservation de la biodiversité n'est pas et ne doit pas être assimilée à la création de nouvelles aires protégées appartenant à l'Etat. Il existe d'autres façons de conserver la biodiversité, telles la création d'aires protégées privées, la dévolution aux communautés locales de l'application de la loi, et le déclassement des aires protégées en Catégorie VI de UICN, avec un zonage approprié pour tenir compte de la réalité de la gestion. Il s'agit d'un processus complexe impliquant des décisions politiques fermes, qui doit être appuyé par une évaluation approfondie de l'ensemble du réseau des aires protégées. Je suggère que la clé du succès pour la préservation de la biodiversité en RDC réside dans un système juste de droits fonciers et une bonne application de la loi locale, qui feront des communautés locales des alliés plutôt que des adversaires de la conservation.



NEW STEPS OF CHANGE: LOOKING BEYOND PROTECTED AREAS TO CONSIDER OTHER EFFECTIVE AREA-BASED CONSERVATION MEASURES

Harry D. Jonas[1]*, Valentina Barbuto[1], Holly C. Jonas[1], Ashish Kothari[2] and Fred Nelson[3]

Corresponding author: harry@naturaljustice.org
[1] Natural Justice, 63 Hout Street, Cape Town, South Africa
[2] Kalpavriksh, Pune, India
[3] Maliasili Initiatives, Vermont, USA

ABSTRACT

In 2010, the Conference of the Parties to the Convention on Biological Diversity adopted the Aichi Biodiversity Targets as part of the *Strategic Plan for Biodiversity 2011-2020*. Target 11 calls for 'at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas' to be conserved by way of 'well-connected systems of protected areas and other effective area-based conservation measures'. Yet four years after their adoption, parties to the CBD and other rights- and stakeholders have not received guidance about either what kinds of arrangements do and do not constitute 'other effective area-based conservation measures', or how best to appropriately recognise and support them. The paper argues that without clear guidance on the issue, conservation law and policy will continue to inappropriately and/or inadequately recognise the great diversity of forms of conservation and sustainable use of ecosystems and their constituent elements across landscapes and seascapes, including by Indigenous peoples and local communities. In this context, and in line with calls from the Convention on Biological Diversity and the IUCN, it proposes the establishment of an IUCN Task Force to further explore the issues with a view to developing clear guidance on 'other effective area-based conservation measures' as a means to effectively and equitably achieve Aichi Biodiversity Target 11.

Key words: Aichi Biodiversity Targets, protected areas, other effective area-based conservation measures, Indigenous peoples and local communities, conserved areas, ICCAs

INTRODUCTION

In October 2010 in Nagoya, Japan, the 10th Conference of the Parties (COP 10) to the Convention on Biological Diversity (CBD) adopted the new *Strategic Plan for Biodiversity 2011-2020* (CBD Decision X/2). The Strategic Plan aims to achieve conservation and sustainable use of biodiversity through twenty Aichi Targets organised under five strategic goals. This paper focuses on Target 11, which belongs to Strategic Goal C (*To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity*) and addresses issues related to the conservation of terrestrial, inland water, coastal, and marine areas.

Specifically, Aichi Target 11 states: "By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and **other effective area-based conservation measures**, and integrated into the wider landscape and seascape." (emphasis added)

Target 11 explicitly calls on states to strive collectively to achieve the global targets for terrestrial and marine areas (17 per cent and 10 per cent, respectively) through well-connected systems of protected areas and 'other effective area-based conservation measures' (OECMs).[1] In other words, the CBD clearly envisages areas outside of protected areas contributing directly, and with equal weighting, to the overall target. However, despite four years having passed since COP 10, the continuing effort invested in developing guidance for protected areas (Borrini-Feyerabend et al., 2013) has not been matched by a similar focus on OECMs (Jonas & Lucas, 2013). This is underscored in a report by the CBD and International

San peoples from the Kalahari have lived in harmony with nature, but their contribution to the conservation and sustainable uses of biodiversity lacks appropriate recognition, particularly in Botswana and South Africa © Harry Jonas

Union for Conservation of Nature (IUCN), which states: 'While Aichi Target 11 explicitly includes "other effective area-based conservation measures", at present there is neither a clear definition of what these measures are, nor comprehensive information on the total area covered by such measures' (Bertzky et al., 2012; Woodley et al., 2012).

The next section of the paper evaluates certain trends in conservation since 1950, pointing especially to the evolution in the typology of protected areas to include a larger proportion of those with sustainable use of natural resources and those under shared governance or governed by Indigenous peoples and local communities. These trends underscore the immediate need for a more nuanced approach to forms of governance and management occurring outside of protected areas that nevertheless deliver conservation outcomes.[2] This leads to a critical assessment of the development of the definitions of 'protected area' and 'conservation' under the auspices of the CBD and IUCN. The assessment highlights IUCN's restriction of the definition of a protected area to exclude from the global protected area estate areas that are achieving biodiversity and landscape conservation without explicitly aiming to do so. This translates into those Indigenous peoples and local communities who would like their areas to be recognised as protected areas suffering an inadequate level of appropriate recognition for their contributions to the conservation and sustainable use of biodiversity. The discussion then turns to OECMs, providing an overview of the existing literature and concluding that the contributions to the discourse are useful but remain neither comprehensive nor reflective of a consensus. The paper concludes by setting out a range of questions and pointers intended to better define OECMs as part of a larger initiative – as called for by the CBD and IUCN – to increase the appropriate recognition of Indigenous peoples' and local communities' contributions to the achievement of Aichi Target 11, not to mention various other Aichi Targets (Kothari & Neumann, 2014).

Notably, some forms of privately conserved areas (Stolton et al., 2014) and sustainable management (Stolton et al., 2014)[3] face related challenges. Although they form an integral part of the future work on OECMs, they are beyond the scope of the present article, which instead focuses on OECMs in the context of territories and areas governed by Indigenous peoples and local communities.

TRENDS IN CONSERVATION

Protected areas coverage increased more than five-fold between 1950 and 2010, from just over 4 million km² to nearly 21 million km² (Bertzky et al., 2012). Yet the overall figure masks important differences in the kind of growth in that period. Over these 60 years, it is possible to recognise two distinct phases of protected area establishment, with 1980 representing a dividing point.

From 1950 to 1980, the most rapid growth in protected areas coverage was registered in areas classified as *national parks* (Category II of the IUCN protected area matrix), which grew from 705,785 km² to 2.79 million km² (IUCN & UNEP-WCMC, 2011). By 1980, Categories I -III comprised 44.4 per cent of the total area of protected areas recorded in the World Database on Protected Areas (WDPA); national parks comprised 32 per cent, and Category I and III areas accounted for another 12.4 per cent (IUCN & UNEP-WCMC, 2011).[4] From 1980 to 2010, the proportion of national parks and other exclusionary state protected areas declined sharply in the overall global protected areas coverage, with Category II areas falling to 20 per cent of the total by 2010. In contrast, during the same period, protected areas with sustainable use of natural resources (Category VI), which include many multi-use protected areas, expanded from 9.5 per cent to 23.6 per cent of the global total (IUCN & UNEP-WCMC, 2011).[5] The patterns of change were even more pronounced after the turn of the century. Between 2000 and 2010, protected areas with sustainable use of natural resources more than doubled in total size from 2.36 to 4.96 million km², eclipsing national parks to become the single largest protected area category in terms of area (Bertzky et al., 2012).[6]

There has also been a growth in co-management and diverse forms of governance. Co-management (now also referred to as 'shared governance') of state protected areas between government and local communities (for example, through participatory forest management) has proliferated around the world since the 1990s (Borrini-Feyerabend et al., 2004). Specifically, co-managed protected areas increased from only 6,334 km² globally in 1990 to more than 1.6 million km² in 2010 (Bertzky et al., 2012), representing an approximately 25,000 per cent increase. Moreover, from 1990 to 2010, the proportion of global protected areas under either co-management or governed by non-state actors increased from 3.9 per cent to 22.8 per cent (Bertzky et al., 2012).[7]

The global protected area estate is evolving to include a larger proportion of protected areas with sustainable use of natural resources and those governed by shared arrangements or by Indigenous peoples and local communities. Notwithstanding this increase, the *Protected Planet Report 2012* suggests that if we intend to meet the terrestrial and marine targets set by Aichi Target 11 (17 per cent and 10 per cent, respectively) through protected areas alone, an additional 6 million km² of terrestrial and inland water areas and an additional 8 million km² of marine and coastal areas will have to be protected (Bertzky et al., 2012).

Inevitably, beyond the boundary of the IUCN protected areas matrix lie areas that are high in biodiversity, but for one reason or another do not meet the IUCN definition of a protected area. Types of areas that can fall either within *or beyond* the global protected area estate include some forms of Indigenous peoples' and community conserved territories and areas (ICCAs),[8] which constitute significantly important areas of cultural and biological diversity (Kothari et al., 2012). For example, Indigenous peoples' territories encompass up to 22 per cent of developing countries' land surface (WRI, 2005) and coincide with areas that hold a significant percentage of the planet's biodiversity (Sobrevila, 2008). Forest area under Indigenous peoples' or local communities' ownership or management is estimated at about 500 million hectares; this figure has steadily increased alongside the growth in decentralised governance from about 10 per cent of the world's forests to about 15 per cent in the last decade, though much of the increase has been concentrated in a few countries, especially in South America (White et al., 2004; Molnar et al., 2004; RRI, 2012a, 2012b, 2014a).[9]

Estimates suggest that ICCAs may number far more than the current officially designated protected areas (of which there were 209,000 listed in the WDPA) and cover as much if not more than their total area, i.e. at least 13 per cent of the Earth's land surface (Kothari et al., 2012). Consequently, ICCAs are significant potential contributors to achieving Aichi Target 11, as recognised by IUCN in 2012: "AWARE also that Target 11 can only be met by including protected areas governed by government agencies, those under shared governance arrangements; areas in private ownership, and territories and areas conserved by indigenous peoples and local communities, and by recognizing and supporting them in national and sectoral development, natural resource management programmes and through cooperation at all levels in an integrated manner including national, regional and international cooperation" (IUCN, 2012a). Elsewhere in the literature, Nepstad et al. (2006) studied deforestation in the Brazilian Amazon and reported that even in high-risk areas of frontier expansion, many Indigenous lands prevented deforestation completely. Indigenous lands comprise approximately 20 per cent of

the region and the authors concluded they were 'the most important barriers to Amazonian deforestation'. These findings are supported by more recent analysis by Porter-Bolland et al. (2011), who concluded that forest areas managed and governed by local communities showed lower deforestation rates than formal protected areas, and by Nolte et al. (2013), who categorised almost 300 Brazilian Amazon protected areas into strict protection, sustainable use, and Indigenous lands and showed that Indigenous lands were particularly effective at avoiding deforestation in areas with high deforestation pressures. Similar results were reported for Latin America and the Caribbean, where investigations utilising forest fire as a proxy for deforestation revealed that Indigenous areas were almost twice as effective as strictly protected areas and multiple use areas in reducing tropical fires, and that Indigenous peoples' governance regimes not only protect forests but also contribute towards biodiversity conservation and climate change mitigation goals (Nelson & Chomitz, 2011). Further studies involving GIS and spatial analysis have highlighted the close correlations between forest cover, biodiversity, and ecosystem connectivity on the one hand, and Indigenous peoples' territories and management practices on the other (see, for example, Lovgren, 2003; CIPTA & WCS, 2013; Carranza et al., 2014).

The above is not to suggest that all Indigenous territories and local community areas are achieving conservation, but that this is a sufficiently widespread phenomenon to merit consideration. At the same time, in the areas where they may not be currently contributing to conservation, this may be because of a host of factors that relate at least partly to lack of their recognition and support by wider society (Jonas et al., 2012; Kothari et al., 2012). A widespread limitation on Indigenous peoples and local communities around the world is that their ability to practise conservation is restricted by inadequate rights conferred on them by the state to make and enforce rules governing resource use and access. Increasing the legal and non-legal recognition of and support for ICCAs is therefore critically important to ensure that these areas and their associated governance and management systems have the resilience to address and adapt to growing threats (Jonas et al, 2013).

THE DEFINITION OF 'PROTECTED AREA' AND 'CONSERVATION'

The historical development of the legal notion of 'protected area' has been the subject of in-depth study and research in the conservation community (Phillips, 2004). Although 'there is no definitive definition for protected areas, and there is no agreed international schema for *all* protected areas' (Gillespie, 2009), there

A Bajau Laut child in biodiversity rich waters off Semporna on the east coast of Sabah, Malaysia. Which innovative approaches to governance can help reconcile customary sustainable use of natural resources, destructive fishing practices and conservation? © Harry Jonas

are two globally accepted definitions. The first is enshrined in the text of the 1992 Convention on Biological Diversity and the second has been developed under the auspices of IUCN (IUCN, 1994, and subsequently revised per Dudley et al., 2008). The CBD defines a protected area as a: "… geographically defined area which is designated or regulated and managed to achieve specific conservation objectives" (CBD, Article 2). IUCN defines a protected area as a: "… clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008).

It is suggested that, despite their differing formulations, there is "tacit agreement between the [CBD Secretariat and IUCN] that the two definitions are equivalent" (Lopoukhine & de Souza Dias, 2012) and many rights-holders and stakeholders are satisfied with their symbiotic coexistence. For example, while the CBD coordinates the global Programme of Work on Protected Areas, it explicitly encourages its parties to use the six IUCN management categories for reporting purposes, as

they provide the basis for the statistical recording of protected areas into the UN List of Protected Areas (now incorporated in the World Database on Protected Areas) (IUCN & UNEP-WCMC, 2011; CBD Decision VII/28, 2004). However, there remain some outstanding critiques and concerns (Dudley, 2008; Dudley et al., 2010; Govan & Jupiter, 2013). This paper examines two in particular related to the respective definitions of 'protected area' and 'conservation'.

First, an area can be assigned a management category *only if* it meets the IUCN definition of a protected area and the related principles, as set out in the IUCN *Guidelines for Applying Protected Area Management Categories* (Dudley et al., 2008). Notably, the first of these principles states: For IUCN, only those areas where the main objective is conserving nature can be considered protected areas; this can include many areas with other goals as well, at the same level, but in the case of conflict, nature conservation will be the priority[10].

This approach is underscored in a recent submission by IUCN to the CBD which states that: "nature conservation is the primary role of protected areas as recognized by IUCN" (IUCN, 2012b). As noted by Govan and Jupiter (2013), the point is reinforced in the latest *Guidelines for Applying the IUCN Protected Area Management Categories to Marine Protected Areas* (Day et al., 2012).

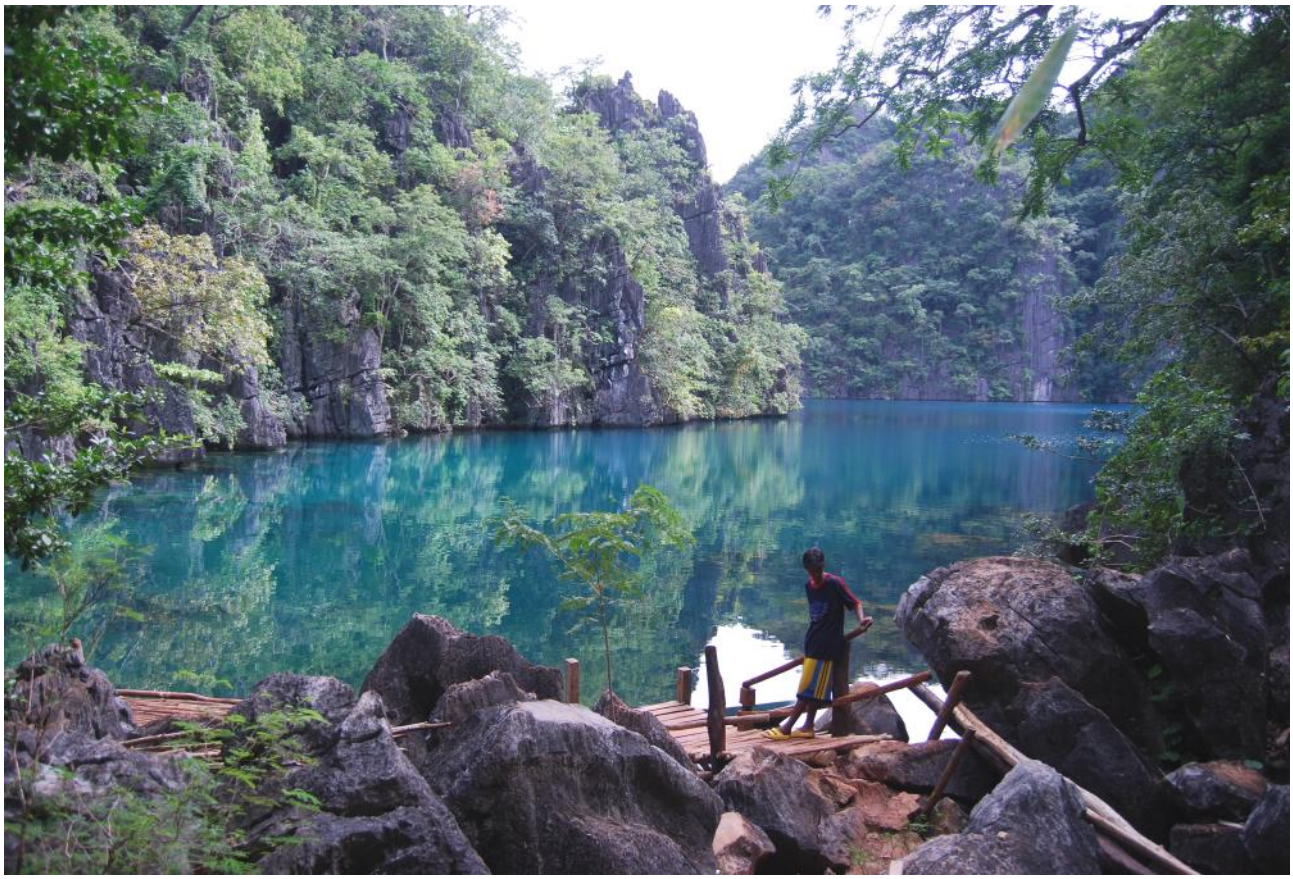
These guidelines specifically state that:

> "Spatial areas which may incidentally appear to deliver nature conservation but DO NOT HAVE STATED nature conservation objectives should NOT automatically be classified as MPAs [marine protected areas], as defined by IUCN. These include:
>
> - Fishery management areas with no **wider stated conservation aims**.
> - Community areas managed **primarily** for sustainable extraction of marine products (e.g. coral, fish, shells, etc.).
> - Marine and coastal management systems managed **primarily** for tourism, which also include areas of conservation interest.
> - Wind farms and oil platforms that **incidentally** help to build up biodiversity around underwater structures and by excluding fishing and other vessels.
> - Marine and coastal areas **set aside for other purposes** but which also have conservation benefit: military training areas or their buffer areas (e.g. exclusion zones); disaster mitigation (e.g. coastal defences that also harbour significant biodiversity); communications cable or pipeline protection areas; shipping lanes etc.
> - Large areas (e.g., regions, provinces, countries) where certain species are protected by law **across the entire region."** (original emphasis)

This list openly acknowledges that some measures may deliver conservation outcomes, but should not 'automatically' be considered marine protected areas. In this context, Govan and Jupiter (2013) argue that IUCN's definition of a protected area and the corresponding principles run counter to the approach taken across the Pacific region (and elsewhere) where the achievement of sustainable livelihoods has traditionally been the major driver for the establishment of marine 'protected areas' that function through local management. Such local forms of natural resource management, driven by livelihood interests in the sustainable use of natural resources, underpin many of the vast array of ICCAs documented around the world, and are increasingly incorporated into global and national conservation policies and programmes. These include community forests, pastoralists' grazing reserves, and many other areas where conservation (defined in a restricted way, see below) is an *outcome* of traditional or locally adaptive resource use institutions, rather than the primary or central *objective* of those management efforts (Kothari et al., 2012). Indeed, many Indigenous peoples and local communities who sustainably manage their territories and areas associate formal conservation efforts with either exploitative or exclusionary outside interests, and as a result some peoples and communities remain hostile to the notion of *conservation* as a stated management objective (Jonas et al., 2013; Stevens, 2014). This issue leads to questions (discussed more fully below) about whether the management objective, rather than conservation outcomes, is the most suitable criterion for assessing OECMs.

Second, there are also critiques concerning the definition of conservation. The above list of criteria for identifying areas that do not conform to IUCN's definition of a marine protected area highlights that the notion of what is considered a protected area is determined at a deeper level by the way *conservation* is defined. The following section provides a chronological analysis of the evolution of the term in the parallel contexts of the CBD and IUCN.

In 1980, IUCN's pioneering *World Conservation Strategy* defined conservation as 'the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations' (IUCN, 1980). It describes conservation as embracing of the traditional concepts of 'preservation' and 'maintenance', but also those of 'sustainable utilization', 'restoration' and



Sacred lake on Coron Island, part of the Tagbanwa Ancestral Domain territory in the Philippines © Ashish Kothari

'enhancement of the natural environment' (IUCN, 1980). It continues: "Conservation is that aspect of management which ensures that the fullest sustainable advantage is derived from the resource base and that activities are so located and conducted that the resource base is maintained... Living conservation has three specific objectives: *to maintain essential ecological processes and life-support systems* ...; *to preserve genetic diversity* ...; [and] *to ensure the sustainable utilization of species and ecosystems* (notably fish and other wildlife, forests and grazing lands) which support millions of rural communities as well as major industries." (original emphasis).

The year 1992 saw the adoption of a global treaty on biodiversity, the CBD, in which IUCN played a central role (Glowka et al., 1994). The CBD's tripartite aims are 'the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising [from the use of] genetic resources' (CBD, Article 1). The CBD does not define 'conservation' *per se*, instead defining the application of the concept in the form of *in-situ conservation* as: 'the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties' (CBD, Article 2). It defines sustainable use as: 'the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations' (CBD, Article 2).

The CBD provides important context to these definitions. First, the CBD specifically defines 'biodiversity' as: diversity within species, between species and of ecosystems', including 'domesticated or cultivated species', being 'species in which the evolutionary process has been influenced by humans to meet their needs' (CBD, Article 2). Second, the CBD calls on States to '"[r]egulate or manage biological resources important for the conservation of biological diversity *whether within or outside protected areas*, with a view to ensuring their conservation and sustainable use" (CBD, Article 8(c), emphasis added). Third, the CBD also calls on parties to "respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities [sic] embodying *traditional lifestyles relevant for the conservation and sustainable use of biological diversity*", and to "[p]rotect and encourage *customary use of biological resources* in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements" (CBD, Articles 8(j)/10(c), emphasis added).

Latterly, IUCN updated its definition of conservation to: 'the *in situ* maintenance of ecosystems and natural and semi-natural habitats and of viable populations of species in their natural surroundings' (Dudley et al., 2008). Notably, this definition includes the conservation of agrobiodiversity and in this context supports associated 'traditional systems of management' (Dudley, 2008). Whether this extends to other customary uses of biodiversity is uncertain, although they could be considered part of 'maintenance' especially given that domesticated biodiversity is by definition in use.

The above chronology highlights the fact that while the IUCN World Conservation Strategy (1980) explicitly includes 'sustainable use' and the CBD (1992) refers to sustainable use and customary uses of biodiversity both within and outside protected areas, the latest IUCN guidance on the linked issues of the definitions of 'conservation' and 'protected area' appears to be more restrictive (Day et al., 2012; Dudley, 2008). IUCN provides a rationale for this approach when discussing whether 'protected areas' should or should not include 'a very wide range of land and water management types that *incidentally* have some value for biodiversity and landscape conservation', (original emphasis) for example, well-managed forests, sustainable use areas, military training areas, or various forms of broad landscape designation (Dudley, 2008). In its guidance, IUCN is clear that 'the weight of opinion amongst IUCN members and others seems to be towards tightening the definition' of protected area (Dudley, 2008). In doing so, the effect is to exclude some areas from the global protected area estate that nevertheless deliver value for biodiversity and landscape conservation; value that can equal or surpass that delivered by areas managed according to more restrictive or stricter notions of conservation, as argued above.

Without entering into the merits of this approach, we are presented with a disparity between the CBD's conceptualisation of 'the integrated management of land, water and living resources that promotes conservation and [customary and] sustainable use in an equitable way' (CBD Decision V/6, 2000) in and beyond protected areas, and IUCN's less inclusive and more recent formulation. Might it be possible for territories or areas to fit the CBD definition of a protected area but fall outside the IUCN definition? Perhaps a deeper question to ask is whether this point is merely an issue of semantics, or whether IUCN's approach is hindering the attainment of the fullest recognition and support for ICCAs and other areas where conservation is being achieved without being either an explicit or primary objective.

There are at least two situations in which Indigenous peoples or local communities, and the biodiversity they govern and/or manage, are adversely affected by the current approach. First, Indigenous peoples or local communities whose sustainable and/or customary uses of biodiversity lead to biodiversity outcomes and who want international and/or (sub-)national recognition may not be eligible for recognition as a protected area under the IUCN definition. Second, stakeholders who govern or manage biodiversity in a manner that complies with the IUCN definition of a protected area may have a range of legal, political or other reasons for not wanting their territory or area to be considered a 'protected area' under the national system of protected areas. In many parts of the world, Indigenous peoples and local communities are wary of a designation that may lead to greater regulation by and influence of state agencies (Borrini-Feyerabend et al., 2010; Martin et al., 2010; Borrini-Feyerabend et al., 2013). The result is that such peoples and communities and the areas they govern and manage are only provided with either weak or inappropriate legal, institutional and financial support, with a corresponding loss of opportunities to achieve and enhance actual conservation outcomes that could further global conservation goals and targets.

There are at least two types of response to this. The more profound one is to reopen the definitions of either 'protected area' or 'conservation'. There may be merit in revisiting these definitions, including in light of the issues raised above about possible disparities between the respective approaches of the CBD and IUCN, but it would clearly require an epochal discussion. Such an investment may be important, however, especially over the medium- to long-term. In the meantime, the second option is to continue to explore ways to offer greater and more appropriate support for *effective conservation measures* that promote the conservation and sustainable use of biodiversity and the integrity of ecosystem processes (among other outcomes), within *and outside* of state-recognised protected areas, whether the primary objective is for (restrictive notions of) conservation or some other locally defined customary or sustainable purpose or value.[11] The rest of the paper is dedicated to this second approach.

OTHER EFFECTIVE AREA-BASED CONSERVATION MEASURES (OECMS)

Despite the arguments raised above regarding the definitions of 'protected area' and 'conservation', there seems to be little appetite in either IUCN or the CBD to reopen the definition of either. Notwithstanding the merits of the current approach, it should not perpetuate

Raika communities maintain an important culture and animal genetic resources, but have been excluded from the Kumbhalgarh Wildlife Sanctuary in Rajasthan, India © Harry Jonas

the current low levels of legal and non-legal recognition and support for biodiversity-rich areas that fall outside the IUCN definition of protected areas (Jonas et al., 2012). To move beyond this impasse, the authors suggest an invigorated focus on the new international term that appeared in 2010 within Aichi Target 11, namely, OECMs. Since COP10, there has been a growing international recognition that more guidance is required on OECMs, including in the following multiple instances.

In September 2012, the Fifth IUCN World Conservation Congress was held in Jeju, Republic of Korea. Among its adopted resolutions and recommendations, it called on 'IUCN Commissions, IUCN Members, UNEP-WCMC, the ICCA Consortium and other organisations to collaborate in support of CBD Decision X/2' to: "Develop criteria for what constitutes 'effective area-based conservation measures', including for, *inter alia*, Private Protected Areas, Indigenous Peoples' Conserved Territories and Areas Conserved by Indigenous Peoples and Local Communities (ICCAs), and Sacred Natural Sites (SNS)." (IUCN, 2012a).[12]

In October 2012, the Eleventh Conference of the Parties to the CBD was held in Hyderabad, India. In a position paper submitted before the event, IUCN set out its preliminary thinking on OECMs (IUCN, 2012b). It states: "IUCN maintains that those 'other effective area-based conservation measures' that contribute to Target 11 should be subject to evaluation as to whether they meet the *effectiveness criteria* for protected areas and therefore whether they qualify as '*effective*' in conserving biodiversity. If biodiversity is not at least one of the principal considerations, with adequate safeguards for their long-term persistence, they should not be factored into the % target, and their role may be limited to other qualitative functions, e.g. in contributing to the connectivity of the protected area system contemplated in Target 11." (IUCN, 2012b, emphasis added).

The focus on 'effectiveness' is notable. In this context, IUCN makes a very clear call for further guidance to be developed for and provided to parties to the CBD: "[IUCN calls] on the Secretariat [of the CBD], supported by IUCN, to provide Parties with specific guidance regarding the kinds of areas that count towards the achievement of the area coverage element of Target 11. *This should clarify that areas that do not, and will never qualify as protected areas, should not be included.* Specific guidance should be provided to Parties to ensure that areas that meet the requirements, but which are not currently recognized or reported, are recognized appropriately, including those 'other effective area-based conservation measures' that qualify." (IUCN, 2012b, emphasis added).

While the call for the development of increased guidance is laudable, the second sentence raises a major question. The statement seems to suggest that only areas that meet the definition of a protected area can count towards Aichi Target 11, including under OECMs. Parties to the CBD and other key rights-holders and stakeholders may be left wondering what an OECM is – with an emphasis on 'other' – and whether it fits the IUCN or CBD definitions of a protected area.

In addition, in October 2013, a preparatory note by the CBD's Executive Secretary for the Seventeenth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) identified the 'recognition and/or integration of indigenous and community conserved areas and private reserves in national protected area systems' as one of the existing scientific and technical gaps related to the implementation of Target 11 (CBD SBSTTA, 2013). It also underscored the necessity of 'improving information on other area-based conservation measures such as community-conserved areas' in the context of assessing the status of progress towards the Target 11 at global, regional, national and subnational levels (CBD SBSTTA, 2013). Moreover, the official report of the meeting states that further consideration of what constitutes OECMs for the purpose of reporting progress toward this target 'would be useful' (CBD SBSTTA, 2014).

To meet this demand, a small but growing body of literature is starting to address the concept of OECMs (Woodley et al., 2012; CCEA, 2013; Jonas and Lucas, 2013; Borrini-Feyerabend and Hill, 2014). In particular, the report of a workshop hosted by the Canadian Council on Ecological Areas (CCEA) provides a clear overview of the participants' emerging consensus on 'the interpretation of [OECMs] for the purpose of tracking and reporting progress towards meeting this part of Aichi Biodiversity Target 11' (CCEA, 2013). Workshop participants reached agreement on the following five issues relating to areas included as OECMs under Target 11, specific to the Canadian context:

- OECMs must have an expressed purpose to conserve biodiversity, and that purpose might be achieved as a co-benefit of other management purposes or activities;
- OECMs must be managed for the 'long term' to be effective, and 'long term' may be defined to mean that there is an expectation that conservation will continue indefinitely;
- In cases of conflict with other objectives, nature conservation objectives shall not be compromised;
- They should result in effective and significant conservation outcomes, and when there are existing measures/areas that are to be considered as OECMs, evidence of conservation outcomes should be used as part of the screening process; and
- OECMs should have a management regime that, through one of more measures that are effective alone or in combination, can reasonably be expected to be strong enough to ensure effective conservation, and if there are gaps, these will be addressed over time.

Participants at the CCEA-hosted workshop also began the development of a 'Decision Screening Tool' to guide Canadian jurisdictions in decisions relating to OECMs. The notes on the Decision Screening Tool highlight that while progress has been made, a range of issues require further thinking, including the meaning of 'long term', how the intent of the conservation measure should be recognised, and definitional issues regarding governance structures.

Borrini-Feyerabend and Hill (2015) have also engaged with OECMs, arguing that the term 'other' indicates that such measures are *not* protected areas.[13] Thus OECMs would constitute areas that are effectively conserved and intended to remain so in the long-term, but are not protected areas, because either they do not meet the IUCN definition of a protected area or the relevant custodians of the territory or area do not want them to be recognised as protected areas. In this context, Borrini-Feyerabend and Hill suggest the following definition of OECMs: "A clearly defined geographical space where *de facto* conservation of nature and associated ecosystem services and cultural values is achieved and expected to be maintained in the long-term *regardless of specific recognition and dedication."* (emphasis added).

Borrini-Feyerabend and Hill intend this formulation to give greater recognition to area-based measures of secondary voluntary conservation, ancillary conservation with a reasonable expectation to be maintained in the long-term, and primary voluntary conservation that refuses the international and/or national protected area label.[14]

NEW STEPS OF CHANGE

International law is not a panacea for local level challenges, but in certain instances, it can present 'space to place new steps of change' (Angelou, 1993). Through the adoption of Target 11 at CBD COP 10 in Nagoya, a new and as yet unclearly defined term has been introduced to the broader legal and policy framework governing the conservation and sustainable use of biodiversity. Notwithstanding the initial contributions, there are several reasons why there should be an inclusive process to comprehensively explore the issues

and develop clear guidance for the parties to the CBD and other rights-holders and stakeholders.

First, a focus on OECMs could contribute to a shift away from national protected area systems that *only* include state-recognised protected areas towards more inclusive and representative '*systems* of protected areas and other effective area-based conservation measures' governed by appropriate multi-stakeholder and rights-holder arrangements (CBD Decision X/2, 2010). Second, this in turn might provide a means to better recognise and support a range of 'other' conservation measures that fall outside of the CBD and IUCN definitions of a protected area but are nevertheless effective in conservation, i.e. 'conservation pluralism' (Shrumm & Campese, 2010).

Third, it is likely that an outcome of the discussions will be a greater and more widespread appreciation of OECMs as supporting not only conservation, but also a range of other values and functions essential to human survival and wellbeing, including the local livelihood, economic, political, cultural, and spiritual aspects of resilient communities. Fourth, this could foster greater focus by the conservation community and beyond on the critical linkages between land tenure, governance and biodiversity, contributing to both the Aichi Targets and the target to double the area of Indigenous and community land tenure in the next five years[15], among a range of related international commitments on development, food and water, livelihoods and employment, human rights, and so on, many of which are currently under discussion for the proposed post-2015 'sustainable development' agenda.

The next subsections set out a number of recommendations for next steps, including regarding the definition of OECMs; the interpretation of the definition; classes of OECMs; potential negative consequences; and the nature of the process required to effectively and equitably deliver comprehensive guidance on these issues.[16]

Definition*:* Building on the analyses by the CCEA and by Borrini-Feyerabend and Hill, further thinking is required about the following non-exhaustive list of questions relating to the definition of OECMs:

- *'Other'*: What is not a protected area but is nevertheless an effective area-based conservation measure? As per Borrini-Feyerabend and Hill's suggested definition, it should at least satisfy the criteria set out in the term: effectively deliver conservation values; be area-based; deliver conservation values; and constitute a measure. Should it also satisfy any other criteria?
- *'Effective'*: How should 'effective' be defined in this context, and how does this dovetail with the ongoing debate about how to better measure conservation effectiveness in protected areas (Geldmann et al., 2013; Nolte et al., 2013; Carranza et al., 2014)?[17] Why is effectiveness an explicit part of OECMs, but not a core criterion for a protected area, which is instead defined by its management objective, not the actual outcomes (Stolton, et al., 2013)?
- *'Area-based'*: Is the wording intentionally limiting the scope of Aichi 11 to exclude measures such as trade rules and industry measures? At another level, it should avoid referring only to a permanently defined area, otherwise it would exclude mobility and flexibility in boundaries exhibited by some ICCAs and increasingly required by other protected areas.[18]
- *'Conservation'*: There may be no need to revisit the definition of conservation, but it may be instructive to recall the *World Conservation Strategy's* definition while noting that the CBD separates conservation (albeit without clearly defining it) and sustainable use.
- *'Measures'*: How broadly should this be defined? Noting IUCN's rationale for limiting the definition of a protected area, how can we adequately address the perceived danger that OECMs may become a catchall for governments to avoid responsibility or for industrial actors to misleadingly claim their actions are leading to effective conservation?
- Beyond these criteria, are there other criteria such as governance quality that should become part of the definition of or guidance on OECMs?

Interpretation of the definition: The concept of OECMs has been introduced to perform a specific function, thus it needs to be defined and understood in context. This raises questions with regard to the small but important divergences in approaches noted above between the CBD and IUCN. On the *CBD Strategic Plan for Biodiversity 2011-2020* and Aichi Targets, the following questions arise:

- Are the differences between the CBD and IUCN definitions of a protected area material, and if so how can these important differences be reconciled? Should the IUCN definition be more reflective of the approach set out by the CBD, especially given a preponderance of countries have ratified the latter?
- How do OECMs relate to the overall wording of Target 11, in particular to the objective of achieving conservation through *effectively and equitably managed, ecologically representative and well-connected systems* of protected areas and OECMs?

- How do OECMs fit within and promote the broader context of the Strategic Plan and the objectives of the CBD? Could they be seen as viable and effective means to contribute to achieving many of the other Aichi Targets?

The following questions concern the IUCN definition of a protected area and the governance types and management categories:

- What is the relationship between protected areas (as defined by the CBD and IUCN) and OECMs, beyond what has already been discussed in this paper? Could conservation 'systems' consist of mosaics of interconnected and representative protected areas and OECMs governed in diverse ways for diverse management purposes, all contributing to effective conservation and a range of other social-ecological objectives?
- What (if any) should be the primary and/or secondary objective(s) of an OECM?[19]
- Should an OECM be defined and assessed by its management objective or its actual contributions to the conservation and sustainable use of biodiversity? As would be evident from this paper, our inclination is towards the latter, as long as such contributions are over a long-term period.
- Could a focused discussion on OECMs lead to the resolution of a number of issues raised *vis-à-vis* the current IUCN definition of a protected area? Specifically, might this approach lead to a) greater acceptance among critics of the definition(s) of a protected area, which (as discussed above) focuses on conservation as the primary objective, and b) a clear definition of OECMs that improves the international recognition of, among other areas, ICCAs based on sustainable use, livelihoods, or other objectives?

Forms or Classes of OECMs: Rather than attempting to describe OECMs in a catchall definition, in the same way 'protected area' is defined by the CBD and IUCN and as suggested above by Borrini-Feyerabend and Hill (2015), it may be useful to develop an illustrative (or exhaustive) taxonomy of OECMs, in order to highlight those intended to be supported and to guard against unintended areas being designated and counted as OECMs. For example, in the context of community conservation, at least the following areas could be considered OECMs, subject to their self-designation of and/or consent to the same: areas governed by Indigenous peoples and local communities (either *de jure* of *de facto*) that achieve conservation but are not recognised as state protected areas because either the government or the custodians do not recognise them as such; and areas that do not conform to the CBD or IUCN definitions of a protected area but are effective in conserving biodiversity (for example, a range of ICCAs, locally managed marine areas and sacred natural sites whose primary management objective is customary, subsistence or small-scale use).

Another approach, which constitutes a halfway house between the catchall definition and the illustrative list, may be to make a distinction between two broad classes of OECMs, namely:

I. The area meets the IUCN definition in practice but those governing the area refuse its designation as a protected area.
II. The area does not meet the IUCN definition because it constitutes:
    a. Secondary voluntary conservation, i.e. where conservation is not the primary objective but is still intended; or
    b. Ancillary conservation, i.e. where conservation is not intended but is nevertheless occurring.[20]

This attempt to define classes of OECMs highlights the need for greater clarity about the distinctions between the CBD's and IUCN's definitions of a protected area; we have used the term 'conservation' above in its restricted current IUCN usage distinct from 'sustainable use' in the CBD, but the definition could also be developed around the CBD's approach. Setting this crucial issue aside for the present purposes, these two classes and sub-classes of OECMs can be illustrated in a matrix, as set out in Figure 1.

Governance types → / Classes of OECM ↓	Government	Shared Governance	Private	Indigenous Peoples and Local Communities
I. Those governing the area refuse its designation as a protected area				
II a. Secondary voluntary conservation				
II b. Ancillary conservation				

Figure 1: Illustrative OECM Matrix

Governance Types →	Government	Shared Governance	Private	Indigenous Peoples and Local Communities
PA Management Categories				
Ia				
Ib				
II				
III				
IV				
V				
VI				
Classes of OECMs				
I				
IIa				
IIb				

Figure 2: Illustrative Aichi Target 11 matrix, emphasising integrated systems of protected areas and OECMs

Looking ahead, this approach might lead to the development of an Aichi Target 11 matrix, an early version of which is suggested in Figure 2 for illustrative purposes. Specifically, it builds on the IUCN protected areas matrix (Dudley, 2008) to highlight the links between *systems* of protected areas and OECMs and to underscore that these two technically distinct areas should be understood as part of a continuum across integrated landscapes and seascapes.[21]

***Potential negative consequences*:** While it is possible to envisage a number of positive outcomes issuing from the discussion and further development of OECMs, there exists potential for negative consequences. What potentially adverse ramifications might arise from a greater focus on OECMs, and how can these be foreseen in advance and minimised? For example, there is a growing concern among some protected area experts that states may use OECMs as a means to avoid what is deemed to be the more challenging path towards establishing new or expanding existing protected areas and/or to providing critically needed protection and support to *bona fide* OECMs under threat (particularly where local resource rights and access are undermined). Instead, certain states may find it 'easier' to achieve Target 11 by recognising at least two types of areas, either ones that are already effectively conserved and require little or no support, or areas that do not actually contribute to conservation outcomes. Moreover, this new approach may lead to a range of adverse effects, including the inclusion of dubious land uses such as industrial monoculture plantations in CBD parties' contributions to Aichi Target 11? While this is a valid concern, the following arguments may allay qualms about increasing the focus on OECMs.

The first argument put forward in fact constitutes one of the core reasons why more work is required to better define OECMs. By clarifying OECMs, states and other actors can more accurately ensure that *effectively and equitably managed, ecologically representative and well-connected* systems of protected areas and OECMs are scaled-up and, at the same time, guard against areas that are not protected areas or OECMs being included in national accounting for Aichi Target 11.

Second, and in response to the potential sense among some that protected areas are necessarily 'better' than OECMs, pushing for new state-governed protected areas in countries that have many unrecognised ICCAs runs the risk of conflict situations such as evictions and land dispossession. Third, more explicit and appropriate recognition of OECMs will provide them with greater resilience against internal and external disturbances (RRI, 2014b). Fourth, others argue convincingly that the important issue at stake here is not only the total area of protected areas or OECMs, but the type and quality of recognition and support that OECMs receive from states, for example, enforced legal protection against industrial developments, infrastructure, and natural resource extraction (Borrini-Feyerabend & Hill, 2014). We argue, below, that if OECMs are conceived and implemented with full respect to the requirement for conservation and in the full spirit of the Aichi Target 11, the scope for such misuse will be minimised. In this context, accurate measurement of conservation effectiveness will be of fundamental importance.

***Nature of the process*:** To actively support the achievement of the CBD's Aichi Biodiversity Targets and implementation of IUCN Resolution 5.035, the authors

Sacred mountain with forests conserved by Bazhu village, Yunnan province, China @ Ashish Kothari

propose a participatory process and programme of work between, at least, the CBD Secretariat, representatives of state parties to the CBD, the PoWPA Friends Consortium, IUCN Secretariat and relevant commissions, World Database on Protected Areas, ICCA Consortium, Indigenous peoples' and local community networks, and other interested organisations and individuals (including those representing private conservation initiatives) to undertake the following tasks:

***In the run-up to CBD COP 12 and the World Parks Congress (WPC)*:** Continue to address the questions inherent in the current discussion about OECMs as they relate to protected areas, including in the law, policy and practice of at least the CBD and IUCN.

***At CBD COP 12*:** Noting that COP 12 will, *inter alia*, conduct a mid-term review of progress towards the Strategic Plan and Aichi Biodiversity Targets,[22] present at a side event and at the CBD Secretariat-organised event on community conservation to draw attention to the issue and bring together interested parties to progress the discussion.

At the WPC: Raise the issues in Streams 1, 4, 6 and 7; deepen the discussion around the nexus of land tenure and natural resource rights, Indigenous peoples' and local communities' rights to self-determination and self-governance, governance and management of terrestrial and marine territories and areas, and inclusive and multi-stakeholder participation; explore innovative systems of conservation encompassing a diversity of governance types and management categories of both protected areas and OECMs, and biodiversity and conservation outcomes; discuss the expansion of the scope of the WDPA to include OECMs; and ensure the issues are reflected in the New Social Compact and Promise of Sydney.

Emerging from the COP 12 and the WPC: In response to the CBD's and IUCN's calls for guidance on OECMs, establish an IUCN Task Force comprising a diverse membership, as suggested above, to actively explore the issues, including through an analysis of specific cases and their contexts, histories and progress.

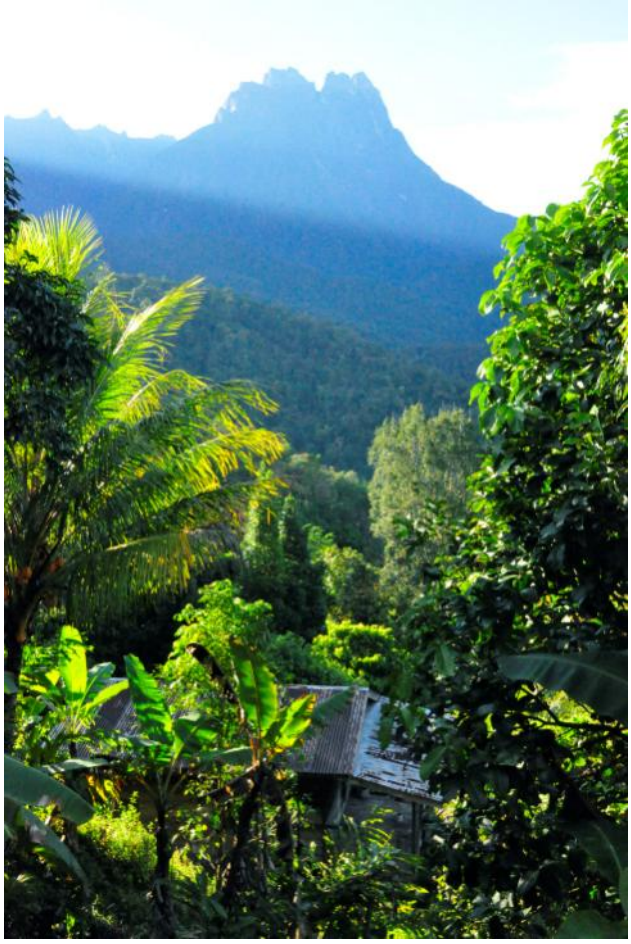
RETHINKING TARGET 11

In this context, the authors ask whether Aichi Target 11 could usefully be disaggregated to develop separate percentage targets for protected areas and OECMs, in terms of indicators, monitoring and reporting. This would enable state parties and other rights-holders and stakeholders to effectively distinguish between and plan for systems of protected areas and OECMs within the overall numerical targets and other criteria for terrestrial and marine areas. In this context, the World Database on Protected Areas could play a major role in recording and monitoring the growth of OECMs.

CONCLUSION

Large areas of lands and waters that form the territories and areas of Indigenous peoples and local communities provide significant local, national and global conservation outcomes – by default or design – in addition to a range of other economic, social, cultural, and other values and outcomes, but are not officially recognised by states and seldom receive the kinds and levels of support granted to state-recognised protected areas. This paper suggests that the incorporation of the term 'other effective area-based conservation measures' within the CBD's Aichi Biodiversity Targets provides a critical opportunity to better evaluate ways and means to more appropriately recognise and support a diversity of effective conservation occurring outside protected areas around the world. For this to happen, key questions need to be addressed around the definition and practicalities of OECMs and how they can be appropriately represented within formal conservation targets and policies. One possible means to do so is through a participatory process, coordinated by an IUCN Task Force. Such a process could generate an important discussion, provide official guidance to IUCN members and state parties to the CBD, and, most importantly, lead to greater and more appropriate recognition and support for OECMs.

One final comment is necessary. Supporting countries to achieve Target 11 is a critically necessary but by no means adequate response to the ecological crises facing humanity and the planet. Overall human activity across the entire planet, not only in 17 per cent of its terrestrial and 10 per cent of its marine area, needs to become sustainable and mindful of the rights of other species. While it may be justified to pay some special attention to protected areas and OECMs, especially in the short-term, these areas cannot remain islands within an ultimately degrading landscape and seascape. More broadly, there is an urgent need to search for fundamentally different pathways of human survival and wellbeing that are sustainable and equitable across the extent of the living planet.



Contiguous forest extending from a Dusun Village (Melangkap Kapa) towards Kinabalu Park, Malaysia, which is also an ASEAN Heritage Park © Harry Jonas

ENDNOTES

[1] A note on the acronym: 'other effective area-based conservation measures' has previously been abbreviated as 'OEABCMs'. The authors took the view that this approach was overly cumbersome. Others have reduced it to OEMs. We decided to stress the following elements in the acronym we use in this paper: 'other', 'effective', 'conservation', and 'measures'.

[2] There is general consensus among the contributors to this paper and the peer reviewers that measuring conservation outcomes, in this context, is a critical factor.

[3] For example, in the Canadian context these include: privately protected areas and conservation easements not included in the Conservation Areas Reporting and Tracking System, fishery closures, municipal water supply protection areas, and watercourse setbacks.

[4] Notably, in 2014 circa 35 per cent of the entries in the World Database on Protected Areas do not have an IUCN category. WDPA.

[5] Interestingly, a global study from 2010 showed, for example, that sustainable-use protected areas (Category VI), on average, have the same level of naturalness (or human influence) as the national parks (Category II) recorded in the WDPA (Leroux et al., 2010).

[6] Much of this increase is likely due to increased documentation and some level of recognition of ICCAs and other locally managed and conserved areas.

[7] Notably, co-management is not a form of governance, but the Protected Planet Report provides the figure in this way. These figures refer only to the proportion of protected areas in the World Database on Protected Areas that have an assigned governance type (49% of all protected areas in the database). Also, while today 88% of the protected areas in the WDPA have a governance type, in terms of areas the governance type of 35% of the area covered by protected areas in the WDPA is unknown.

[8] This paper does not address the complex and often overlapping nature of ICCAs, Locally Managed Marine Areas (LMMAs) and/or Sacred Natural Sites (SNSs). It uses the terms ICCAs to include LMMAs as well as SNSs that are governed by Indigenous peoples and/or local communities. ICCAs are described as having three defining characteristics: a) a people or community is closely connected to a well-defined territory, area or species; b) the community is the major player in decision-making (governance) and implementation regarding the management of the territory, area or species; and c) the community management decisions and efforts lead to the conservation of the territory, area or species and associated cultural values.

[9] For clarity, not all of these territories and areas necessarily qualify or are self-defined by the respective peoples or communities as ICCAs.

[10] Notwithstanding this guidance, one of the examples of protected area forests in Japan used to supply timber to temples near Nara, Japan (Dudley, 2008).

[1] Among other things, this would suggest that IUCN and UNEP -WCMC should scale up the inclusion of OECMs in the World Database on Protected Areas.

[2] Sue Stolton points out that this resolution uses confusing terminology by referring to 'Private Protected Areas' because as a group, like ICCAs, LMMAs and SNSs, a private conservation initiative may or may not fall within the definition(s) of protected areas. Personal communication, 27 January 2014.

[3] Borrini-Feyerabend and Hill's analysis makes the distinction between a measure that is recognized by either international (i.e. IUCN/CBD) and/or national level bodies.

[4] Borrini-Feyerabend and Hill state that: 'The term **voluntary conservation** captures the idea that conservation may be a desired result of governance as a primary objective but also as a secondary, implicit or not fully conscious, objective. In other cases, when conservation is a fully unintended consequence of managing nature, the term **ancillary conservation** is more appropriate' (original emphasis).

[5] International Conference on Scaling-up Strategies to Secure Community and Resource Rights: www.communitylandrights.org/

[6] While the questions in this section focus on ICCAs, LMMAs and SNSs, the questions and proposal are also directly relevant for private conservation initiatives.

[7] See, for example, the Management Effectiveness Tracking Tool: www.wdpa.org/me/PDF/METT.pdf

[8] ICCAs generally have defined territories (even if boundaries shift seasonally, e.g. with migration routes) and there is nothing in the OECM term that necessitates the area having to be permanent or inflexible. It should also be noted that the boundaries of some formal protected areas also change over time and that it is likely that many such boundaries will need to be changed to accommodate the growing shifts in species' distributions induced by climate change. This may, however, hinder related measurement and the tracking of progress.

[9] We would argue that even if conservation is a secondary or ancillary objective, this should be considered part of OECMs.

[20] The authors are grateful to the comments by Grazia Borrini-Feyerabend and an anonymous reviewer for assisting to develop and refine these classes of OECM.

[2] Together, the protected area and OECM matrices would provide the full spectrum of options of area-based conservation under Aichi Target 11, constituting an Aichi 11 matrix.

[22] CBD COP 12 provisional agenda: www.cbd.int/doc/?meeting=COP-12.

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ABOUT THE AUTHORS

Valentina Barbuto: Valentina has an LLM with distinction in Global Environment and Climate Change Law from the University of Edinburgh and previous academic background in Chinese Studies. She has collaborated on land rights and investment deals with the International Institute for Environment and Development (IIED); and on the implementation of Aichi Target 11 with the International Development Law Organization (IDLO) and Natural Justice. Valentina has also worked in the DG Climate Action of the European Commission on multiple issues related to three policy areas: climate finance; forestry, agriculture and other land-use; EU strategic partnerships with third countries.

Harry D. Jonas: Harry Jonas is an international environmental and human rights lawyer, a founder of Natural Justice: Lawyers for Communities and the Environment, and an Ashoka Global Fellow. Harry is a member of a number of IUCN commissions, including on environmental law (WCEL), environmental, economic and social policy (CEESP) and protected areas (WCPA). Harry's publications include: *Human Rights Standards for Conservation*, *The Right to Responsibility*, *The Living Convention* and *Recognizing and Supporting Conservation by Indigenous Peoples and Local Communities*.

Holly C. Jonas: Based in Sabah, Malaysian Borneo, Holly is the International Policy Assistant for the ICCA Consortium and currently coordinates Natural Justice's

work in Asia. Her background is in international environmental and human rights law, zoology, and anthropology and she works on a range of issues in support of community stewardship and governance of territories and resources.

Ashish Kothari: Member of Kalpavriksh, an Indian environmental NGO, Ashish has worked for 35 years on various issues of environment and development. He was a co-chair of the IUCN Strategic Direction on Governance, Equity and Livelihoods in Relation to Protected Areas (TILCEPA), and on the steering committees of IUCN's Commission on Environmental, Economic and Social Policy and World Commission on Protected Areas. He has been on the Board of Greenpeace International and Greenpeace India, and is on the steering committee of the ICCA Consortium. He coordinated a multi-country study on ICCA recognition, and his latest book is a detailed critique of India's globalisation process.

Fred Nelson: Fred is the founder and Executive Director of Maliasili Initiatives, an organisation which promotes sustainable natural resource management and conservation in Africa by focusing on strengthening leading local civil society organisations. He lived in Tanzania for more than a decade, helped establish the Tanzania Natural Resource Forum, and has worked closely with pastoralist communities on wildlife, tourism and livelihood issues. He has done applied research on community natural resource management across eastern and southern Africa, and worked extensively on natural resource policy and governance in the region.

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RESUMEN

En 2010, la Conferencia de las Partes en el Convenio sobre la Diversidad Biológica adoptó las Metas de Aichi, como parte del Plan Estratégico para la Diversidad Biológica 2011-2020. La Meta 11 aspira a que "al menos el 17 por ciento de las zonas terrestres y de aguas continentales y el 10 por ciento de las zonas marinas y costeras" se conservan por medio de "sistemas de áreas protegidas bien conectados y otras medidas de conservación eficaces basadas en áreas". Sin embargo, cuatro años después de su adopción, las partes en el CDB y otros interesados no han recibido orientación sobre qué tipo de arreglos constituyen o no "otras medidas de conservación eficaces basadas en áreas", ni sobre la mejor manera de reconocerlas y apoyarlas. El documento sostiene que sin una orientación clara a este respecto, la legislación y las políticas sobre conservación seguirán reconociendo de manera inapropiada y/o inadecuada la gran diversidad de formas de conservación y uso sostenible de los ecosistemas y sus elementos constitutivos en los paisajes terrestres y marinos, incluidos los pueblos indígenas y las comunidades locales. En este contexto, y en línea con las solicitudes del Convenio sobre la Diversidad Biológica y de la UICN, propone el establecimiento de un Grupo de tareas de la UICN para explorar más a fondo estas cuestiones, con el fin de desarrollar una orientación clara sobre "otras medidas de conservación eficaces basadas en áreas" para cumplir de manera eficaz y equitativa la Meta 11 de Aichi.

RESUME

En 2010, la Conférence des membres de la Convention sur la diversité biologique a adopté les objectifs d'Aichi pour la biodiversité dans le cadre du Plan stratégique pour la biodiversité 2011-2020. L'Objectif n°11 demande qu' «au moins 17 pour cent des zones terrestres et d'eaux intérieures et 10 pour cent des zones côtières et marines» soient conservées au moyen de «systèmes bien reliés d'aires protégées et d'autres mesures de conservation effectives par zone». Pourtant, quatre ans après leur adoption, les membres de la CDB et d'autres parties prenantes n'ont reçu aucune instruction sur le genre de dispositions qui constituent les «autres mesures de conservation effectives par zone», ni sur la façon de les reconnaître de manière appropriée et de les soutenir. Ce document fait valoir que, sans une orientation claire sur cette question, la loi et les politiques de conservation continueront de reconnaître de façon inappropriée ou inadéquate la grande diversité des formes de conservation et d'utilisation durable des écosystèmes et de leurs éléments constituants, tant terrestres que marins, y compris parmi les peuples autochtones et les communautés locales. Dans ce contexte, et conformément aux appels de la Convention sur la diversité biologique et l'UICN, le document propose la création d'un groupe de travail à l'UICN pour explorer de façon plus approfondie ces questions en vue de développer des directives claires sur les «autres mesures de conservation effectives par zone» comme un moyen d'atteindre efficacement et équitablement Objectif n°11 d'Aichi.

SOCIO-ECONOMIC IMPACTS OF PROTECTED AREAS ON PEOPLE LIVING CLOSE TO THE MOUNT CAMEROON NATIONAL PARK

Eric Djomo Nana[1, 2,*] and Norbert Ngameni Tchamadeu[2, 3]

* Corresponding author's e-mail: ericdn@live.co.uk
[1] Department of Ecology, Faculty of Science, Charles University in Prague, Albertov 6, 128 43 Praha 2, Czech Republic
[2] IRTC – International Research and Training Center, P.O. Box 3055 Messa, Yaoundé, Cameroon
[3] Department of Animal Biology, Faculty of Science, University of Dschang, P.O. Box 67, Dschang, Cameroon

ABSTRACT

Local people living near protected areas can either be a threat to conservation or allies. Whether they take actions which are consistent with conservation or detrimental to conservation depends in part on the costs and benefits associated with each action. Incorporating the views of these local people in the process of decision-making and providing alternative livelihood solutions are important steps towards successful conservation. The aim of this study was to highlight the problems encountered by local populations living near Mount Cameroon National Park, Cameroon. We sampled households in six village communities who tend to harvest large volumes of resources from the national park, and found that due to restrictions on access to resources they consider a traditional right, these people exert a high pressure on wildlife through increased poaching. The majority were also against the creation of this park. We show that park management has recruited local people as Cluster Facilitators who take part in the decision-making process. This has led to increased collaboration of local communities, and a reduction in poaching activities. We argue that for local communities to be compliant with management policies, they should take part in the process of decision-making.

Key words: local people, decision-making process, Mt Cameroon National Park, successful conservation

INTRODUCTION

Local people living near areas of great importance to conservation (e.g. protected areas), are trapped between their dependence on resources from these areas to meet their local development aspirations, and international pressure to protect resources of high international value (Van-vliet, 2010). The establishment and management of protected areas has become the cornerstone of biodiversity conservation strategies the world over (Adams & Mulligan, 2003; Brechin et al., 2003; Ervin, 2013; Lele et al., 2010; Singh et al., 2013). Although it is increasingly recognised that the conservation of biodiversity cannot be successful without providing alternative livelihood solutions to local communities dependent on forest resources (West et al., 2006), global experiences illustrate that the successful integration of conservation and development continue to be elusive, especially in Africa (Lele et al., 2010; Schmidt-Soltau, 2000; Van-vliet, 2010).

In Africa, many people depend on their surrounding environment as a major source of livelihood, as forests provide important cultural and economic resources for the rural and urban poor (King, 2009; Wicander, 2012). Sub-Saharan Africa has been the site of intense conservation planning since the colonial era (King, 2007, 2009). Under the auspices of wilderness protection, colonial authorities established national parks largely for the purpose of hunting and tourism, while forcibly evicting indigenous populations and without taking into account the long-term unsustainable effects of such actions (Adams & Mulligan, 2003; Schroeder, 1999). The rise of sustainable development as a guiding paradigm for global conservation, coupled with increasing concerns about biodiversity loss, has generated a growth of protected areas in Africa.

Highlighting the socio-economic problems encountered by local populations living near the Mount Cameroon

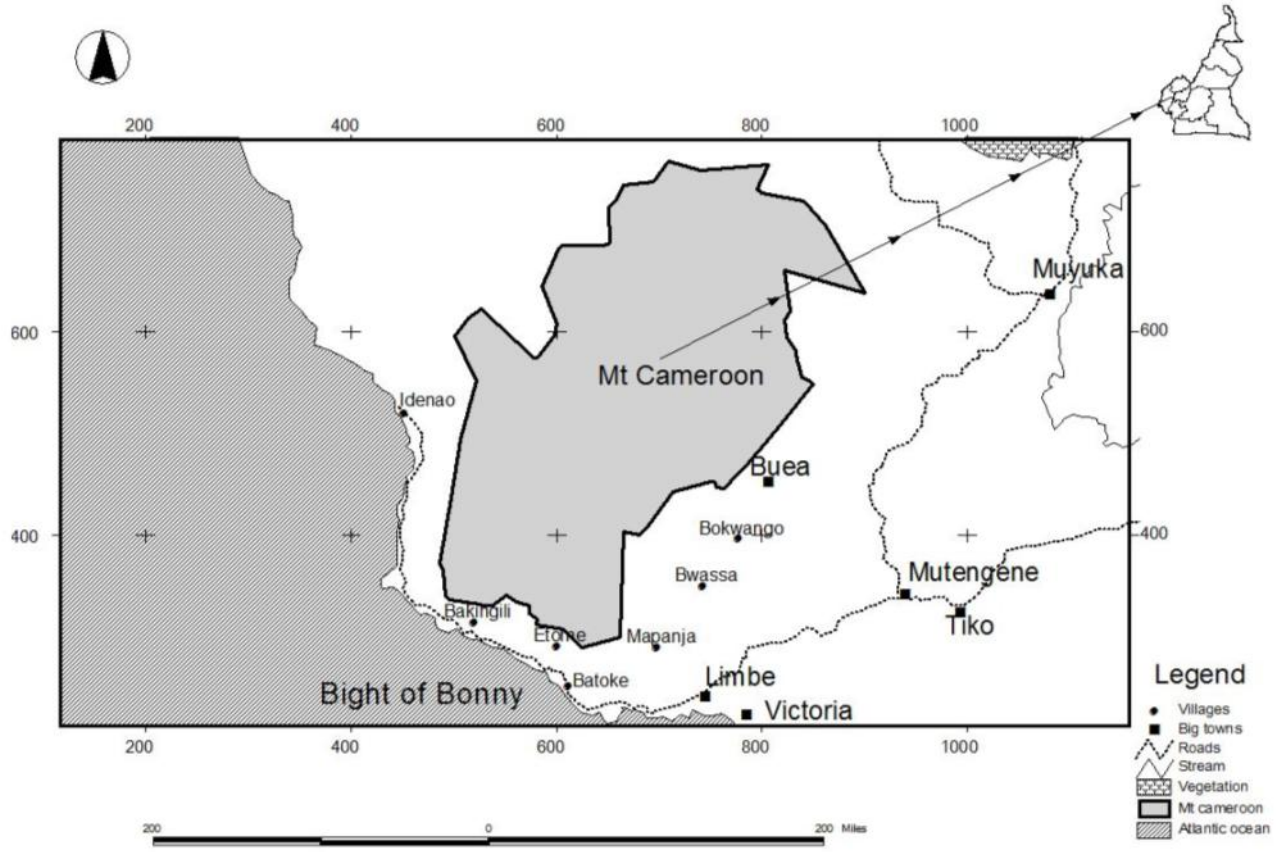

Figure 1. Map of Mt Cameroon National Park showing study villages in the Southwest region of Cameroon

National Park, and the implications for the conservation of its fragile biodiversity, was the main goal of this study. Specific objectives were to: (i) develop a baseline survey in order to assess conservation and development activities in the area, (ii) determine the level of dependence of local communities on forest resources of the national park, and (iii) provide conservation and development agencies working in the region with additional information in the planning of their activities.

MATERIALS AND METHODS

Study area

The Mount Cameroon National Park (4° 08 N 9° 07 E) is situated on the coast of Southwest Cameroon, in the Gulf of Guinea, Bight of Bonny (Figure 1). The climate in this region is maritime and equatorial, with an average annual temperature of 26°C, and average annual rainfall attaining 10,000 mm at the foot of the mountain towards Debuncha, which is the second wettest place in the world (MIAVITA, 2011; Toteu et al., 2010).

The Mount Cameroon National Park was created in December 2009, following intense efforts since 1995 by the Mount Cameroon Project (MCP), a multilateral biodiversity conservation project funded by the Department for International Development (DFID) of the United Kingdom, working directly with local communities. The goal of the MCP was to maintain biodiversity in the region by increasing the capacity of local stakeholders to sustainably manage natural resources (Brown, 1998). Increased collaboration since 2007 between the World Wide Fund for Nature (WWF), MINFOF (Cameroon's Ministry of Forestry and Wildlife), and with the financial support of the German Cooperation organisation, KfW, led the way to the creation of the park. MINFOF gazetted an area of 58,178 hectares in the region to be the national park, with a buffer zone that extends 5 km from the park's limit to the surrounding villages. The buffer zone is the area adjacent to the national park, and is defined by an imaginary line extending on average 5 kms from the park's external boundary. This area was identified to enhance the protection, and lessen the negative impacts of restrictions on neighbouring communities (MINFOF & WWF, 2006). The local people were then told to stop exploiting forest resources in these newly marked areas during sensitisation meetings which followed, but no compensatory measures were put in place.

The Bakweri tribes were the first to settle in the area, to the eastern part of the mountain, and later on the Woveas to the north east (Ardener, 1996). These two tribes constitute the major indigenous groups in the area, and make up about 10 per cent of the population,

Local communities near Mt Cameroon National Park © Eric Djomo Nana

whereas the other 90 per cent of the population is made up of people from other parts of Cameroon, and other nearby countries including Nigeria, Ghana and Benin (Laird et al., 2011). This highly heterogeneous population is mostly dependent on farming and forest resources, such as non timber forest products (NTFPs) and bushmeat for their livelihoods (Burnham, 2000; Cernea & Schmidt-Soltau, 2006).

In the nineteenth century, the German government claimed control of the Kamerun protectorate, and alienated most of the land from the local people in the Mount Cameroon region, because of the high fertility of the land. The Germans needed a large labour force, and so decided to bring in thousands of people from other villages in Cameroon to work in German plantations in the area. After the first world war, this part of Cameroon was under British colonial administration, which seized German plantations, but did not give the natives their land back despite efforts made by the Bakweri Land Claim Committee who petitioned the British government to allow the indigenes to reclaim their land (BLCC, 2006). Instead, the land was placed under the custody of the Governor of Nigeria to hold in trust for the Bakweri. It was only after independence of the Federal Republic of Cameroon in 1961, that indigenous people could reclaim part of their land, although the majority was leased to a newly created statutory corporation, the Cameroon Development Corporation (CDC), and later on to other major agro-industrial firms like PAMOL Plantations Limited Cameroon (PPLC) and Saxenhof Tea Estate.

Field work

Interviews were conducted with community respondents in November 2012 in six villages situated next to the Mount Cameroon National Park (Bokwango, Batoke, Bakingili, Bwassa, Mapanja and Etome) with a total population of more than 20,000 people (Table 1). A questionnaire consisting of both open-ended questions, and a discrete categorical scale was designed for the purpose of this study. We endeavoured to recruit respondents from a cross section of the population to make our samples as representative as possible, and therefore included representatives of civil society, state officials, community elders, traditional chiefs and other local residents.

The people from the communities under investigation were informed about the aims, relevance, and procedure of the study, and that there was no obligation to

Poaching inside the Mount Cameroon National Park © Eric Djomo Nana

participate. These particular forest-dependent communities were selected to represent typical local communities in the region because they were located next to the national park, and also, because there is a general lack of services like good roads and healthcare services. Acute poverty is endemic in this area with 87 per cent of the people living below the poverty line (World Bank, 2011).

Due to differences in the population sizes of the sampled villages, sampling was proportionate to the village sizes, and we sampled those who were available for interview. Though the sampling was therefore opportunistic, the possibility of non-response bias in the study cannot be excluded. However, the large sample size which we endeavoured to make as representative as possible in this study likely means that non-response bias was minimised (Isreal, 2012). While a few respondents could read, and completed the questionnaire on their own, most of the respondents were illiterate, and interviews were conducted to assist them in completing the questionnaire. Interviews were conducted at homes, and in work places either in English, Pidgin-English, or in the local dialect and each interview lasted 30 minutes on average. To minimise the occurrence of biased responses, leading questions were avoided during the interviews, and questions that would waste time or disturb people with irrelevant issues were also avoided (Ammenberg, 2003; Kvale, 1996). Community members were asked to state the name of their village, ethnic group, occupation, level of education, and identify any relevant affiliations within the community (for example, government, traditional groups, religious groups, labour unions, or educational institutions). Respondents were then asked more focused questions on household structures, and types of forest resources harvested with their frequencies of harvest.

Questions were asked on community involvement in the process of management decision-making to provide further details regarding their engagement in various aspects of the process (for example, supporting or opposing projects or programmes of participation), the name(s) of the project(s), as well as their perceived levels of contribution to the process (using a 4-point continuous scale). This was followed by a question on their awareness of an 'Environmental Impact Assessment' (EIA) Decree (Decree No. 2005/0577/PM) containing provisions for public participation in any development project likely to affect their forests, as well as their perceptions of the efficacy of the government in promoting, and implementing this Decree (again, using a 4-point continuous scale). Finally, the last questions asked respondents to list a series of potential obstacles to effective public participation in management decision-making, and to state their impressions regarding the creation of this national park.

Data analysis

A chi-square test was used to determine differences in the frequencies of harvest of forest resources by the study villages from the Mount Cameroon National Park. This information was obtained from the questionnaire. T-tests were used to test for differences between the number of local people in favour or against the creation of this national park, as well as, for the average age-sex distribution of people living across all the study villages, and the Mount Cameroon region. Data on age-sex distribution of people in the Mount Cameroon region was obtained from the regional delegations of Ministry of Economy, Planning and Regional Development (MINEPAT), and Ministry of Social Affairs (MINAS) of the Republic of Cameroon. Analyses were done with STATISTICA 6.0.

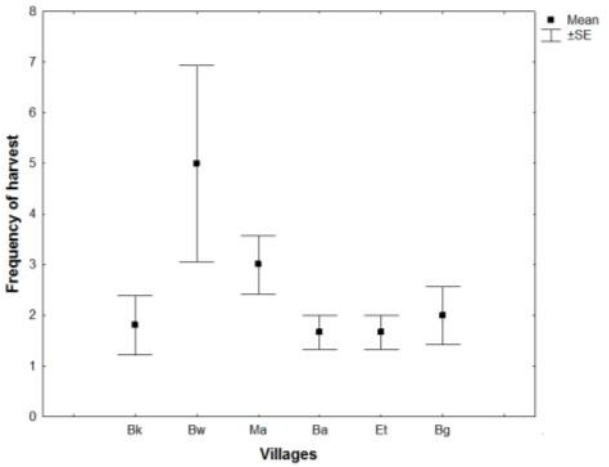

Figure 2. Frequency of harvest of natural resources of the study villages in the Mount Cameroon National Park. Bk = Bokwango, Bw = Bwassa, Ma = Mapanja, Ba = Batoke, Et = Etome, Bg = Bakingili

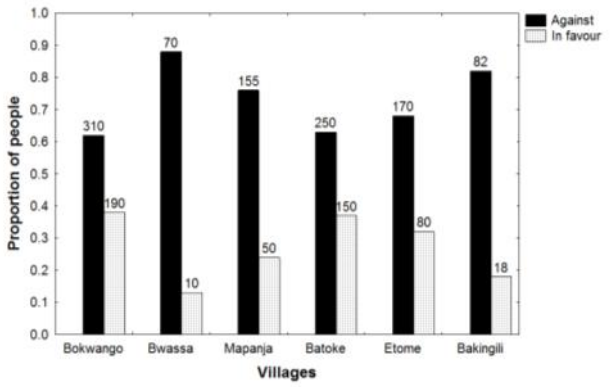

Figure 3. Percentage of people against or in favour of the Mount Cameroon National Park in the six study villages. The dark bars represent the people against in each study village while the light bars represent the people in favour. The numbers on each bar represent the total number of people interviewed for each category per village

RESULTS

Age-sex distribution and occupational structure

The sample comprised 1,535 people surveyed in six villages. The age and sex distribution of people in the study villages (Table 1), was not significantly different from the regional average; t-test; t = -0.09, $p > 0.05$, $df = 1, 950$. The population's occupational structure showed two dominant occupations: food crop farming and harvesting of forest resources. Food crop farming was given by respondents as the main occupation, and made up 83.61 per cent of livelihood, making it the principal source of livelihood.

Harvesting of forest resources and impressions of people

There were significant differences in the frequencies of harvest of forest resources between the study villages ($\chi^2 = 34.5$, $df = 4$, $p < 0.001$), with Bwassa and Mapanja harvesting more forest resources inside the National Park than the other villages (Figure 2). Bwassa and Mapanja tended to harvest more forest resources than the other villages because the state of their farm to market roads were worse than those of the other villages, making them more isolated. In all the villages sampled, the impressions of the local people participating in this study were generally against the creation of this national park (t-test; t = 9.29, $p < 0.001$, $df = 1,534$) because of the restriction of what they considered to be a traditional right (Figure 3). Some villagers promised to intensify poaching in retaliation to the restrictions imposed on them.

Management activities

Only 13 forest guards (none of which was an indigene from the area) had been allocated to this park which is over 58,000 hectares in area. However, some villagers had been recruited by the conservator's office to serve as Cluster Facilitators for the national park. Cluster Facilitators are teams composed of community members of villages around the park whose goal is to ensure effective collaboration of local people, and reduce management costs. These members are elected by village management committee members. They meet twice a year to discuss, and plan activities for six months. Together with the park service team, they discuss and find solutions to problems and challenges relating to forest matters. They play the role of so-called 'village parliamentarians' as they are responsible for disseminating information and planned activities adopted at cluster meetings back to their community members.

DISCUSSION

The household and occupational structure in the study villages reveal that these villages have a high proportion of young inhabitants with few income generating activities, as is the case for the region. These people present a high risk for the fragile biodiversity of the national park. In order to survive, and get revenue for a decent living, they have no choice but to encroach on the forest resources of the park. The people adjacent to the Mount Cameroon National Park have been exploiting these forest resources for generations, and consider this to be a traditional right (BLCC, 2006). With the transformation of the area into a national park, they find themselves dispossessed of their customary lands, with no compensatory measures put in place to support their livelihoods. This can explain the negative attitude these communities had towards this park. Some even went so far as promising to increase hunting in the park.

Table 1. Age and sex of people living in the sampled houses in percentages. In brackets are the number of people sampled in each village community and the total gives the percentage of each age group in the entire sample.

Village	Sex	Age group				
		0 - 15	16 - 30	31 - 45	46 - 60	>60
Bokwango	female (251)	43	9.6	37.8	4.8	4.8
	male (249)	42.6	4.8	47.8	4.8	0
Batoke	female (176)	23.3	47.2	14.7	14.8	0
	male (224)	40.5	41.1	9.4	4.5	4.5
Bakingili	female (60)	41.7	28.3	15	15	0
	male (40)	27.5	27.5	15	22.5	7.5
Bwassa	female (40)	25	30	25	5	15
	male (40)	45	37.5	5	7.5	5
Mapanja	female (108)	19.4	34.3	34.3	8.3	3.7
	male (97)	32	30.9	18.6	7.2	11.3
Etome	female (166)	25.3	49.4	25.3	0	0
	male (84)	0	50	50	0	0
	Total	32.8	29.8	27.8	6.4	3.2

In other tropical areas where rural communities have been dispossessed of their customary lands, it has been reported that restrictions to forest resources led to increased income losses, and significant changes in their diets, and reduced access to native medicinal plants (Bajracharya et al., 2006; Ferraro, 2002; Coad et al., 2008). In the Congo Basin, bushmeat has been reported to be an important source of fall-back income in the absence of alternative livelihood opportunities (Kümpel et al., 2010), and also provides from 30 to 80 per cent of the daily protein requirements (Foppes & Ketphanh, 2004; Wilkie & Carpenter, 1999). In forest zones of West and Central Africa, hunting for trade to urban markets has been shown to contribute 60 per cent of the income of poor to middle income households (Coad et al., 2010; Endamana et al., 2010; Kümpel et al., 2010). Kayambazinthu (1988) reported that in Malawi, 90 per cent of the primary energy supply needed by local communities living around protected areas is provided from fuelwood, and that imposed restrictions have often led to a disregard of management policies, causing tension between the local communities and park managers. These different studies illustrate the vulnerability of forest communities living near protected areas in the tropics, and their high dependence on forest resources.

Thus, dispossessing local communities of their customary lands, can significantly affect livelihoods, because these communities lose their main source of income (Kümpel et al., 2010). This can seriously frustrate local communities, especially if no compensatory measures are put in place (West & Brockington, 2006), further impoverishing communities who are already part of the poor to middle income households. These people will then have little choice but to surreptitiously enter into those areas from which they have been dispossessed to increase poaching, with disastrous consequences for wildlife. For example Cernea & Schmidt-Soltau (2006) showed that local communities in Gabon who had been dispossessed of their customary lands, had increased incentives to intensify hunting by re-infiltrating those areas.

Food crop farming was the most important source of livelihood for the local people of Mount Cameroon, and it is worth mentioning that many farms of local people are now situated in the Mount Cameroon National Park's buffer zone. With the loss of part of their farmland, and a restriction on accessing forest resources inside the park, the future prospects of development for these local people are quite bleak. It is urgently necessary to provide alternative income generating activities to these people if conservation is to be successful.

There has, however, been some compliance of local communities of Mount Cameroon with management policies since some of the villagers were recruited as Cluster Facilitators. Through this participatory approach, embraced by management of the Mount Cameroon National Park, the park authorities have reported increased collaboration of local communities, and a reduction in poaching activities.

Savannah-montane forest border on Mt Cameroon © Eric Djomo Nana

CONCLUSION

Research shows that protected areas can make positive contributions to well-being and poverty reduction. Protected area policies increasingly stipulate such approaches, but there is still often a significant difference between policies and practice (Ferraro et al., 2011). This study shows that for protected areas like the Mount Cameroon National Park, which continue to carry a huge cost for local people, greater efforts are needed on the ground to bring practice in line with policy regarding treatment of local communities. Including villagers in the process of decision-making as Cluster Facilitators is a step in that direction. It is quite clear that biodiversity conservation and economic development can have compatible goals, provided efforts are made to take into account the needs of the local people. Integrating local people in the process of decision making is important if conservation is to be successful (Lotter & Clark, 2014). With sufficient supportive policies in place, livelihoods will be improved while protecting and managing biodiversity in sustainable ways.

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ABOUT THE AUTHORS

Eric Djomo Nana is a final year Ph.D candidate in Charles University in Prague, Czech Republic, and works as a researcher for the International Research and Training Center in Yaounde, Cameroon.

Ngameni Tchamadeu Norbert is a final year Ph.D candidate and lecturer at the University of Dschang, West Cameroon. He works as a researcher for the International Research and Training Center in Yaounde, Cameroon.

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RESUMEN

La población local que reside cerca de las áreas protegidas puede representar o una amenaza o un aliado para los esfuerzos de conservación. El hecho de si estos habitantes toman acciones que son coherentes con las metas de conservación o acciones perjudiciales para la conservación depende de los costos y beneficios asociados con cada acción. El incorporar la perspectiva de estas poblaciones en el proceso de toma de decisiones y ofrecerles soluciones y alternativas en términos de sus medios de vida, son pasos fundamentales hacia un esfuerzo de conservación exitoso. El objetivo del presente estudio fue destacar los problemas enfrentados por las poblaciones locales cerca del Parque Nacional del Monte Camerún. Llevamos a cabo una encuesta de los hogares en seis aldeas que generalmente cosechan grandes cantidades de recursos del parque nacional, y encontramos que debido a restricciones en el acceso a los recursos que ellos consideran un derecho tradicional, estos habitantes han ejercido una alta presión en la vida silvestre de la zona mediante un aumento en la caza furtiva. Además, la mayoría de las personas encuestadas estaban en contra de la creación del parque. Nuestro estudio muestra que los administradores del parque han reclutado a algunos representantes de la población local para participar en la toma de decisiones y servir como facilitadores con los demás habitantes. Esto ha resultado en mayor colaboración de las comunidades locales en los procesos de gestión y una reducción en las actividades de caza furtiva. Nosotros concluimos que la participación de las comunidades locales en la toma de decisiones es necesaria para conseguir que estas mismas cumplan las políticas de manejo del parque.

RESUME

Les populations vivant à proximité des zones protégées peuvent soit constituer une menace envers la conservation soit en être les alliés. Leur action en faveur ou en défaveur de la conservation dépend en partie des coûts et des bénéfices qui y sont liés. Le fait d'intégrer le point de vue de ces populations locales dans le processus de prise de décision et puis de leur fournir des solutions alternatives de subsistance, constituent des étapes importantes vers la réussite de la conservation. L'objectif de cette étude est de mettre en évidence les problèmes rencontrés par les populations locales qui vivent près du parc national du Mont Cameroun, au Cameroun. Notre étude concerne un échantillon de ménages dans six communautés villageoises qui ont tendance à prélever de grandes quantités de ressources sur le territoire du parc national. Nous avons trouvé qu'en raison de restrictions d'accès aux ressources qu'elles considèrent comme un droit traditionnel, ces communautés exercent une forte pression sur la faune du parc à travers l'augmentation du braconnage. De plus, la majorité était contre la création de ce parc. Les gestionnaires du parc ont alors recruté des facilitateurs parmi la population locale qui prennent part au processus de prise de décision. Cela a conduit à une collaboration accrue des communautés locales, et une réduction des activités de braconnage. Nous soutenons donc qu'afin d'assurer la cohésion des collectivités locales aux politiques de gestion, ils doivent être associées au processus de prise de décision.