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IUCN WCPA WORLD COMMISSION ON PROTECTED AREAS

Convention on Biological Diversity

protected planet

IUCN PROTECTED AREA DEFINITION, MANAGEMENT CATEGORIES AND GOVERNANCE TYPES

IUCN DEFINES A PROTECTED AREA AS:

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

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

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

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

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

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

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

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

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

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

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

IUCN defines four governance types.

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

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

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

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

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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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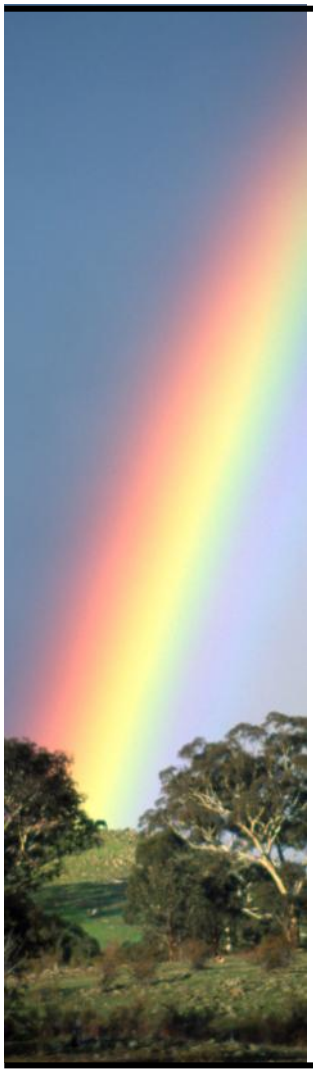

THE PROMISE OF SYDNEY: AN EDITORIAL ESSAY

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ABSTRACT

The IUCN World Parks Congress is a once in a decade event that has traditionally been a major forum for advancing global protected area policy and practice. The Congress this November in Sydney Australia will be run along eight streams; addressing biodiversity, climate change, health, ecosystem services, development, governance, indigenous peoples issues and youth; cross-cutting themes address marine issues, capacity building, World Heritage and a New Social Compact. In the following extended editorial, the organisers of the various streams lay out their aims and hopes for the 2014 Congress.

Key words: World Parks Congress, climate change, health, governance, indigenous peoples issues, youth; marine issues, capacity building, protected areas

INTRODUCTION

The IUCN World Parks Congress (WPC), convened by resolution of the IUCN World Conservation Congress, has long been recognized as a harbinger of change: a unique, once-in-a-decade meeting in which protected area professionals come together to share practice, discuss policy and meet people from very different parts of the world, who are working towards a common goal and often face similar professional challenges. Importantly, each WPC has also created or reflected a groundswell of change; introducing new ideas, launching new commitments and signalling important developments in policy. The Congresses stand out as a series of milestones in the development of the world's protected area system (Phillips, 2003).

In 2003 , the 5th WPC in Durban effectively created the bulk of the text of the Convention on Biological Diversity's (CBD) *Programme of Work on Protected Areas* (POWPA) (CBD, 2004), which remains a touchstone and key strategy for protected area development. But the Durban meeting also saw other very significant policy shifts: it witnessed the emergence into the mainstream of a more people-centred and

Uatumã Biological Reserve is part of the Amazon Region Protected Areas (ARPA) © WWF-US / Ricardo Lisboa

community-based approach to protected area establishment, management and governance, particularly involving indigenous peoples, local communities and ethnic minorities. It occurred during a period when discussion about the IUCN definition of a protected area was just beginning, leading eventually to a new definition five years later. That Congress also marked the start of a decade-long debate with the extractive industry sector, which initially proved hugely controversial amongst IUCN members.

But there were also many things that did not get much attention in Durban. Climate change occupied one small session at the Congress. Discussion of ecosystem services was virtually confined to the role of protected areas in providing high quality water. Young people introduced the Congress through traditional South African dance but there was little focus on engagement with youth during the subsequent discussions. The question of wildlife crime was scarcely mentioned.

By their nature, global policies quickly become dated, as we learn more and as conditions change: yesterday's preoccupations quickly fade away and new issues emerge into the mainstream. The CBD POWPA is now a decade old and while continuing to set the agenda for the effective management of protected area systems, cannot reflect all the emerging issues of importance to protected areas; the phrase 'climate change' only appears once in a 5,000 word document for example, limited to a concern with integrating considerations of climate change into planning. Recognition of a much broader range of issues is reflected in the Strategic Plan for Biodiversity 2011-2020 agreed at the 10th Conference of the Parties to the CBD in Nagoya, Japan in 2010 (CBD, 2010) where a new target for protected areas is juxtaposed with targets for many other critical issues for biodiversity conservation and sustainable development. Aichi Target 11 on Protected Areas reads: "*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*". The Nagoya decision therefore substantially increased the target for area under protection and requires responses that go far beyond spatial coverage.

Later this year another of these important milestones will take place; the IUCN WPC 2014 in Sydney, Australia[1]. It will, once again, celebrate achievements of the past decade, highlight areas of policy and practice that have emerged as priorities over the last few years, seek consensus on divisive issues and launch a range of new publications, tools and policy initiatives.

With its theme '*Parks, people, planet: inspiring solutions*', the Congress aims to:

- Find better and fairer ways to conserve natural and cultural diversity, involving governments, businesses and citizens in establishing and managing **parks**[2];
- Inspire **people** around the world and across generations to reconnect with nature; and
- Demonstrate nature's solutions to our **planet**'s challenges such as climate change, health, food and water security.

Most importantly, it will position protected areas firmly within the broader goals of sustainable development and community well-being through the next decade and beyond. The ambitions of the Congress will be to accelerate implementation of the important unfinished business created in Durban and to embrace innovative and transformative approaches that address new challenges in the decades to come. This statement will be agreed in Sydney and published as the ***Promise of Sydney***, offering a broad constituency the opportunity to make their own promise of commitments both during and after the Congress towards achieving the outcomes.

The eight streams of the Congress, and some important cross cutting themes, provide a guide to the range of issues preoccupying protected area practitioners at the moment. We believe that the discussions in Sydney will be critical in setting priorities for protected area agencies, managers and supporters for the coming decade. But the Congress itself is only a single meeting, and the majority of people involved in protected areas will not be able to attend. Discussions before and after the week in Sydney will help shape thinking: events such as the Asia Parks Congress in Sendai, Japan and the 9th Pacific Island Conference on Nature Conservation and Protected Areas in Suva, Fiji, both in late 2013, are examples. In order to facilitate as broad a discussion as possible in the lead up to the Congress, we outline the themes of the Congress below, and highlight preliminary thoughts about policy messages, aims and outcomes.

REACHING CONSERVATION GOALS

In the decade since the last WPC, the science of conservation has advanced rapidly, but so too have the pressures on protected areas and the requirements for a scaling up of responses. Critics have claimed that protected areas are not the most effective tool for conservation, citing their limited size and relative isolation and proposing instead less well-defined approaches for ecosystem management, regulations and best practices. There have been a number of responses to the critique of protected areas. The IUCN WCPA has been working with the Species Survival Commission (SSC) to build up long-term data on the survival of species inside and outside protected areas, to show the efficacy of protected areas as a tool and to work out the circumstances that can lead to success or failure within protected area strategies. Concurrently, WCPA and SSC have also been working together on the development and standardisation of key biodiversity areas as a tool to identify the sites contributing significantly to the global persistence of biodiversity. The stream will also address many of the key challenges facing protected area managers including alien invasive species, wildlife crime and the recent explosion of poaching. Responses including evaluation and enhancement of management effectiveness, connectivity conservation and the IUCN Green List of Protected Areas will be examined. Progress with establishment of formal, privately and indigenous and community conserved areas will be analysed, reviewed and gaps identified. More broadly, a more complete integration of conservation science and protected area management is recognized as being an important priority.

Key policy aims for and beyond the IUCN WPC 2014: Through the CBD, the world's countries have agreed on an enlightened plan for halting biodiversity loss, made real by agreement on the 20 Aichi Targets. The 'Reaching Conservation Goals' stream of the WPC will be a global discussion on how to fully use protected areas to meet the Aichi Targets, in particular Target 11. 2014 is a pivotal year to focus global attention on protected areas in achieving conservation goals, halting biodiversity loss, and creating connected ecosystems that are best able to adapt to global stresses, while providing benefits for people. There will be a focus on marine, freshwater and terrestrial systems.

The main outcome of 'Reaching Conservation Goals' will be commitments to accelerate achievement of Aichi Target 11 and to facilitate achievement of the Strategic Plan for Biodiversity. Innovative methods to achieve systems of protected areas that reach all of the elements of Target 11, to celebrate, inspire and replicate success in implementation, and to counter the progressive downgrading of protected areas in a number of countries will be at the heart of the discussion. The Congress will launch and encourage application of a new standard for the effective and equitable management and governance of protected areas (the IUCN Green List of Protected Areas) and present for final review a new standard for the identification of sites contributing significantly to the global persistence of biodiversity (Key Biodiversity Areas). The stream will provide an in-depth focus on assessing biodiversity outcomes, dealing with the global poaching crisis, ensuring ecological connectivity and many other current challenges.

The stream will conclude with a look at the future. If the Aichi Targets are meant to be interim targets for 2020, what should the ultimate targets for nature conservation look like? What does a truly sustainable protected planet look like? What science is available to inform this question? There is a need to start thinking now about a future beyond the Aichi Targets.

Skaftafellsjokull, in the Skaftafell National Park, like all Iceland's glaciers is receding due to climate change. Scientists predict that all Iceland's glaciers will have disappeared within 100 years © Global Warming Images / WWF-Canon

RESPONDING TO CLIMATE CHANGE

Since 2003, climate change has come to occupy centre stage in both development and conservation debates, sometimes threatening to eclipse more immediate problems for protected area managers. Protected areas are now viewed as a potential instrument for mitigating climate change by securing carbon-rich habitats in new and enhanced protected areas and facilitating adaptation through the provision of ecosystem services and cultural benefits that enable society to cope. But at the same time climate change is increasingly being viewed as a major threat to protected areas, because plant and animal ranges may shift outside the borders of the areas set aside for their survival, by climate extremes adding to everyday stress on the ecosystem and in some instances because changing climate will virtually or completely eliminate suitable habitat for some species or increase the threat of invasive alien species. The spectre of ocean acidification hangs over many coastal and marine protected areas and predicted sea-level rise and increased intensity of storm surges may inundate vulnerable habitats. Immediate priorities at a field level include developing better guidance for protected area agencies and their staff on how to manage in the face of climate change, including options for ecosystem-based mitigation and adaptation.

At a wider policy level there is an urgent need to build an understanding amongst governments and industry about the critical role that protected area systems can play in climate change response strategies, following integrated and landscape approaches. Adaptation actions have been developed by people and societies through history with different levels of success, and the promotion of culturally diverse approaches enhances adaptive capacity to face climate change impacts. However, adaptation is not possible where impacts go beyond the resilience capacity of ecosystems and societies, and need for transformative change is being increasingly recognized.

Key policy aims for and beyond the IUCN WPC 2014: This stream will position protected areas in relation to climate change policy discussions and solutions. The stream will contribute to society's understanding and acceptance that climate change is already affecting ecosystems and protected areas through altered water supplies, habitats, infrastructure, and subsistence activities of communities and will enhance protected area managers' ability to communicate about and cope with these changes. A major goal of the Congress is the implementation of an integrated and dynamic network of healthy, well-managed protected areas that anticipates climate and ecosystem change, and

that contributes to the solutions that the world needs to face up to this crisis, such as reducing human vulnerability to disasters.

IMPROVING HEALTH AND WELL-BEING

One major new strand of protected area policy and practice that has emerged in the last decade is a more comprehensive understanding of the wide variety of health benefits of protected areas.

Previous links between health benefits of parks and protected areas tended to focus on ecosystem services such as providing medicines and fresh water. The 2010 International *Healthy Parks Healthy People* Congress in Melbourne, Australia, launched a movement that has started to spread around the world. The recent advent of the Healthy Parks Healthy People approach has established broader understanding of the diverse health benefits of nature. These include regulating disease, climate, floods and pollination, as well as the bio-cultural benefits of nature and nature experience in delivering physical, mental, and spiritual health, cultural heritage and diversity, supporting livelihoods, and fostering social well-being to sustain life. As a philosophy and an emerging community of practice for parks and protected areas, Healthy Parks Healthy People resonates with developed and developing countries, including urban and wildlands alike based on the fundamental value proposition that parks and protected areas provide ecosystem services that are vital for sustaining all life. At its essence Healthy Parks Healthy People addresses the interconnection of people and parks (ecosystems) for health co-benefits.

In 2012, human well-being ranked second among the top themes by percentage distribution of resolutions at the IUCN World Conservation Congress. Among the resolutions, a Healthy Parks Healthy People motion was passed unanimously, recommending members "*to protect the earth's two most important assets – nature and people*" and "*to promote the benefits of enhancing healthy ecosystems and human health and well-being synergistically*". This emerging context for valuing nature for its life-sustaining role in promoting health and well-being is also evident in the formation of new alliances to address Aichi Biodiversity Targets. In 2012 and 2013, the World Health Organization and the Secretariat of the CBD joined forces to run regionally-based biodiversity and health capacity-development workshops, and in 2014 they are leading the development of a new, authoritative, interdisciplinary state of knowledge review on the inter-linkages between human health and biodiversity (and related ecosystem services) in the context of the post-2015 development agenda. This technical volume will be widely distributed in the international community and across different sectors, including the WPC, just after its launch at the Conference of the Parties to the CBD in South Korea in October, 2014.

The 'Improving Health and Well-being' stream of the WPC is expected to further support the value of parks and protected areas in contributing to Aichi Biodiversity Target 11, and place increasing emphasis on the importance of activities that support achievement of Target 14, given the contribution of parks and protected areas to human health, well-being, and livelihoods. The stream will further build on the Healthy Parks Healthy People movement by sharing scientific knowledge and traditional knowledge on the health benefits – mental, physical, social, economic and spiritual – of nature. It will also identify knowledge gaps in research, highlight practical experiences, generate useful key policy messages and bring together sectors for collaborative, inspiring solutions.

Key policy aims for and beyond the IUCN WPC 2014: This stream will further harness support for the global movement involving protected areas and health sectors, resulting in concerted global actions to sustain protected areas and improve the health of individuals and communities around the world. A significant result of the stream will be the 2nd International Healthy Parks Healthy People Congress and EXPO in Atlanta, USA in July 2015.

The stream will also further contribute to the Healthy Parks Healthy People global research agenda by bolstering the body of evidence and influencing key policy directions of global and regional authorities, such as the CBD and the World Health Assembly. With the support of these authorities, the Healthy People Healthy People approach will be a guiding factor in advancing the development of relevant Sustainable Development Goals. The Congress will be an opportunity to launch a draft and consult on the IUCN *Healthy Parks Healthy People Best Practice Guidelines*, which will be finalised in 2015 and launched at the 2nd International Healthy Parks Healthy People Congress and EXPO.

SUPPORTING HUMAN LIFE

The last ten years has seen an explosion of interest in the wider benefits of protected areas, from links with faith groups and sacred natural sites to the role of parks in stabilising soils and protecting coastlines. IUCN has identified three benefits as especially critical: disaster risk reduction, provision of freshwater and contributions to the maintenance of food security. Each has multiple

The fish market in Pasar Sapowatu, Wakatobi island Kaledupa. Wakatobi Marine National Park, Southeast Sulawesi, Indonesia © Jikkie Jonkman / WWF-Canon

facets. Natural ecosystems in protected areas can help mitigate natural disasters by stabilising soils, protecting coastlines, providing spillover for floods and preventing avalanches and landslip. Forests and natural wetlands help to supply downstream communities with pure water. Marine protected areas maintain fish stocks and terrestrial reserves preserve the crop wild relatives critical for agricultural breeding programmes. Since Durban, not only have the benefits been recognized but there have been increasing efforts to quantify these and feed their economic values back into protected area management. The Economics of Ecosystems and Biodiversity (TEEB) studies have provided a baseline of information, and a variety of tools for measuring values *in situ* are starting to emerge, some working with local communities to agree key costs and benefits. Priorities now include helping managers, who are often trained principally as biologists, to understand and manage for multiple benefits, as increasingly demanded by governments and other stakeholders. Getting proper recognition for these wider values is also still a challenge amongst state governments and other beneficiaries of these ecosystem services; most governments gain an order of magnitude or more from their protected areas in terms of benefits than they invest, yet even the limited funding available continues to decline in many countries.

Key policy aims for and beyond the IUCN WPC 2014: As an outcome of the Congress, this stream expects that people and institutions will perceive and understand protected areas in a wider sense and at the scale of landscapes, providing basic physical services such as food and wild living resources, water, and disaster risk reduction functions. The stream will aim for the adoption of compelling evidence on the role of protected areas for disaster risk reduction in global policy (Hyogo Framework for Action 2), as well as national policies and local practices. It will also assert and reinforce the role of protected areas in food and water and the management of genetic resources and tailor these perspectives for introduction into national and international policy.

RECONCILING DEVELOPMENT CHALLENGES

Sustainable development is about increasing human well-being without compromising nature or future development prospects. While governments struggle to maintain food and water security, and ensure jobs and sustainable livelihoods, they are often faced with hard choices and trade-offs. Nature-based solutions can help the world deal with some of the challenges of the 21st Century and protected areas deliver significant environmental, social and economic benefits to society, for instance the freshwater supply of major cities. The stream will focus on the intersection between protected areas, and the many development goals and challenges facing national governments. The mission of the United Nations Development Programme (UNDP), and the World Bank, the world's largest development finance institution, is to support countries to achieve sustainable

development, while maintaining key ecosystem services and promoting climate resilient natural and human communities. The stream involving UNDP, World Bank, Conservation International and IUCN's Business and Biodiversity Programme presents solutions and tools on how protected areas can be integrated in development planning and economic decision-making, and provides sector-specific experience and guidance in managing the intersection between protected areas and development. There is a need to make protected areas part of the economy, and to place protected areas within national development strategies and frameworks. There is a need to transform how the world measures and accounts for development and to change the business-as-usual trajectory. The stream will discuss important steps to develop a better understanding of and provide the means for wider benefits that protected area systems bring to societies and development.

Key policy aims for and beyond the IUCN WPC 2014: This stream will deliver guidance, aimed at protected area practitioners and planners, as well as managers and policy makers of productive sectors and development, on how protected areas can be designed, managed and utilised to achieve development goals and meet development challenges. It will also disseminate cases where protected areas have been intimately embedded within development plans, natural capital accounting, sectoral practices, poverty reduction strategies or other participatory mechanisms driving development. A major component of this stream's efforts will be the establishment of the National Biodiversity Strategies and Action Plans Forum, with an anticipated membership of over 2,500 participants from biodiversity, protection, restoration, production and mainstreaming sectors. The stream will use this Forum to disseminate lessons learned to be adopted in the development of National Biodiversity Strategies and Action Plans in more than 140 countries, and being recognized and adopted by all stakeholders including relevant civil society and private sector partners around the world.

ENHANCING DIVERSITY AND QUALITY OF GOVERNANCE

Two trends emerged directly from the WPC 2003 and associated actions: the increasing recognition of indigenous peoples' and community conserved territories and areas (ICCAs) by governments and a rapid increase in self-declared protected areas by indigenous peoples or local communities, most notably in Australia where over 20 million hectares have been declared as Indigenous Protected Areas in little more than a decade. While still not free of controversy, with some analysts believing that they do not contain sufficient safeguards against degradation and others saying this is also true of government protected areas, the movement is gathering speed and the ICCA Consortium, recently established, is providing global policy guidance. However, wider issues of governance still remain under-developed. The governance element of the CBD POWPA remains poorly implemented compared with other parts of the Programme, with many governments lagging behind in applying good governance principles to existing or new protected areas, or in recognising ICCAs, rights of communities, or privately protected areas (PPAs). The global policy focus on ICCAs needs to be complemented by a focus on shared governance and PPAs; in the case of the latter, countries like South Africa and Colombia have shown the way by recognizing PPAs as another form of bottom up conservation that can both fill important gaps in national protected area systems and sometimes be created faster than is possible with state systems. Aichi Target 11 can only be realistically achieved with the contribution of all the different governance types and other effective area-based conservation measures.

Key policy aims for and beyond the IUCN WPC 2014: A first and crucial long-term impact of the Governance stream will be a world where diversity and quality of governance of protected areas and other effective area-based conservation measures, in full synergy with 'management effectiveness', are widely understood, acted upon and made useful to conservation. A second ambition will be to advance the governance frontiers through substantial steps in understanding and action and, therefore, to make sure that the concept and practice of effective and equitable governance influence policies beyond the conservation realm. Improved and more diverse governance can and should become one of the pillars of the post-2015 development agenda. Drawing from the experience of protected areas, well-governed landscapes and seascapes will thus develop as 'models for sustainable living'.

RESPECTING INDIGENOUS AND TRADITIONAL KNOWLEDGE AND CULTURE

Several of the representatives of indigenous people came to the WPC 2003 with the specific aim of eliminating protected areas from their countries: two groups who frequently want the same result, protection of natural ecosystems, had drifted dangerously apart. People wanting to eliminate any remaining blocks on unrestrained development have been happy to encourage such divisions. Hopefully in the years since Durban there have been important steps taken towards healing the rifts

between some indigenous peoples' groups and protected area authorities, as demonstrated by an increased number of collaboratively managed protected areas, indigenous protected areas (Australia), self-declared protected areas, officially recognized ICCAs and other partnerships between local communities and protected areas. Adoption of the UN Declaration on the Rights of Indigenous Peoples; development of agreements such as the *Akwe Kon* guidelines, facilitated by the CBD; better understanding of issues of governance quality within protected areas; and the wider application of Free, Prior and Informed Consent, together helped to build safeguards and new attitudes. But there is still a long way to go in terms of developing and disseminating best practice: governments who treat minorities badly are unlikely to make an exception within their protected area management. In particular, more case studies of successful collaborations are needed to build skills and confidence, and attitudes still need to change within many government departments and NGOs.

Key policy aims for and beyond the IUCN WPC 2014: The stream aims to address the need to deliver on -the-ground benefits to indigenous peoples and local communities managing their landscapes, seascapes and resources by highlighting the acceptance and recognition of multiple, innovative and culturally-driven approaches that contribute to conservation and livelihoods locally and globally, and that will lead to increased understanding, respect and support for the role of traditional management systems in protected areas and beyond. Securing long-term international funding commitments and improving national and international policies to support indigenous peoples and local communities in managing their landscapes and seascapes will also be developed. A specific ambition is to develop a capacity-building programme for indigenous managers, including community exchange networks and invigorating pathways to engage two-way learning between scientists and traditional knowledge holders.

INSPIRING A NEW GENERATION

For the first time ever, the majority of the world's population lives in cities and the proportion continues to grow. By 2030, it is estimated that 60 per cent of the world's population will live in cities. People in developed countries are spending more time indoors than in any point in history and society has shifted towards emphasizing safety over experience. A growing body of empirical evidence demonstrates that deepening the relationship with nature, by fostering and enabling direct and meaningful experiences, has a positive impact on every facet of our society.

Today, young people (35 years old and under) represent more than half of the world's population, making them a significant group of people, not just as the future generation, but as a living and breathing force of great potential here and now, whose voices must be heard, stories told and experiences shared. The 'Inspiring a New Generation' stream will launch an enduring global initiative to inspire a new generation to connect with nature. The WPC will explore and share motivators, experiences, best practise and stories related to:

- Connecting a new generation: focusing on exciting and inclusive ways to invite people who have not had opportunities to engage with nature to connect with nature in safe but transformative ways, engendering respect and supporting action for nature and its conservation among future generations.
- Investing in children: addressing school age children, in particular, and the challenges of connecting them with nature in a world where nature is increasingly scarce, exploring the benefits of and examining innovative ways in which children can be supported to experience nature through exposure to parks; and
- Empowering inspired young people: developing an inspiring process and empowered forum for young people to engage in collective actions, networking, co-learning, experience-sharing, and capacity-building/ raising to inspire people across all generations of the broader public to connect and engage for Parks, People and Planet.

Key policy aims for and beyond the IUCN WPC 2014: A renewed and enhanced focus on connecting young people with nature as a key global priority for addressing the underlying causes of biodiversity loss (Strategic Goal A of the CBD Strategic Plan 2011-2020 and Aichi Target 1) and building support for protected areas (Aichi Target 11).The stream will launch a global initiative to inspire a new generation to connect with nature by bringing together key partners – young people, park agencies, conservation organizations, corporate and social leaders that share an interest in supporting a new generation's discovery, love and stewardship of nature. The stream will also support the growth of a dynamic alliance of young people across the world and its initiatives will include: a new toolkit to support protected area managers in the development of strategies and programmes to inspire a new generation to connect with nature; a Young Peoples' Media Coalition, technological solutions for sharing young peoples' ideas and experiences, open-source capacity-building workshops, on-the-ground projects and a Young Peoples' Pact for Parks, People and Planet. The stream will inspire and empower young people to take actions for nature

Fijian men celebrating the creation of a new Marine Protected Area, Vanua Levu, Fiji © Brent Stirton / Getty Images

conservation and building leadership and engagement by young people and through intergenerational partnerships for protected areas.

MARINE PROTECTED AREAS

The huge growth in protected areas during the latter half of the 20th century was almost entirely on land, with protection in the marine realm falling far behind. Oceans and coasts face a wide range of threats, some of which are similar to threats facing land ecosystems (e.g. invasive alien species, pollution, habitat loss, exploration for mineral resources) while some others are specific to marine habitats (e.g., ocean acidification and warming, land-based run-off, unsustainable and/or illegal fishing, and dredging/sea dumping). Although the ocean is a critical source of food and livelihoods for millions in coastal communities, many fish stocks have collapsed, or are collapsing. Cooperation with the fisheries sector to ensure sustainability needs improvement and overfishing and illegal fishing still remain major threats in many marine areas. While several parts of the world have a long history of proactive action in coastal and marine protection, even iconic sites like Australia's Great Barrier Reef have been assessed as deteriorating, the result of cumulative effects from both global and local pressures.

The coming decade is likely to be decisive in respect of whether or not the world retains a series of vibrant marine ecosystems or sees a worldwide collapse in biodiversity and functionality. Because the sea is traditionally and legally viewed as a commons, privately protected areas are much less relevant than in terrestrial environments. This means that policy priorities must continue to focus on persuading those with decision-making power – communities, nations and international organizations – of the need for urgent and increasingly ambitious action, and providing the tools and advice to manage marine protected areas effectively under rapidly changing conditions. The recent trend of establishing very large marine protected areas (MPAs) that encompass whole ecosystems, and community-based MPAs that support local livelihoods, are two approaches that will help us meet our marine conservation goals.

Key policy aims for and beyond the IUCN WPC 2014: The ambition of the marine cross-cutting theme will be to expand and strengthen management effectiveness of existing MPAs and networks for the 21st Century. The specific outcomes sought will be:

- Protect More: Achieving the target of conserving 10 per cent of coastal and marine areas around the world;

Parcs Gabon eco guard departs on a two week anti-poaching patrol mission, Makokou, Gabon © WWF-Canon / James Morgan

- Involve More: Connecting people and protected areas by creating a Global Protected Area Network for future generations;
- Invest More: Appreciating ocean wealth by recognizing the true value of marine resources.

These ambitions will build on and complement the outcomes of the Third International Marine Protected Areas Congress (IMPAC3), connecting terrestrial, coastal and marine protected areas into an effective global network of people and places.

CAPACITY DEVELOPMENT

The pace at which new protected areas have been established has often outstripped the ability to manage them effectively; there are simply not enough well-trained staff available, particularly as management needs and priorities are changing so rapidly. IUCN's WCPA has a long history of providing technical advice, through its Best Practice Protected Area Guidelines series, provision of experts and individualized training sessions, but it is generally recognized that this is no longer sufficient. Field rangers in particular often miss out on training, through lack of basic educational opportunities in many countries, inability to read English, French or Spanish and lack of access to materials. IUCN has been working to fill this gap, through development of online training materials based around minimum competency standards, by developing an accreditation system for courses offered on protected areas in tertiary educational establishments and through focused courses and teaching. There remain many gaps and priorities in order to ensure that the curriculum is comprehensive and is adopted by the premier education and training institutions and authorities for a new generation of qualified and competent professionals.

Key policy aims for and beyond the IUCN WPC 2014: This cross-cutting theme will promote a new approach for capacity development containing three broad components which will form the basis of the Congress outcome: (i) the development of standards for education and training of protected area professionals and higher level government decision-makers; (ii) the production of learning resources and knowledge products such as books, Best Practice Protected Area Guidelines, technical briefs, electronic-learning modules, and the development of tools to support achievement of competent professionals; and (iii) a Global Partnership for Professionalising Protected Areas Management based on competency-based curriculum and courses and the development and promotion of guidelines for the certification of core competences and a body of knowledge that codifies how to achieve competence. Activities promoted by the streams to build capacity at the societal, organisational and individual levels will continue well beyond the Congress as part of the implementation of this partnership.

WORLD HERITAGE

As the official Advisory Body to UNESCO's World Heritage Convention, IUCN has for many years provided technical advice with respect to natural World Heritage sites, organizing evaluations of nominated sites, undertaking reactive monitoring missions for sites facing challenges, and providing a range of support to UNESCO

and to individual site managers. The task keeps growing as more sites are added to the list, and as the World Heritage Committee grows in political importance (and as a result becomes increasingly politicised itself). World Heritage Sites, which cover more than 10 per cent of the area of all protected areas globally, also need to change their role to provide leadership to global efforts on protected areas. Another major aim is to bring natural World Heritage closer, philosophically and in practice, to the conservation of the larger number of cultural sites on the World Heritage list. Both face similar challenges in terms of development, the need to maintain naturalness or authenticity, and their key role in educating and inspiring present and future generations about our common heritage.

Key policy aims for and beyond the IUCN WPC 2014: The World Heritage cross-cutting theme will create conditions for all natural World Heritage sites to fulfil their leadership role in demonstrating best practice for protected area management. This will be made possible by enabling better capacity within State actors, increasing commitment by all partners – including key threat sectors such as the extractive industry, and encouraging more international support for World Heritage performance, such as funding of community-based management. Another major part of this impact will be the raised profile of the World Heritage Convention in civil society and the conservation community and better understanding of its unique leverage on key issues affecting protected areas. This also implies increased commitment to recognize and respect indigenous people's rights in World Heritage areas, particularly to ensure effective participation in site nomination, management and monitoring.

A NEW SOCIAL COMPACT FOR EFFECTIVE AND JUST CONSERVATION

Finally, protected areas will only work, and continue to work in the future, if they are supported by a broad range of people; the pressures ranged against conservation are too great for protected areas to survive in the hands of a few enthusiasts. The New Social Compact process, to be run throughout the Congress, will bring together people from very different backgrounds to work together, following a particular Congress theme, to agree some common understanding about its values, challenges and opportunities. An inspirational platform will be created across the themes of the Congress where diverse rights holders, stakeholders and interest groups are able to enter into dialogue and commit to building solidarity in human networks and a shared understanding of the intrinsic and functional value of nature.

Key policy aims for and beyond the IUCN WPC 2014: A process of speaking to each other and listening to one another with a new sense of urgency is part of the outcome of this cross-cutting theme. Professional facilitators associated with each stream will convene dialogues with delegates from diverse constituencies to speak frankly about ethical, social, cultural, economic and political relationships between humans and what is required to find a shared commitment to address and reverse the anthropogenic drivers of climate change and biodiversity loss. Out of each dialogue, there will be opportunities for projects, processes, and policies, expressed as a *New Social Compact for Effective and Just Conservation of Biological and Cultural Diversity*. The New Social Compact will build on the foundation of the Earth Charter, of Agenda 21 and the Durban Accord, signalling a new era of a global commitment to saving the planet now.

CONCLUSIONS

The results of large congresses are not all foreseeable. Regardless of how much preparation is in place, the results depend on the chemistry between individuals at the time, who happens to talk together in corridors or between meetings, who gets inspired, other global events and circumstances of the day, and so on. The IUCN WPC 2014 will bring people and circumstances together to prepare for a promising future, building on its predecessors, and engaging with new issues and partners. It will probe the experience of its many participants and contributors to determine what is innovative, inspiring and above all, promising for the next decade, and what kinds of commitments and partnerships will implement these new approaches. Its outcome document, the *Promise of Sydney* will integrate and describe the essential synergies of all of the streams and cross-cutting themes described in this paper, by the end of the Congress. It will not result in a new action plan, but in new ways to accelerate implementation of those approaches that work. It will inspire confidence that the investment that the world has made in protected areas will come to fruition in the decades ahead as the world grapples with existing and new challenges. What that means depends eventually on IUCN's membership, friends and collaborators, and their ability to engage the participation of many actors from relevant sectors. IUCN WCPA is looking for input on the themes identified, and about other issues that may have been omitted, understated or ignored. The floor is open for debate.

ENDNOTES

[1] www.worldparkscongress.org

[2] The term 'park' here refers to the full range of protected areas encompassed by the IUCN definition of a protected area

Rainbow over the Australian Bush Australia © Martin Harvey / WWF-Canon

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RESUMEN

El Congreso Mundial de Parques de la UICN, un evento que tiene lugar cada diez años, ha sido tradicionalmente un foro importante para el avance de las políticas globales de manejo y gestión de áreas protegidas. El Congreso que se celebrará en noviembre de este año en Sydney, Australia, girará en torno a ocho corrientes: ciencia, cambio climático, salud, servicios de los ecosistemas, desarrollo, gobernanza, pueblos indígenas y jóvenes; los temas transversales abordan cuestiones relacionadas con el medio marino, la creación de capacidades, el Patrimonio de la Humanidad y un nuevo pacto social. En el siguiente editorial ampliado, los organizadores de las distintas corrientes trazan sus objetivos y esperanzas para el Congreso de 2014.

RÉSUMÉ

Le Congrès mondial des Parcs est une manifestation décennale qui constitue traditionnellement un forum majeur pour faire avancer les politiques mondiales sur les aires protégées. Le Congrès qui se déroulera en novembre à Sydney, Australie, sera classé en huit thèmes, dont le changement climatique, la santé, les services écosystémiques, le développement, la gouvernance, le cas des peuples autochtones et des jeunes, et des thèmes transversaux portent sur des questions maritimes, le renforcement des capacités, le Patrimoine Mondial et un nouveau pacte social. Dans l'éditorial suivant, les organisateurs des différents thèmes énoncent leurs objectifs et leurs espoirs pour le Congrès 2014.

COMMUNITY INVOLVEMENT AND JOINT OPERATIONS AID EFFECTIVE ANTI-POACHING IN TANZANIA

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ABSTRACT

The Ruvuma Elephant Project (REP) area is located in the United Republic of Tanzania and lies between Selous Game Reserve in southern Tanzania and Niassa National Reserve in Mozambique. The area is dominated by miombo woodland with a mosaic of different land uses. Unfortunately, this mosaic of wildlife, forests, people with a variety of often competing land uses, as well as the presence of an international border close by, helps make it one of the worst impacted areas in Africa in terms of elephant poaching for the ivory trade. Despite the recent resurgence of elephant poaching in Tanzania, and in particular within the Selous ecosystem which includes the REP area, the results show the project has managed to curb elephant poaching. It is believed that the local elephant population within the REP area should remain stable if current anti-poaching input levels can be maintained. The success of the REP may be attributed to various approaches and activities that are beyond the scope of conventional anti-poaching units or programmes. These include a strong focus on: working with communities to achieve their reciprocal support and participation; joint patrols and operations; and intelligence-led operations within and outside the protected areas.

KEYWORDS: poaching, anti-poaching, communities, elephants, Tanzania, Selous Game Reserve

INTRODUCTION

The Ruvuma Elephant Project (REP) area is located in the United Republic of Tanzania, and lies between Selous Game Reserve in southern Tanzania and Niassa National Reserve in Mozambique (see map overleaf). The REP area is approximately 2,500,000 ha in total extent. It forms an important ecological corridor and is dominated by miombo woodland, interrupted by wetlands, open woodland and riparian forest. This area supports typical miombo species, including substantial numbers of elephant (*Loxodonta africana*), buffalo (*Syncerus caffer*), sable (*Hippotragus niger*) and wild dog (*Lycaon pictus*) populations.

The area falls within three local government districts, namely Namtumbo, Tunduru and Namyumbo. It is primarily community owned land, consisting of: five Wildlife Management Areas (WMA) managed by community based organizations which have been given Authorized Association status to protect, manage and sustainably utilize the wildlife resources; five forest reserves managed by the respective District Forest Officers; one game reserve managed by the Wildlife Division (Lukwika-Lumesule, on the Ruvuma River); and village land managed by the local village governments and the Districts.

The land use in the REP area therefore consists of intact miombo woodlands supporting wildlife, interspersed with villages and associated infrastructure, subsistence agriculture farms, limited but expanding numbers of livestock, and a limited network of roads. The wildlife land use component comprises a little less than 50 per cent of the total area.

Unfortunately this mosaic of wildlife habitat, forests, human settled areas with a variety of often competing land uses, as well as the presence of an easily accessible international border close by, helps make it difficult to manage, and is consequently one of the worst impacted areas in Africa in terms of elephant poaching for the ivory trade and also an important area for illegal timber trade. Jackson (2013) notes that there has been a huge increase in illegal elephant killing in Tanzania over the past few years. Some poaching groups reportedly enter the Selous Game Reserve for periods of up to two weeks

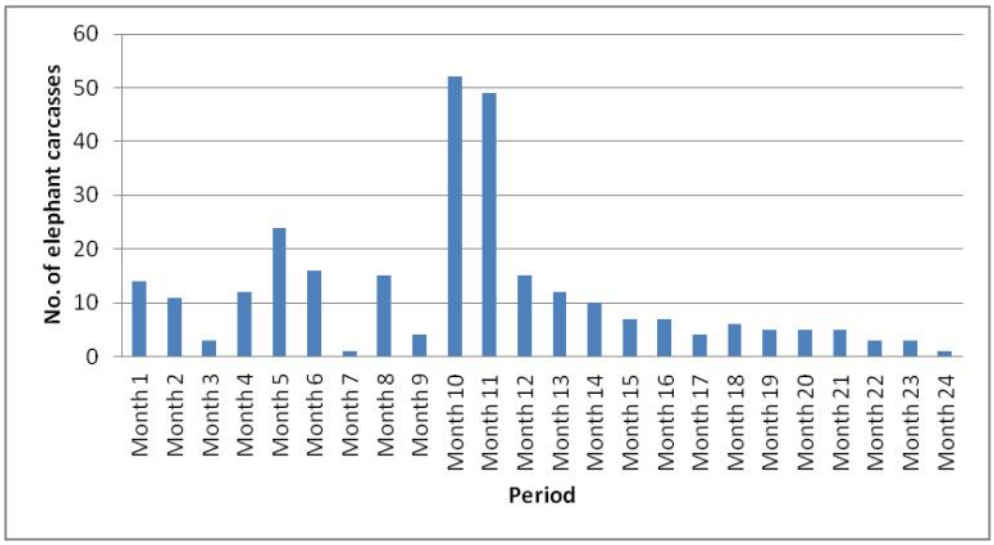


Figure 1: Number of elephant carcasses observed in the Ruvuma Elephant Project area during foot and aerial patrols, Dec 2011 to Nov 2013

Note: Aerial surveillance was introduced during month 10

and kill as many as 10 elephants each trip. Jackson further refers to a continual flow of poached ivory out of the Selous, which is then being hidden, buried at remote locations on the edge of the reserve until it is sold to traders.

ELEPHANT POACHING CRISIS

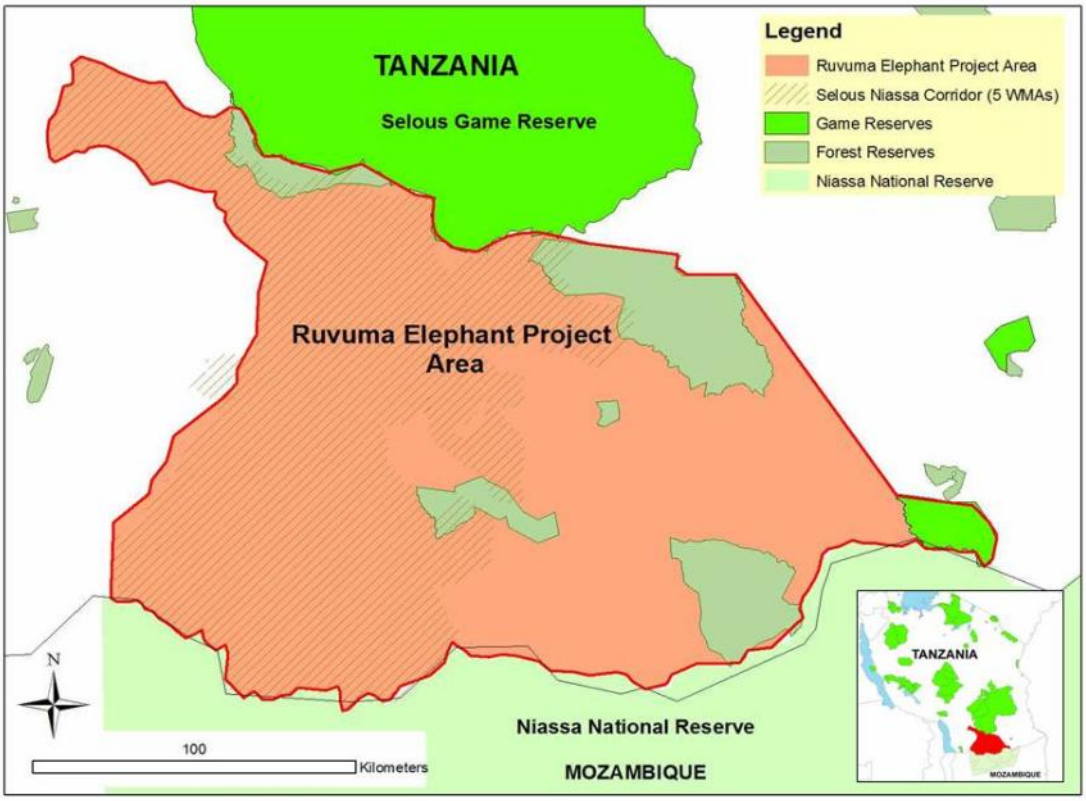
There has been a massive resurgence of elephant poaching for ivory in Africa in recent years, with Tanzania being hit particularly hard (Nelleman et al., 2013; TAWIRI, 2014). Statistics indicate that Kenya and the United Republic of Tanzania are currently the major exit points for illicit ivory (UNEP et al., 2013). Wasser et al. (2009), show through DNA fingerprinting how ivory seizures in Hong Kong and Taiwan provided further strong evidence that a lot of the ivory was poached in a relatively small area on the Tanzania and Mozambique border that includes the Selous and Niassa protected areas. This was similarly a hotspot during the previous international ivory poaching crisis during the 1980s. The substantial losses in places like the Selous Game Reserve in southern Tanzania provided fuel for the international outcry and the many campaigns that led to the CITES ban on the sale of ivory (UNEP et al., 2013).

The most recent aerial census of the Selous Game Reserve (World Heritage Site) ecosystem, which was conducted in late 2013, estimates the elephant population at 13,084. This represents a dramatic decline from 2006 when it was estimated to be at 70,406 and a major decline from the estimated 2009 census population of 38,975 (TAWIRI, 2014). The REP area falls within the greater Selous ecosystem, but is directly neighbouring the Mozambique border where transboundary poaching as well as the integration of villages and public roads traversing the area make effective law enforcement and the pursuit of poachers more difficult.

Whereas corruption is a major challenge across the continent (Jackson, 2013), UNEP et al. (2013) cite poor law enforcement, weak governance structures and political and military conflicts as some of the main drivers that facilitate poaching and allow illicit trade in ivory to grow. Locally, poaching levels are associated with a wide variety of complex socio-economic factors and cultural attitudes. The ivory trade entices many different people for lots of different reasons, from corrupt militias to poverty-stricken people eking a living at the edges of protected areas (Jackson, 2013). UNEP et al. (2013) further acknowledge that while hunting for meat or ivory has been a traditional source of protein and income for many rural communities, poverty also facilitates the ability of profit-seeking criminal groups to recruit local hunters who know the terrain, and to corrupt poorly remunerated enforcement authorities. In Jackson (2013) it is purported that poachers are well known in the communities neighbouring the Selous Game Reserve. The cash they get after delivering their poached ivory to middlemen gives them immediate status and makes them become role models for young people who see only the immediate benefit of an illegal activity.

RUVUMA ELEPHANT PROJECT

PAMS Foundation is a not for profit conservation organization registered in Tanzania. PAMS Foundation started the REP during August 2011. The aim of the REP is to improve the status of elephant conservation in the area between Selous Game Reserve and the Niassa National Reserve. The primary objectives include to: determine the current status of and threats to elephants in the project area using reliable and objective methods; gain a meaningful understanding of the seasonal movements of elephants in the project area; control the poaching of elephants; ensure that law enforcement and prosecution is a sufficient deterrent for elephant



Map of the project area

poachers; and reduce elephant mortality resulting from Human–Elephant Conflict (HEC).

The primary project activities include:

- Training game scouts and rangers in basic anti-poaching skills and case preparation;
- Implementing joint field patrols on an ongoing basis. Typically patrol teams consist of village game scouts accompanied by wildlife officials or rangers, from either the applicable District or from the Wildlife Division. Numerous patrols are undertaken in the project area each month, with a top priority focus being in areas where the density of both elephants and of poaching incidents has been the highest;
- Undertaking aerial surveillance in order to locate illegal activity, identify poaching hotspot areas and understand elephant distribution in the landscape in order to better prioritize ground patrols. Aerial surveillance includes flying set routes on a near monthly basis, in which all elephants were counted (total counts) and recorded on GPS, along with all new carcasses and illegal activities. This was done in order to allow for monthly, seasonal and yearly comparisons;
- Providing incentives and rewards for ensuring good performance and results to those undertaking patrols and special operations, as well as to finance an informer network;
- Informing and co-financing special intelligence-led operations;
- Implementing a HEC mitigation programme, including erecting chili pepper fences and beehive fences for protecting communities' crops against elephants;
- Supporting income generating activities for the WMA communities; and
- Monitoring wildlife densities and distribution through patrols and aerial surveillance work.

The challenges of the REP have been immense. However, as the project was able to begin to equip, train and deploy a pool of more than 200 village game scouts and a small number of government wildlife and law enforcement staff and commence with achieving its range of activities, the situation has steadily improved.

Roe et al. (2014) note that law enforcement strategies tend to overlook how involving local people in conservation, for example as community game guards, can boost more formal law enforcement approaches. Their paper further states that "Ultimately, the illegal wildlife trade will be best controlled not by guns and rangers but by solutions that respect and make partners of local communities and landowners, through providing sound incentives and opportunities to value and conserve wildlife".

The REP has involved local people extensively and has provided incentives and opportunities for participation for as many individuals and groups as possible, including

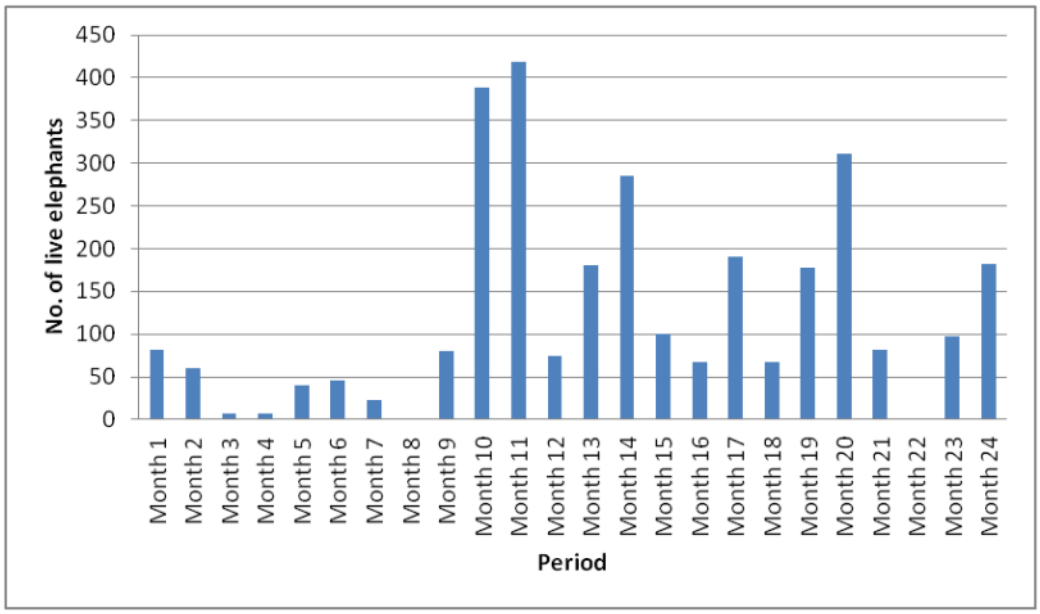


Figure 2: Number of live elephants observed in the Ruvuma Elephant Project area, Dec 2011 to Nov 2013

Note: Aerial surveillance was introduced during month 10

paying financial rewards to any and everyone who provides assistance or helpful information that furthers the objectives of the project.

RESULTS FROM THE RUVUMA ELEPHANT PROJECT

The first patrols of the REP were conducted in 2011. All of the initial eight patrols results included photographs and Global Position System (GPS) locations of elephants shot, poisoned or spiked to death. The meat had not been removed in 95 per cent the carcasses, only the faces hacked away and the ivory removed. The elephant carcasses included elephant cows and juvenile elephants. It was also evident that scavengers were unable to keep up with the volume of fresh elephant meat, resulting in many carcasses being untouched and meat left to rot.

Data from project patrols and aerial surveillance (Lotter & Clark, 2014) show a substantial annual decrease in the number of elephant carcasses observed over the 24 month period of operation (Figure 1). A total of 216 elephant carcasses were observed in year one, and 68 in year two. These exclude a small number of carcasses of elephants that were suspected to have died as a result of natural causes. The sudden spike in the number of elephant carcasses observed in month 10 is a data bias attributable to the introduction of aerial surveillance.

The numbers of live elephants observed over this period did not indicate a decline over the 24 month period (Figure 2). A total of 1,226 live elephants were observed in year one, and 1,325 in year two (Lotter & Clark, 2014). These data were obtained from foot patrols as well as aerial surveillance. Patrol effort as well as areas and distances covered through aerial surveillance were similar in both years.

Results from patrols and other law enforcement interventions implemented since project inception include: the seizure of 1,582 snares; 25,586 illegal timber (pieces); 175 elephant tusks; 805 firearms; 1, 531 rounds of ammunition; six vehicles; 15 motorcycles; the arrest of 563 people; and the discovery of 284 elephant carcasses and 17 other wildlife carcasses that were believed to have been illegally killed (Lotter & Clark, 2014). These results are substantially higher than any other anti-poaching unit or project in Tanzania apart from the Friedkin Conservation Fund (FCF), which has comparable levels of effectiveness from their operations in western and northern Tanzania. FCF operate similarly to the REP in that they also focus to a large extent on working within communities neighbouring the protected areas where they have been allocated their concessions and have emulated the strongly intelligence-led multiple agency approach adopted by the REP.

The large number of elephant carcasses discovered that had been poached, and other observations including the frequency of live elephant sightings from patrols and work in the field, indicated that the population was declining extremely rapidly at the time of inception of the REP. The number of fresh elephant carcasses observed in the field and the volume of ivory being sold in the area were particularly high during the early stages of the project. The poaching was notably high in 2011 and 2012, but was demonstrably reduced during 2013 to the level whereby the local elephant population should remain stable if current anti-poaching input levels can be maintained.

Carcasses from other wildlife also decreased dramatically during the corresponding period, with no new records reported from within the area over the last six months of

A recently killed elephant © Krissie Clark

2013. Hunting Concession block owners and field staff from within Niassa National Reserve reported measurable declines in cross-border poaching in their respective areas following major intelligence-led multi-departmental special operations conducted during late 2012 (Tunduru) and 2013 (Namtumbo), respectively (J Wilson 2013, pers. comm.). These operations form part of the *modus operandi* of the REP.

The use of poison to kill elephants and other wildlife was reduced, with no cases of suspected wildlife poisoning having been reported during the last six months of 2013. Similarly, the number of elephants killed as a result of HEC also declined, albeit not dramatically, to an average of four during 2012 and 2013 respectively compared with the previous annual average of 11.

Poaching has been reduced within the REP area in spite of the precipitous decline in elephant numbers throughout the Greater Selous ecosystem as a whole.

DISCUSSION

It is useful to compare the relative successes and trends from some different protection models.

Comparing Selous Game Reserve with Ruvuma Elephant Project: The 4.5 million hectare Selous Game Reserve is managed and protected by a single Government authority, and has several private sector concessionaires undertaking hunting and photographic safaris within it. It has experienced very significant declines in elephant numbers over the last five years.

The Ruvuma Elephant Project (REP) area, on the other hand is managed and protected by multiple Government agencies (not a single authority), including several community based organizations and a non-government organization specializing in protected area management support (PAMS Foundation). These organizations work together in a coordinated manner.

As discussed, evidence suggests that poaching has been reduced in the REP area, which was instituted beginning three years after the dramatic poaching onslaught started in 2009, but there is no strong evidence of it abating yet in the Selous Game Reserve (SGR) in spite of there not being a meaningful difference between the SGR and REP in terms of rangers and scouts available for conducting patrols. The REP has a slightly higher density of scouts

available per unit area, but the SGR has more firearms and better equipment available for their patrol teams. A further notable difference is that in the case of the REP there are substantially more arrests and seizures made outside of the actual protected areas (Wildlife Management Areas, Forest Reserves and a Game Reserve) in and around villages and community areas, than within them in the field.

Comparing Kruger National Park with Ruvuma Elephant Project: To consider another case study of a protected area adopting a more conventional approach similar to the first model (SGR), the situation in South Africa's Kruger National Park (KNP) provides an interesting example. The KNP is one of the most developed and best resourced protected areas in Africa, and has one of the best trained and equipped ranger corps as well as a specialized anti-poaching department. Functioning as a government authority and operating primarily by conducting patrols and operations within the protected area itself, the KNP has suffered increasingly heavier losses of rhinoceros species (*Ceratotherium simum* and *Diceros bicornis*) due to poaching on an annual basis. The numbers of ranger staff stationed at the 22 main senior ranger sector bases has been increased a few times as part of the effort to turn the tide; more training and equipment has been provided; more aircraft and some drones and tracker dogs have been brought in; a retired military general was appointed to oversee the effort and defense force units have been deployed to bolster the efforts on the ground. Substantial public and media campaigns were launched and the private sector in South Africa has rallied and financial donations have been made. In spite of all this arguably making the KNP one of the best protected area operations on the continent in terms of being trained and equipped to deal with illegal wildlife killing, the rhino poaching problem continues to worsen.

Rademeyer (2012) proposes that the primary reason for conventional anti-poaching approaches failing to protect rhinoceros populations in South Africa is because of corruption in the system. Multiple agency involvement is a way to increase transparency and reduce corruption, hence it was adopted by the REP. As with the SGR case

Spikes used to kill elephants © Shaziri Adamu

example, a further notable difference compared with the REP is that in the case of the KNP substantially less arrests and seizures are made in community and urban areas outside of the actual protected area compared with those made in the field.

A summary of the anti-poaching results from the Kruger National Park can be seen in Table 1.

SECRETS OF SUCCESS

The case examples discussed above suggest that in many cases the simple, conventional approaches are no longer effective and that a broader scope, multi-party run programme adds to effectiveness. No matter how well and professionally tactics are implemented, if the strategy is inadequate then overall success cannot be achieved against a well organized adversary.

The all too common tendency to treat symptoms rather than causes is one of the reasons many programmes fail, or enjoy only limited success.

For example, at the protected area level neighbouring community participation in poaching is one of the key issues to be addressed to achieve effective wildlife protection. It is extremely difficult for commercial poachers to be successful without community participation in various forms, filling the roles of guides, porters, informers, etc. So, what are the causes and what are the symptoms in this example?

	2010	2011	2012	2013
Rhino poached	146	252	425	609
Arrests	67	73	82	127

Table 1: Rhino poaching results for Kruger National Park, 2010 to 2013 (South African National Parks, 2014)


Confiscated ivory © Krissie Clark (left) and weapons and other items © Max Jenes (right)

Local community participation in commercial poaching is the manifestation of a problem that is caused primarily by: the need for cash; lack of viable alternatives; lack of understanding of the importance and value of conservation (and living wildlife); and lack of good relationships between community members and protected area authorities. These causes all need to be recognized and treated before any long term success can be expected. Conducting patrols and related law enforcement activities is essential but it is addressing a symptom and not the root causes of why most of these people are poaching.

Similarly, focusing on operations to defeat poaching groups within the protected areas alone is also a reactive, not a proactive, strategy. At least equivalent attention must be given to the corrupt financiers of poachers in towns and cities surrounding the protected areas and their neighbouring communities. Apart from the fact that not doing so is ignoring another cause and treating only its most obvious symptoms, there is also a practical advantage of including this approach to an anti-poaching programme. In reality it is more difficult to locate and surprise poachers in a large protected area, compared with informer-led actions in the villages or towns where they live and spend the majority of their time.

Another reason why people are lured into poaching as easily as so many are, is because many poachers who are caught are freed shortly thereafter, or are fined lightly and are thus not put off sufficiently to deter them from going back and poaching again. The fear of being severely punished (convicted and heavily sentenced) is a bigger deterrent, where it is a reality, than the act of being arrested. Proper case preparation, prosecution and sentencing of poachers adequately to the maximum extent of the law, should therefore enjoy much more focus and attention than it does. The judiciary system and the people who run it should be the allies of conservation, whereas in reality there are many cases where even magistrates and prosecutors are not on the side of conservation. In the case of the REP, most of the worst offenders were repeat offenders. However, over the past year this trend changed since these aspects were better addressed and some poachers who were previously freed shortly after being arrested, have been properly convicted and sentenced to prison terms ranging from 3 years to 10 years. Similarly to the REP, there have been substantial numbers of convictions of poachers in the KNP, and hence not many repeat offenders arrested.

Finally, we suggest that another important ingredient needed for ensuring success in anti-poaching at the protected area level is to involve more than one agency in the law enforcement effort. It is far easier for criminal syndicate leaders to be able to understand, predict and in many cases influence and corrupt, single agencies and systems working within well known reporting structures than it is to do so when there is more of a multi-agency approach. It is prudent that not only one agency should be tasked, empowered and incentivized to deal with the problem of commercial poaching and its associated crimes, and equally important that the approach employed should include the implementation of routine as well as unanticipated cross-checks. A measure of unpredictability needs to be a part of the *modus operandi* at all times to keep the enemy guessing. Establishing ad hoc task forces reporting only to the highest authority in each country and comprised of a selection of the best officers coming from all the agencies (national parks, police, security, customs, army, etc.) is a practical way to accomplish this.

CONCLUSION

In the case of the Ruvuma Elephant Project (REP) within the Selous–Niassa ecosystem in southern Tanzania, an unconventionally holistic approach has led to a reduction in large scale ivory poaching. The strategy has included

Training wardens in anti-poaching techniques © Shaziri Adamu

various approaches and activities which are beyond the scope of conventional anti-poaching units or programmes; to which most of the success achieved thus far is primarily attributed. These include a strong focus on: working with communities to achieve their reciprocal support and participation; joint patrols and operations; and intelligence-led operations within and extensively outside the protected areas.

The success of the REP may be attributed to various approaches and some activities which are beyond the scope of most conventional anti-poaching units or programmes.

In comparison, several much better trained, equipped and resourced, anti-poaching efforts adopting a more conventional approach, have not been experiencing similar trends of success.

It is acknowledged that there is no room for complacency, and there is still a lot of work needed before it can be said that the project aim and objectives have been achieved. However, due to a combined effort including various government, community and private sector partners, the REP has achieved some meaningful early successes. From the lessons learnt and shared and by looking to improve and adapt further, as well as working more closely with and in support of our neighbours on this immense problem that respects no boundaries, it is believed that the results achieved thus far should be maintained and improved.

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RESUMEN

El Proyecto para la conservación del elefante en la región del Ruvuma (REP) se desarrolla en la República Unida de Tanzania, entre la Reserva de Caza Selous, en el sur de Tanzania, y la Reserva Nacional Niassa en Mozambique. La zona está dominada por bosques de miombo con un mosaico de diferentes usos de la tierra. Desafortunadamente, este mosaico de vida silvestre, bosques y personas con una variedad de usos concurrentes de la tierra, así como la presencia de una frontera internacional cercana, contribuyen a que sea una de las regiones más afectadas de África en términos de la caza furtiva de elefantes para el comercio de marfil. A pesar del reciente resurgimiento de la caza furtiva de elefantes en Tanzania, especialmente dentro del ecosistema Selous, que incluye la zona del proyecto REP, los resultados reflejan que el proyecto ha logrado frenar la caza furtiva de elefantes. Se cree que la población local de elefantes dentro de la zona del proyecto REP podría permanecer estable si se mantienen las medidas actuales en contra de la caza furtiva. El éxito del proyecto REP se puede atribuir a diversos enfoques y actividades que rebasan el ámbito de las unidades o programas convencionales para combatir la caza furtiva. Estos incluyen un marcado énfasis en: el trabajo con las comunidades en procura de apoyo y participación recíproca, patrullas y operaciones conjuntas, y operaciones de inteligencia dentro y fuera de las áreas protegidas.

Aerial surveillance © Krissie Clark

RÉSUMÉ

Le Ruvuma Elephant Project (REP) se trouve en République Uni de Tanzanie entre la Réserve Naturelle de Selous au sud et la Réserve Nationale de Niassa en Mozambique. Bien que des boisements de miombo prédominent dans la région, l'on observe aussi toute une mosaïque de terrains, arborant des animaux, des forêts, et des habitants dont les activités agricoles sont souvent opposées. Malheureusement cette mosaïque de terrains différents, ainsi que la frontière toute proche, ont contribué à créer l'un des pires régions pour le braconnage d'ivoire d'éléphants en Afrique. Cependant, malgré la récente résurgence du braconnage d'éléphants en Tanzanie, notamment dans le Selous et la région du REP, ce projet a réussi à enrayer la montée du braconnage. La population d'éléphants au sein du REP devrait en effet rester stable si cet effort anti-braconnage est maintenu. Le REP doit ses succès à la diversité de ses méthodes et à des activités qui dépassent le champ d'application des programmes habituelles de lutte contre le braconnage. On y voit par exemple un travail au sein des communautés pour favoriser une collaboration réciproque, des patrouilles conjointes, et des opérations basées sur le renseignement à l'intérieur et à l'extérieur des aires protégées.

SUCCESSFUL COMMUNITY ENGAGEMENT AND IMPLEMENTATION OF A CONSERVATION PLAN IN THE SOLOMON ISLANDS: A LOCAL PERSPECTIVE

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ABSTRACT

The indigenous people and clans of Choiseul Province, or Lauru as it is known locally, retain strong customary ownership over their lands and seas, and maintain many customs relating to the use of their natural resources. The rural population of Lauru also has a strong collective voice through the Lauru Land Conference of Tribal Community (LLCTC). The activities of the LLCTC Environmental Office resulted in the establishment of eight Locally Managed Marine Areas (LMMAs) by 2008, and word of mouth on the value of these LMMAs generated numerous community requests to LLCTC for assistance in establishing additional protected areas. In 2009 a stakeholder-driven conservation plan for the whole of Lauru was developed, which led to a political commitment from the LLCTC and the government to establish a provincial-wide Lauru Protected Area Network, the first such commitment in Melanesia. By 2012, 15 LMMAs and several terrestrial community conserved areas had been established. This paper outlines the process of community engagement that the LLCTC Environmental office uses when establishing protected areas and some of the common misunderstandings that frequently need to be addressed. The paper also outlines how the stakeholder-driven implementation process is informed by the Choiseul Ridges to Reefs Conservation Plan that was developed using the best available scientific and local knowledge.

KEYWORDS: customary owners, indigenous people, Locally Managed Marine Areas, Choiseul Province, Solomon Islands, stakeholder-driven conservation plan

INTRODUCTION

Choiseul Province, or Lauru as it is known locally, is one of the nine provinces of Solomon Islands (Figure 1). It lies between the island of Bougainville (part of Papua New Guinea) and Santa Isabel in the west of Solomon Islands. It consists mainly of Choiseul Island with an area of 3,106 km², two small islands: Wagina (82 km²) and Rob Roy (67 km²), with over 300 small islets less than 1 km² each. 95.5 per cent of Choiseul is under tribal ownership, with the remainder being alienated land. Wagina Island makes up the largest area of alienated land in Choiseul Province (Choiseul Province Ridges to Reefs Conservation plan 2010).

Lauru is a multi-cultural society. Its population is made up predominantly of indigenous Melanesians. The total population of Choiseul Province is 26,372 with an average growth rate of 2.8 per cent (National Census, 2009). Although one of the larger islands in the Solomon Archipelago, Choiseul is considered to be very remote due to lack of basic infrastructure such as roads, wharfs, frequent shipping and air services, telecommunication and banking facilities. This lack of basic infrastructure has constrained economic development in the province and also hampers the delivery of basic health and education services (Choiseul Province Medium Term Development Plan 2009-2011).

Choiseul communities have limited income earning opportunities and they are heavily dependent on their natural resources for the survival and as means of generating cash income.

Over 90 per cent of households in Choiseul have subsistence gardens and over 86 per cent are engaged in subsistence capture of finfish (National Census 1999). More than 80 per cent are also involved in small scale copra production, and high value, non-perishable marine export products such as beche-de-mer (dried sea cucumber), trochus and shark fin are particularly sought after commodities. Other sources of income including logging royalties, small scale timber production,

Figure 1: Provinces of Solomon Islands

remittances from family members working in urban centres in Solomon Islands and the limited sale of vegetables and finfish (Choiseul Ridges to Reefs Conservation Plan 2010)

The rural population of Lauru has a strong collective voice through the Lauru Land Conference of Tribal Community (LLCTC), an ecumenical non-governmental organization established in 1981. The LLCTC has an annual meeting that brings together all of the Chiefs and leaders of the province, and in 2006 an environmental arm was established within the LLCTC. In 2008, the LLCTC and the Choiseul Provincial Government requested support from The Nature Conservancy (TNC) for the development of a conservation plan for the land and seas of Choiseul (Lipsett-Moore et al., 2010). This request came about from an understanding that the future sustainability and prosperity of the Choiseul people are linked to the province's natural ecosystems. The development of a Choiseul conservation plan that takes biodiversity, threats to that biodiversity and opportunities for benefits from nature into account was seen as an important asset to enable the Lauru people to make wise and informed choices about their future. This is especially urgent given the pressures from logging and increased exploration by mining interests.

In its simplest form, developing a conservation plan involves comparing the distribution of biodiversity with the distribution of protected areas and finding where species and ecosystems are left unprotected or under-protected. To address these problems in a systematic way, the concept of ecological representation was developed. This refers to the need for protected areas to represent, or sample, the full variety of biodiversity of different biological realms (freshwater, marine and terrestrial through all the ecoregions) and biological scales (ecosystems, species and within-species variation) (Game et al., 2011). Many island ecosystem components provide vital goods and services, such as protection against extreme weather events, while also providing habitat for marine animals and reef fish. Thus the conservation of island biodiversity represents a cost-effective and practical way for islands to ensure sustainability and adapt to threats such as climate change.

However, as with any plan and strategy, the challenge is in implementation. From the commitment to a Lauru Protected Area Network (Lauru PAN), LLCTC then needed to lead a process of demonstration, guidance and build confidence and momentum towards implementing the plan. This paper describes how the LLCTC has been successful in establishing a series of conservation areas based on the province-wide conservation plan. It focuses on identifying the challenges involved in this process and how they were overcome.

METHODOLOGY

The conservation work happening in Choiseul Province is supported by an array of partners, including The Lauru Land Conference of Tribal Community (LLCTC), Choiseul Provincial Government and The Nature Conservancy. LLCTC is the key convener and facilitator of work on the ground and is linked strongly to communities through its existing network around the

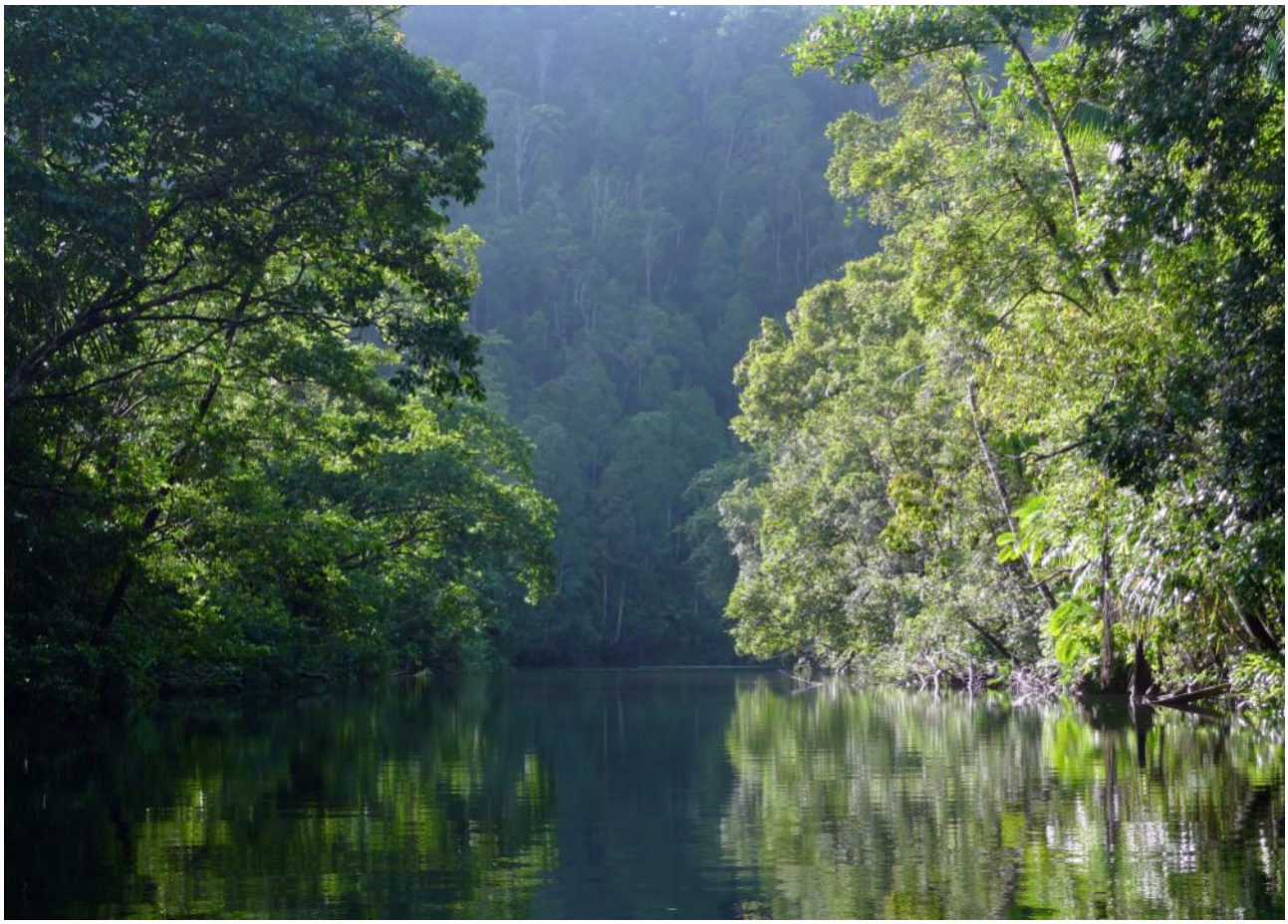
Community participation in protected area planning. LLCTC uses innovative community engagement and mapping tools, such as participatory 3D modeling, first used in Chivoko village in 2008 © Jimmy Kereseka LLCTC

province. The LLCTC plays a role in resolving tribal disputes and disagreements. The Provincial Government supports conservation efforts by recognizing and endorsing the work at the government level; The Nature Conservancy provides additional financial and technical support to the overall programme in Choiseul Province.

Once a tribe or community becomes interested in conserving their reef or forest, they submit a request for protected area assistance to the LLCTC environment office signed by the chief and elders of a particular tribe after consulting their tribal community. Before these leaders approach the LLCTC about establishing a protected area, a full community meeting is held to ensure consensus is reached and there are no unresolved conflicts over land ownership in the proposed area. A community or tribe becomes part of the network through a clear process of engagement.

Because the LLCTC environmental office receives multiple requests, the LLCTC environment officer makes initial decisions about which community to engage with first, guided by the Choiseul Ridges to Reefs Conservation plan (Lipsett-Moore et al., 2010). Support to the community or tribe is prioritized according to extent to which their lands and seas might potentially contribute to the representative protection of Choiseul biodiversity, and also to the perceived level of the tribes' commitment.

The LLCTC officer will then manage expectations through a series of education and awareness events, initial consultations and confirmations. A key role of the LLCTC environment officer is to make sure that the interest comes from the whole tribe or community rather than from only a few representatives. This is to avoid misunderstanding between the members of the tribe with regards to the project, and to avoid marginalizing community member's voices. For example, in Zinoa community, after the initial engagement it became apparent that certain members of the community were at odds with the proposed conservation measures. In response, the LLCTC provided a full orientation and explanation of the conservation work.



Guere Conservation Area, Choiseul. The Ridges to Reefs Conservation Plan ensures coastal and terrestrial areas are included in the Lauru PAN, such as Guere Community Conserved Area in Boe Boe community, South Choiseul © James Hardcastle, IUCN

The next step is to introduce and explain process, tools and the Lauru Protected Area Network concept. Part of the consultation requires education regarding the importance of conservation and what type of regulations may be considered, and some of the implications. This is to give a clear understanding on the scope of the work for all partners. This is accomplished with full community involvement so they understand the realities of the project.

Next, areas that might be protected or managed are explored, again with full community involvement. The tribal community is advised of the conservation options for the area they choose to conserve, including whether to expand or change the position of the site depending on such factors as biodiversity, habitat or community history. Once an area is agreed upon, Global Positioning System (GPS) coordinates are used to demarcate the boundary of the area to be conserved. This is then synchronized with a master map maintained by the LLCTC Environment Office, with the final boundaries to become part of the Lauru PAN.

The tribal community forms a committee to oversee and manage the area to be conserved. This committee will have management authority of the area and also serve as point of contact for partners. The final step is to develop a management plan for the conservation area and produce a map of the area and update the map of the Provincial-wide network of protected areas.

Over time the established sites are monitored to track changes and trends in fish and invertebrate populations, and the health of the coral reefs or other habitats being protected. Interested community members are trained in community-based monitoring. The communities monitor the areas they conserve with the support from partners. In this way the community has a sense of ownership and greater responsibility for the management of their area and at the same time keep updated on the status of the resources in their protected area.

This initiative is coordinated with the overall conservation goals of the Solomon Islands Locally Managed Marine Areas network (SILMMA) and the Convention on Biological Diversity Programme of Work on Protected Areas (PoWPA) of Solomon Islands. LLCTC is a member of the SILMMA network that benefits from information and educational resources that can be used by the tribes and community for resource management and understanding species life histories.

RESULTS

At the LLCTC annual general meeting in 2009, more than one hundred chiefs from around Choiseul Province made a commitment to have at least one marine and one terrestrial protected area in each ward of the province by 2013. This statement by the chiefs is a positive step in the advancement of the Lauru PAN.

The process described above is how the Lauru PAN has been advanced over the past years. The number of protected areas increased from the eight shown in figure 2 for 2008 to 15 as of June 2012 (mapping of these sites is currently in progress). The LLCTC and Environment Office receive regular letters of expression of interest from further tribal communities who are interested in setting up conservation areas. The word of mouth and continuous education and awareness on the importance of conservation, protected areas and resource management fuels this initiative.

There is continuous engagement with the established sites through monthly visits and consultation, and exchange between the established management committees. The Chivoko community themselves made an informative video[1] to share with other communities, outlining the successes and challenges in protecting their forests and their reefs. This has been extremely useful as a resource for LLCTC to share in community meetings across Lauru.

LLCTC formed an environment and conservation committee in 2007, which includes representatives from the Provincial Government, The Nature Conservancy and a representative from each of the tribal communities involved in conservation. The main task of the committee is to oversee and endorse the management and operation of the Lauru PAN. The committee meets twice a year to oversee progress and endorse new sites into the Lauru PAN.

For more than five years the LMMAs have included permanent closure as a management approach. However due to the dramatic increase of their resources in the areas they manage, several communities altered their decisions and harvested resources within certain periods of time. They harvest mainly trochus shells to raise money for community projects including the church and school. In the case of Redman Island Tribal Community, in 2011 the management committee allowed the community to harvest the resources for only about three hours. Within the three hours the women and youth harvested trochus shells and clamshells for the first time since they protected the area, with proceeds from the harvest benefiting church fundraising. In the Moli community, members harvested trochus shells in the conservation area in early 2011 to go towards the students' school fees. The communities were overwhelmed by the amount of resources and the monetary value they got from harvesting the resources in these areas. Such practical examples strongly influence communities, and persuade them that there can also be monetary benefits to conservation (Read et al., 2010).

Protected Island, Choiseul. Many LMMA areas include near-shore islands © James Hardcastle, IUCN

CHALLENGES AND SOLUTIONS

Disagreement over ownership of potential LMMA lands and seas: Disagreement over land ownership extending to the marine environment is a common issue in Choiseul Province. Whenever there is an incident, LLCTC deals with this according to the culture and traditional process of Lauru. The secretary of LLCTC deals directly with the tribes involved. For example, in the Rabakela conservation area two tribes have disagreements over land which affects the coastal conservation area. This case is being dealt with by LLCTC according to the tradition and culture of Choiseul, but the resolution process is time-consuming. Therefore, once we find out that there are land disputes within the community during our early engagement process, we do not progress with the engagement process but allow them to sort the issue. In the case where we have already engaged with the community before there is a dispute over land ownership, the LLCTC deals directly with the parties involved.

Disagreement within communities about conservation actions*:* Communities do not always agree and this can hinder the development of a plan. When communities are divided, the LLCTC does not become involved directly but helps the process by providing advice and talking with the different parties

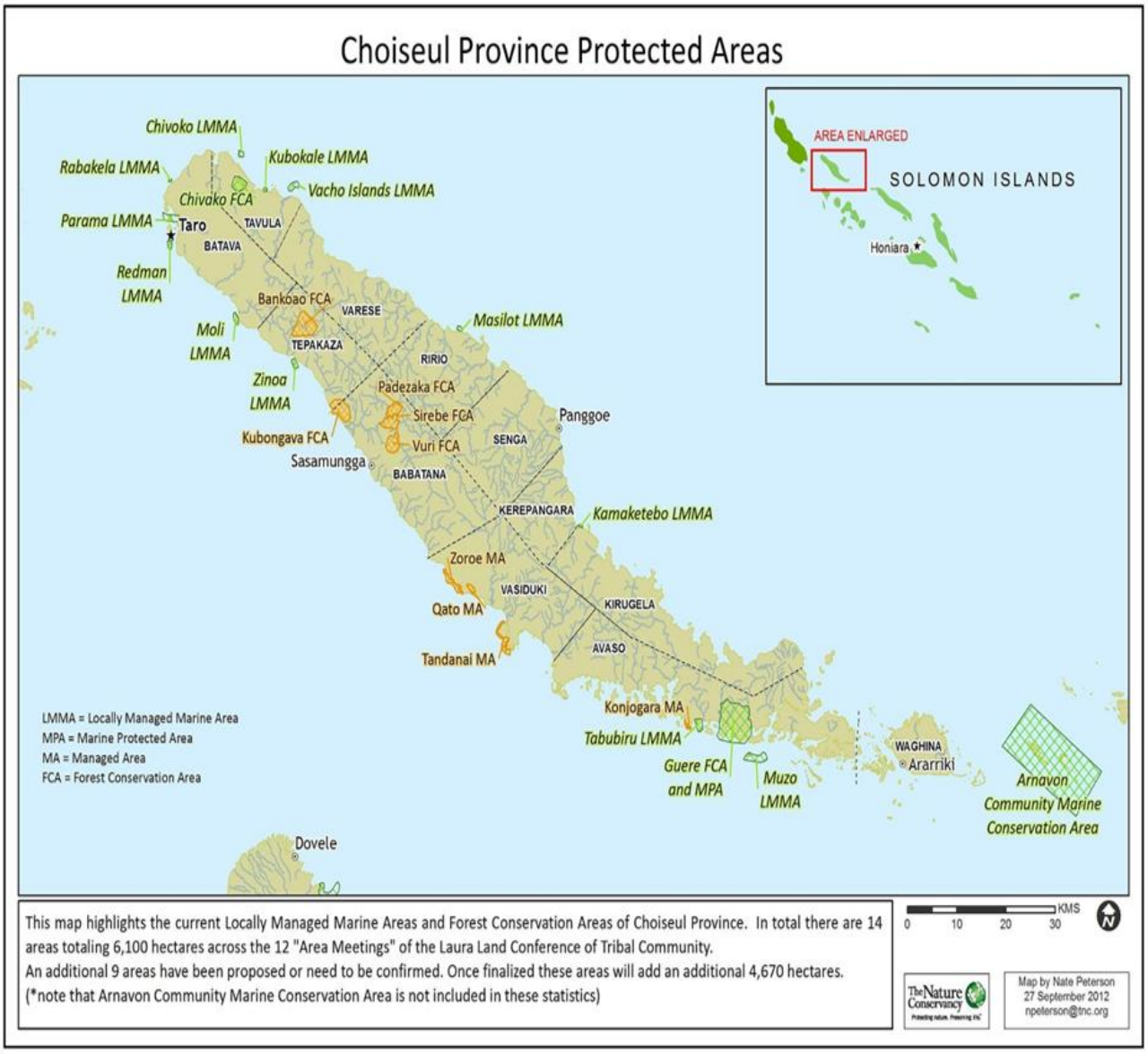


Figure 2: Locally Managed Marine Area (LMMA) under the Lauru PA Network

involved. The community is encouraged to solve the problem internally. In most cases it is easier to deal with community disagreements than with tribal disagreements.

Limited capacity for community management*:* Although a management committee might be set up to oversee the overall management of the conservation area and serve as point of contact for partners who worked with them, there is no guarantee the committee has the needed skills (Filardi & Pikacha, 2007). As part of the SILMMA network, LLCTC is able to draw upon many resources to support orientation and training for newly established committees. Also, the number of existing management committees provides a great opportunity for peer-peer exchange and learning. Furthermore, the annual meeting of the LLCTC provides a good opportunity for side-events and special sessions. Funding for management activities is generally not a major issue – aside from monitoring, most management actions become a routine part of daily activities. As such, while there is a cost, in terms of time and effort, the financial needs are minimal.

Resource monitoring*:* The management committees coordinate community members to help monitor the overall status of the protected area and the key resources and indicators important to the community. Training is provided by LLCTC and TNC. This component is very important for the community since it provides feedback to the customary owners on the status of their resources and provides them with a strong sense of ownership. However, LLCTC also provides external scientific biological monitoring in collaboration with The Nature Conservancy and the Choiseul Provincial Government through the fisheries division, every three to four years.

High community expectations that may not be met*:* There are always monetary expectations from communities in relation to projects (Read et al., 2010). LLCTC attempts to manage these expectations by frankly informing the community of what can be achieved, and what is outside the collaborative scope of work. LLCTC make it clear from the start, and only when all are in agreement will the conservation work begin.

Deciding where to conserve*:* The community decides on the site they would like to conserve at the local level and LLCTC advises based on size and site, guided by the Choiseul provincial conservation plan to prioritize which community to respond to first where several requests are received at any given time. This helps LLCTC to advance the Lauru PAN according to the plan, yet also meet community resource conservation needs (Game et al., 2011).

Sustainability of the Lauru PAN after NGOs departs*:* This is one of the challenges that really needs to be addressed for the future of the on-the-ground work. Financial sustainability is a big concern for the LPAN. LLCTC anticipate this by building the capacity of the Environment Office to be able to oversee the project into the future. The Choiseul Provincial Government has also made a commitment to support the Lauru PAN financially through development planning and budgetary processes. At the same time LLCTC advocate and support a community-based management approaches. With all the sites LLCTC encourages the community to take the lead in managing their affairs.

Compatible livelihoods may be difficult to provide*:* Where feasible, LLCTC aim to support livelihoods of communities who conserve their areas, especially where there is a clear opportunity cost incurred through conservation. LLCTC are exploring options to integrate ecotourism with conservation through support to the Parama Island, Zinoa and Chivoko conservation areas to build eco-lodges to collect some income from accommodation. Additionally, Chivoko community is being supported by LLCTC and partners to develop an ecotimber operation as an alternative to industrial logging.

DISCUSSION

If the process outlined above is followed, and the local communities overcome the challenges, community-based management of local ecosystems can succeed (Keppel et al 2012). In this paper we detailed the way a conservation plan can successfully turn into conservation action on the ground and record rapid recovery of valuable marine resources following effective community-based management efforts. This is consistent with empirical cases studies from Papua New Guinea that show that community-based conservation will result in the rapid recovery of resources if management regulations are adequately enforced (e.g. Cinner et al., 2006: Hamilton et al., 2011). The key to this approach and turning the Choiseul Conservation Plan into action is the strong traditional and cultural ties to the LLCTC as an indigenous organization that belongs to the people of Lauru, which combines its traditional cultures with scientific approaches to planning and resource management.

The LLCTC is inundated with requests for help in setting up conservation areas, evidence of the success of this idea, but also an indicator that demand outstrips the capacity of LLCTC to respond in a timely manner. Initially there was no legal framework guiding the Lauru PAN since its establishment; however, communities rely very much on the traditional law and practice of dealing with unwanted action and attitudes. Based on the success in the increasing number of sites, the Choiseul Provincial Government took a leading role in developing the Choiseul Province Fishery and Marine Environment ordinance in 2011. This ordinance, now ratified in parliament, will legally bind the work that the community are involved in and further support the traditional laws that are practiced. There is a continuous positive and strong support from the Provincial Government through the fisheries division in support of the partnership effort on the ground.

The tribes and communities who have worked with LLCTC and partners for some time really understand that what they are doing with resource management is tied to long term food security for sustainable livelihoods. This understanding develops over time with continuous education and awareness. However, some tribes and communities expect conservation to provide money immediately, a result of past experience with logging royalties. This thinking will fade provided there is sufficient education and awareness building by local partners. Communities will slowly understand that monetary benefit is not the only benefit.

Generally communities do take the leading role in looking after the area from management to enforcement. Partners provide mainly technical and targeted financial support to communities. There is no expense associated with enforcement activity carried out by Lauru PAN Communities; it is perceived as common business to look after the conservation area at the community level. The integration of ecotourism and conservation will

Chivoko Establish Their Locally-Managed Marine Area. Community members in Lauru freely engage in conservation activities of their own volition and motivation © Jimmy Kereseka LLCTC

potentially support livelihoods in tandem with biodiversity conservation. The Lauru PAN is not just about conservation. The network is integrating sustainable livelihood options and social development for the communities as a benefit to conserving their marine and terrestrial environments. Communities may have many perceptions on conservation areas, but the bottom line always ties to resource management, food security and human sustainability.

There have also been failures that need attention from the conservation community. For instance, LLCTC has not been able to consistently engage several communities over time, due to constraints on human capacity at LLCTC, which employs only a small core team of staff. There is a need to continuously engage communities with other environmental activities apart from resource management, such as solid waste management, and more on climate change adaptation in conservation areas. There is a need to integrate other projects in the sites that where LLCTC works, including livelihood projects and sanitation. This is essential because when LLCTC does not access a community for a long period of time, the feedback is often negative as the community feels deserted and abandoned. We need to then re-invest more time to win back support and trust.

Furthermore, at many sites, the management committee doesn't always play an active role in the management of the conservation areas; they still rely heavily on direction from the LLCTC, and even external partners such as The Nature Conservancy, rather than leading their own planning with targeted and needs-based LLCTC support. Management will never be self-sustaining until the communities no longer require external assistance. This understanding needs strengthening as this is the anticipated way forward for the sites under the Lauru PAN.

Additionally, there is a need to develop more consistent management plans for each site, particularly recently established conservation areas. Several sites haven't started drafting their management plans and the LLCTC lacks capacity to develop plans for each community. Without management plans, there is no accountable oversight and clear representation of regulations for

resources harvested or harvesting protocols. Management plans do not need to be in any specific format, but certain principles need to be defined and agreed upon by the whole community.

CONCLUSION

The implementation of the Lauru PAN is a long-term process, and initial progress will only translate into longer-term success if momentum can be maintained. This will be achieved if LLCTC continues to be focused on delivering clear and transparent services to communities, who are the real initiators and owners of the PA network. To date, the steady increase of sites within the Lauru PAN, the initial success and returns from enclosed and no-take zones, the results of initial biological monitoring, and the endorsement and support from all stakeholders, including Government, all suggest that the Lauru PAN is being implemented successfully. The strongest message is word of mouth on the benefits of a locally managed conservation area, passed from one community to another which triggers interest and enthusiasm to start a similar conservation area for a community.

The Lauru PAN is also a blueprint for other provinces and communities in Solomon Islands, and LLCTC and the Provincial Government are working to ensure Solomon Islands national legislation reflects and enhances the Lauru PAN experience nationally.

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ENDNOTES

[1] The participatory video 'Conservation Story Blong Chivoko' can be viewed at: www.youtube.com/watch?v=zgTqt4qbLhg&feature=plcp

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RESUMEN

Los pueblos y grupos indígenas de la provincia de Choiseul, o Lauru como se le conoce localmente, en las Islas Salomón, conservan un fuerte dominio consuetudinario de sus tierras y mares, y mantienen muchas costumbres relacionadas con el uso de sus recursos naturales. La población rural de Lauru también se expresa con voz firme a través de la Conferencia sobre la tierra de las comunidades tribales de Lauru (LLCTC). Las actividades de la Oficina de Medio Ambiente de la LLCTC desembocaron en 2008 en la creación de ocho áreas marinas localmente gestionadas (LMMA), y la recomendación oral sobre el valor de estas LMMA generó numerosas peticiones de la comunidad a la LLCTC solicitando asistencia para el establecimiento de áreas protegidas adicionales. En 2009, se desarrolló un plan de conservación basado en la gestión participativa para todo Lauru, que llevó a un compromiso político entre la LLCTC y el Gobierno para establecer una Red de Áreas Protegidas en la provincia de Lauro, el primero de su tipo en la Melanesia. Para 2012, se habían establecido 15 LMMA y varias áreas terrestres conservadas por la comunidad. En este documento se describe el proceso de participación comunitaria que la oficina de Medio Ambiente de la LLCTC utiliza para establecer áreas protegidas y algunos de los malentendidos que con más frecuencia es necesario abordar. También describe cómo el proceso de implementación impulsado por los propios interesados se nutre del Plan de Conservación desde las Cordilleras hasta los Arrecifes de Choiseul que se desarrolló con base en el mejor conocimiento científico y local disponible.

RÉSUMÉ

La population autochtone et les clans de la province de Choiseul, également appelée Lauru au niveau local, de l'archipel des îles Salomon, conserve un solide droit de propriété coutumière sur leurs terres et les mers, et perpétue de nombreuses coutumes liées à l'utilisation des ressources naturelles. La population rurale de Lauru exerce également une autorité collective considérable par le biais de la *Lauru Land Conference of Tribal Community* (LLCTC). Les activités du bureau de l'environnement du LLCTC ont abouti en 2008 à la création de huit Aires Marines localement gérées (LMMA), et le bouche à oreille sur la qualité des ces LMMA a suscité de nombreuses demandes d'assistance auprès du LLCTC afin que soient créées des zones protégées supplémentaires. En 2009, un plan de conservation, dirigé par les parties prenantes pour l'ensemble de Lauru a été mis sur pied, et suscité l'engagement politique du LLCTC et du gouvernement afin d'établir un Réseau de zones protégées à l'échelle de la province de Lauru, ce qui constitue le premier engagement de ce type en Mélanésie. Dès 2012, 15 LMMA et plusieurs aires territoriales sous protection de la communauté étaient déjà instituées. Le présent document décrit le processus d'engagement des communautés que le bureau Environnemental met en œuvre quand il établit des zones protégées, ainsi que certains des malentendus les plus courants qui doivent souvent être traités. Le document montre également comment le processus de mise en œuvre dirigé par les parties prenantes est nourri par le *Choiseul Ridges to Reefs Conservation Plan*, qui a bénéficié des meilleurs acquis disponibles dans les domaines des savoirs scientifiques et locaux.

FIRE MANAGEMENT IN A CHANGING LANDSCAPE: A CASE STUDY FROM LOPÉ NATIONAL PARK, GABON

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ABSTRACT

A key management goal in Lopé National Park, Gabon, is to protect regionally-rare savannah ecosystems within the continuous rainforest block. In order to evaluate the impact of existing protection efforts, data on burning season environmental conditions, burning effort and current woody values for savannahs were examined between 1995 and 2008. Results showed (a) spatial heterogeneity in woody values to be correlated with grassy vegetation type (b) a negative relationship between woody vegetation and fire return frequency over the study, suggesting that decreased fire return frequency may favour savannah thickening and (c) that inconsistent burn effort by Park staff, and burns designed for reduced heat, may limit the efficiency of fire to prevent savannah thickening or forest expansion. Optimal humidity and fuel moisture conditions for burning are identified and recommendations made for improving the existing fire plan to achieve the management goal. Modifications will require significant investment of resources and training and require urgent experimental work to disentangle the direct impacts of fire from other processes of vegetation change. Lopé's fire policy should ultimately be a dynamic response to change in the local landscape driven by direct fire impacts or by global climate change.

KEYWORDS: fire management, savannah ecosystems, Lopé National Park, Gabon,

INTRODUCTION

Both forest expansion and savannah thickening (an increase in density of savannah woody species) are significant challenges for the long-term management of protected savannahs in Africa, yet have received limited attention from the research or conservation communities and park managers have limited knowledge or critical assessment of practical management tools for savannah preservation. Forest expansion into savannah habitats, in response to global and local drivers, is common in Southern Africa (Parr et al., 2012; Wigley et al., 2010), West Africa (Goetze et al., 2006; Fairhead & Leach, 1996; Wardell et al., 2003), Eastern Africa (Leuthold, 1996; Gil-Romera et al., 2011; Belsky & Amundson, 1992) and is increasingly reported for Central Africa (Maley, 1990; Dowsett & Dowsett-Lemaire, 1991; Schwartz et al., 1996; Vincens et al., 2000; Guillet et al., 2001; Mitchard et al., 2009). In addition to forest expansion, savannah thickening is also occurring as a parallel process within savannahs, particularly in southern Africa (Parr et al., 2012). Recent studies suggest that Gabon's savannahs, which cover an estimated 20 per cent of the country, are being encroached by forest (Delegue et al., 2001; Nana, 2005; Leal et al., 2007). Some coastal forests in Gabon and the Republic of Congo are the result of expansion occurring in the past 500 – 1000 years (Delegue et al.,

2001), with a rate as high as 50 m per century (Schwartz et al., 1996). Encroachment occurs from both the continuous forest edge and as islands of forest species that become established in the savannah (Favier et al., 2004). In these savannahs, fire slows forest progression but does not stop it (de Foresta, 1990) and protection of the forest edge has been found to favour forest expansion (King et al., 1997). Fire-resistant forest-edge species protect forests from fires (Koechlin, 1961, Dowsett-Lemaire, 1996) and facilitate forest expansion. In Central Africa, savannah thickening is rarely reported, but in Gabon, one study suggests that this process is also occurring, due to changes in traditional fire regimes (Walters, 2012).

Forest expansion and savannah thickening were not considered a conservation issue in Central Africa until recently, as forest conservation has been the overall priority for the region. However, the savannah ecosystems are regionally rare and can form important islands of habitat, harbouring nationally rare savannah specialist species and providing significant patches of preferred habitat for species such as forest buffalo, forest elephant and bushbuck, which can reach locally high densities (Vande Weghe, 2011; Walters et al., 2012). This is the case for Lopé National Park which protects savannahs of the middle Ogooué region in central Gabon. Understanding savannah ecosystem change, its potential interaction with climate change and the role of direct management intervention is therefore particularly relevant to the case of Lopé National Park, where management objectives aim to maintain these important habitats.

In Gabon, 13 out of 20 state-managed strict protected areas harbour some savannah. Although anthropogenic savannah fires are commonplace, Lopé National Park (a UNESCO World Heritage site), is one of only two protected areas in Gabon to use a prescriptive fire programme to manage its savannahs, which it has done since 1993. Fire has been used by humans in Gabon for thousands of years, and Lopé's savannahs are thought to be relicts of a dynamic vegetation history linked to historic human migration events and past climatic conditions (Maley, 2001; Oslisly, 2001; White, 2001; Ngomanda et al., 2007). Human fire activity combined with a dry climate is thought to have maintained large areas of savannah between 2000–3000 years ago (Oslisly & Peyrot, 1992; Peyrot et al., 2003; White, 1995). A period of human absence beginning around 1400 BP coincided with more humid conditions and rapid forest expansion (Oslisly, 1995; Oslisly, 2001; White, 1995; White, 2001), indicating that both historical human activities and climate have contributed to alternating trends in forest/savannah conversion. Lopé's forests have been expanding for the past 2,500 years (Palla et al., 2011) and islands of forest vegetation are also being established within the savannahs (White, 1995; Ukizintambara et al., 2007).

The Lopé fire management programme was originally implemented with the objectives of reducing rates of forest expansion into the savannah, maintaining the diversity of habitats at the forest/savannah transition zone and encouraging seasonal use of the savannahs by large mammals to improve tourism opportunities (White, 1995; Molloy, 1997; Ukizintambara et al., 2007). Despite the annual fires, forest expansion is occurring rapidly (Nana, 2005; Palla et al., 2011) and visible changes in savannah structure can be seen. Some unburned areas at forest edges have made a clear transformation from savannah to colonising forest in just 15 years (see photo 1).

As savannah conservation has traditionally been a lower priority than wildlife or forest conservation, the managed burning plan has been implemented with limited resources and a lack of trained personnel. Until now there has been no empirical evaluation of the effectiveness of the burn plan to achieve its management objectives. In the context of climate change, understanding the most balanced management response to a landscape changed by both global and local drivers is becoming more critical, as Lopé strives to protect its unique ecosystems for the long term.

In this paper we examine data from the fire management programme in Lopé to investigate the results of the current burning practices. We address the following questions:

1. Is there an underlying influence of savannah grass type on the distribution of woody vegetation in Lopé savannahs?
2. Is there a relationship between the fire return frequency and the woody vegetation cover within the managed savannah zone?
3. Is burn effort consistent throughout the fire season and efficient for the management goals?
4. When are the optimal conditions during the day and during the season for burning?

MATERIALS AND METHODS

Fire Management Programme*:* The study area comprises a mosaic of savannah units in the north of Lopé National Park covering a total of 3,940 hectares (Figure 1). Two main types of savannah vegetation have been described according to their grass species composition, and their distribution is determined mainly by erosion and soil

Photo 1: Forest encroachment of a single savannah patch in Lopé National Park, which has not burned since at least 1993. Top photo: in 1993, the patch is a densely shrubbed savannah readily distinguished from the adjacent forest block. Bottom photo: in 2008, the same patch has transformed into colonising forest and the forest-savannah boundary has shifted >100m © Lee JT White and Fiona Maisels

moisture content (Alers & Blom, 1988). Type 1 savannah, found mostly in the north of the study area, is species poor, dominated by *Anadelphia afzeliana*. Type 2 savannah, typical of the southern savannahs, is species rich, dominated by *Hyparrhenia diplandra*, *Schizachyrium platyphyllum* and *Panicum nervatum* (Alers & Blom, 1988). Both types contain woody shrubs, principally of the species *Sarcocephalus latifolius, Crossopteryx febrifuga and Psidium guineense* (White, 1995*)*.

In 1993 a fire management programme was developed, consisting of an annual burn scheme with most areas programmed for annual burns. A 790 hectare area, including both Type 1 and Type 2 savannahs, was set aside for either a 2–3 year fire return period, or protected entirely from burning (Figure 1), in order to maintain habitat diversity at the savannah/forest transition zone and preserve savannah patches of guava (*Psidium guineensis*) which draw elephants into open areas for tourist viewing. Savannah units (determined in size by firebreaks) were burned progressively over a six-week burn season between July and September, to extend seasonal visibility of buffalo by staggering sward regrowth. Actual inter-annual start and stop dates vary slightly according to seasonal rainfall, but planned burns started in late July when grasses were sufficiently dry for combustion. From 1993–2001 around 20 large savannah

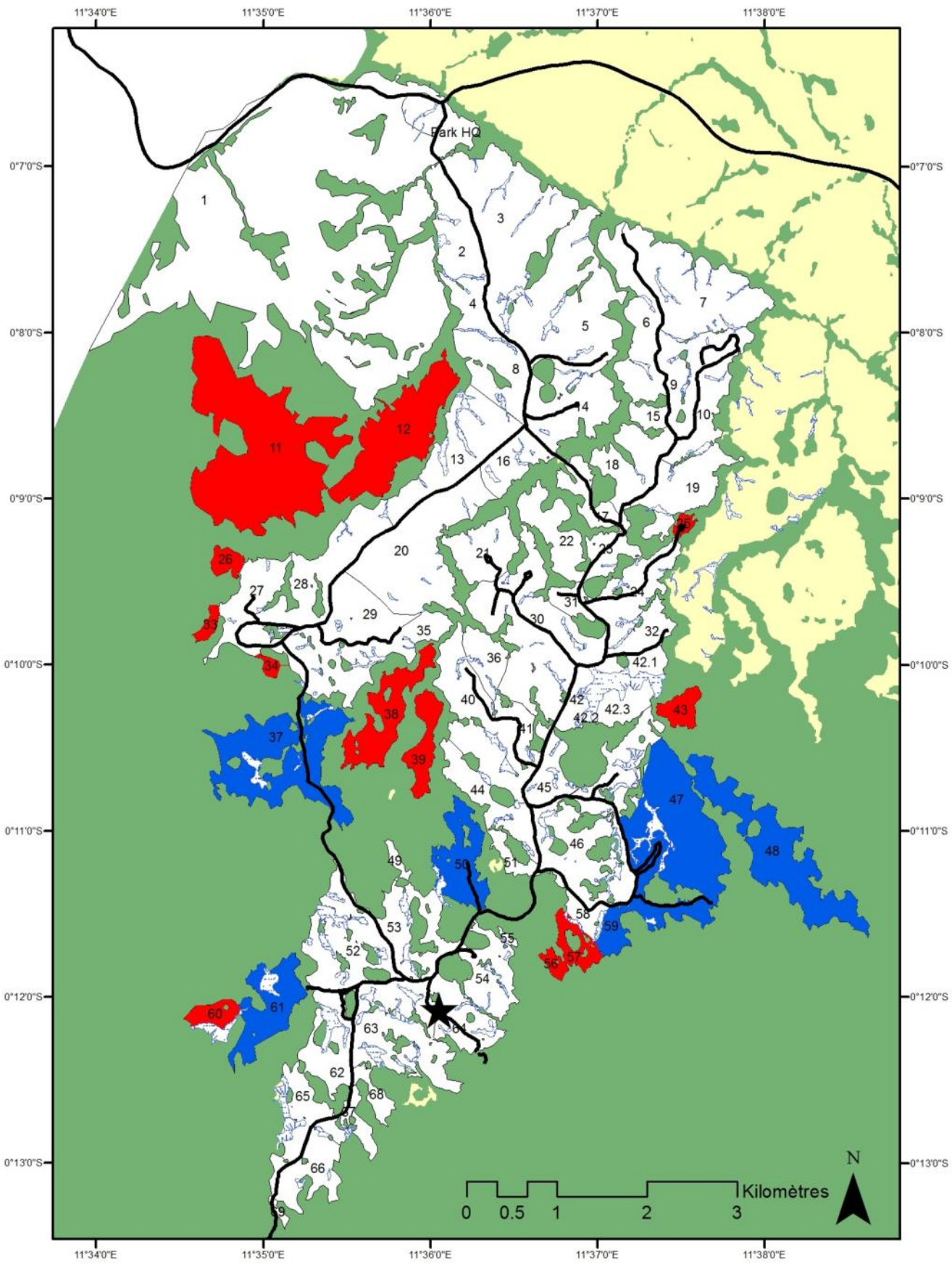

Figure 1: Map of the study area and managed burn zone, Lopé National Park, Gabon. White numbered zones are savannahs programmed for annual burns, red are savannahs protected from fire, and blue are savannahs on a 2-3 year burn cycle. Forested habitat is green and yellow areas are savannahs outside the managed burn zone. Thick black lines indicate roads, thin black lines indicate locations of fire breaks that separate savannah units. Marshes are outlined in blue. The star indicates the location of rainfall and humidity data collection.

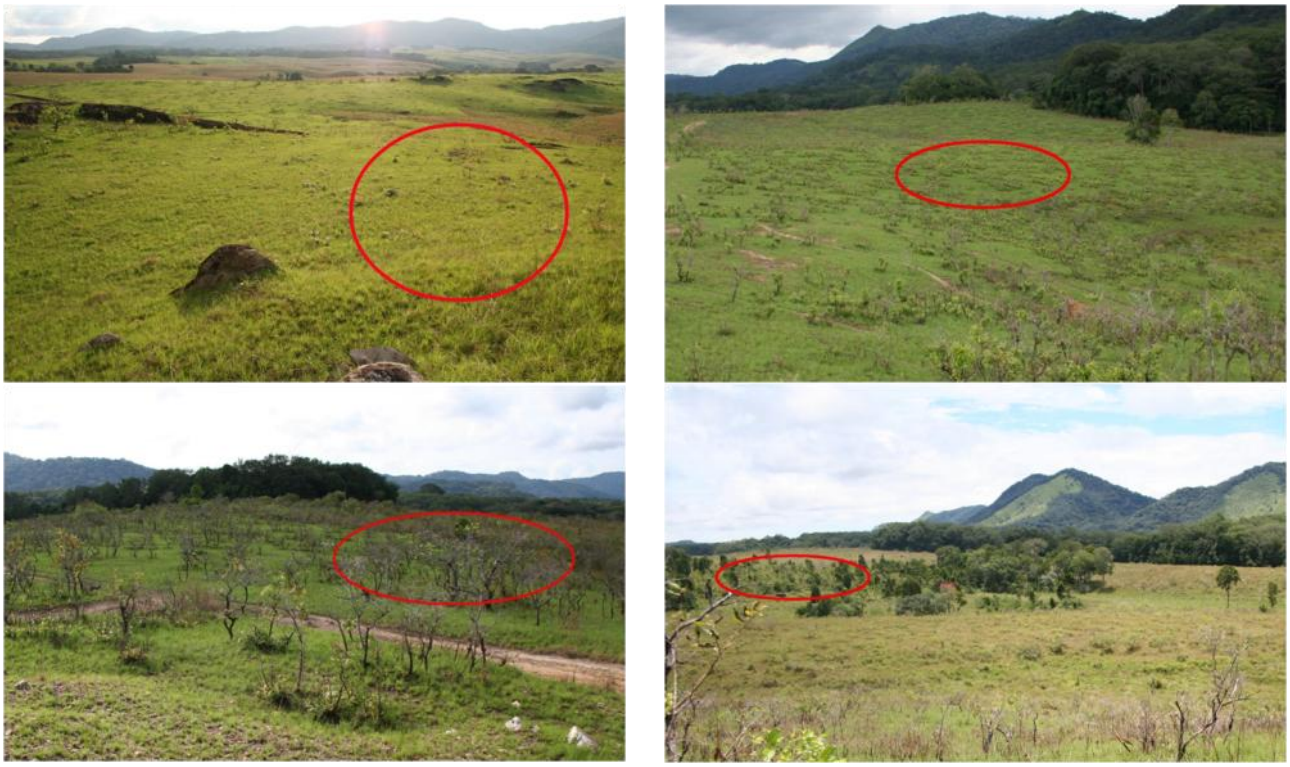

Figure 2: Four vegetation types identified in Lopé's savannahs in October 2008 from photographic interpretation (as identified inside the red ellipses). Top left: open savannah; Top right: young woody savannah; Bottom left: mature woody savannah; Bottom right: colonising forest © Kathryn J Jeffery

units were defined by natural firebreaks such as roads, marshes and forests, thus these units were not necessarily related to their biological characteristics or animal use. In 2002, the savannah units were revised to better incorporate knowledge of buffalo home ranges (Molloy, 1997; Korte, 2008) and 69 smaller distinct savannah units were identified, separated by natural firebreaks and man-made barriers cut with machetes one month prior to the burn season. Fires were lit between 15:00 and 18:00 as a security measure to favour less intense, more controllable fires. Burn dates and savannah units burned were recorded and data were managed in an ArcGIS 9.x database (ESRI), which was also used to calculate the original areas of each savannah unit. Burn areas were not directly measured but estimated as the whole area of the savannah unit that had been lit on a particular date. During some years, environmental conditions led to incomplete burns of some units; these incompletely burned savannahs were either re-burned at a later date if less than approximately half of the unit had originally burned, or left partially burned if the majority of the unit had been burned. Partial burn areas were recorded on maps wherever possible. Annual burn plans were prepared and implemented each year, although data on burn dates and spatial accuracy of implementation of the burn plan for each savannah unit were incomplete for some years. We considered data collected during a 14 year period between 1995 and 2008, where complete data were available for nine years. No data existed for 1993 and 1994, which were not considered in this study. Only these years are used for analysis of the burn effort. Human error and environmental conditions did lead to some error in spatial implementation of the burning plan, however recorded fire return frequencies were close to the burn plan prediction (see Figure 3 in results section).

Vegetation Classification: In Central Africa, and elsewhere, definitions of savannah types based on tree density have been proposed (Conseil Scientifique pour l'Afrique, 1956; UNESCO, 1973) but never universally adopted (Bourlière & Hadley, 1983), leaving researchers and managers to adopt measures adapted to their situation. In this study, the following method was used to create a local objective standard, against which change can be measured. The equivalence of our four classes to the terms used in other Lopé literature (White, 1995; White, 2001) is indicated for each one, to avoid confusion and create a single standard terminology.

Digital photographic images were taken from each ordinal and cardinal direction at 29 viewpoints across the study area in October 2008 using a Canon 3EOS 350D at ISO 200-400, and GPS locations were recorded. Over 150 point locations were randomly selected from the photographs and visually inspected. The area immediately surrounding each point (between 10 and 50 m radius) was assigned to one of four vegetation

categories from visual inspection of images (Figure 2), along with corresponding four point 'woody vegetation' score as follows: (1) Open savannah: woody shrubs rare or absent (n=40): White (2001) "Savannah vegetation"; (2) Young woody savannah: woody shrubs common, young woody shrubs <1 m in height dominate (n=26): White (2001) "Savannah vegetation"; (3) Mature woody savannah: woody shrubs common, mature woody shrubs >1 m in height dominate (n=45): White (2001) "Savannah vegetation"; (4) Expanding forest: savannah species rare or absent, colonising tree species dominant (n=12): White (2001) "Colonising Forest". Point locations were rejected if they did not fall into one of the four vegetation categories described above (e.g. mature forest block or marsh). In cases where the point fell on mixed vegetation types, the prevailing vegetation type visible in the photograph was used to assign the vegetation category. In total 123 point locations were retained, representing 52 different savannah units inside the managed burn zone.

Environmental data: Four seasons are recognized at Lopé: a short dry season occurring between December and February, a long dry season (mid June to mid September) and two rainy seasons (Vande Weghe, 2011). We defined the "average" long dry season from rainfall data which were collected daily in Lopé from a single savannah location at the *Station d'Etudes des Gorilles et Chimpanzés* (Figure 1) between 1984 and 2009: average annual rainfall is 1483 mm (SD 191). Weeks where average rainfall was below 20 mm were considered "dry season"; these corresponded to a 14 week period between 11 June and 16 September. Early season was defined as the period 11 June–15 July; mid season 16 July–19 August; and late season 20 August–16 September. Humidity data were collected at the same savannah location every 15 minutes between 2002 and 2008 using automated data loggers (HOBO data logger 2002–2006; TinyTag Plus 2007–2008).

RESULTS

1. **Influence of grass savannah type on current woody vegetation:** To control for the effects of fire treatment, we restricted this analysis only to savannahs that had been burned annually. Mean woody vegetation scores for annually burned Type 1 and Type 2 savannahs (Alers & Blom, 1988) were 2.18 (SD 0.96) and 1.71 (SD 0.83) respectively (n= 92), a difference that was significant (Mann Whitney U test, W = 1668; p = 0.018, adjusted for ties).

2. **Relationship between fire return frequency and woody vegetation cover:** We plotted average woody vegetation scores as a function of the planned fire return frequencies; i.e. savannahs that were planned to burn annually, on a 2-3 year rotation, or never burned (Figure 3) and tested for differences in 2008 woody vegetation scores between fire return categories for each savannah type. Sample sizes were too small to permit an analysis of Type 2 savannahs, however within Type 1 savannahs our results suggest a negative relationship between woody vegetation and planned fire return frequency. Mann-Whitney U tests between paired categories confirmed a significant difference between Never Burned and Burned Annually (W=1334, $p < 0.01$, adjusted for ties), and between Never Burned and Burned Every 2 - 3 years (W=179, p = 0.02, adjusted for ties), but not between Burned Annually and Burned Every 2 - 3 years (W = 1591, p = 0.092, adjusted for ties).

   By assuming that for years in which burn data were not recorded for a given savannah a value of either 0 (unburned) or 1 (burned) could be true, we then calculated the maximum and minimum possible fire return frequencies for all savannahs over the 14 year period. We compared savannahs that fell into one of two discrete groups; those that had burned the least often (between 0 and 7 times) and those that had burned the most often (between 8 and 14 times). The analysis was restricted to Savannah Type 1 due to inadequate sample sizes for Type 2 savannahs. Although sample sizes were small for Type 1, median woody vegetation scores were significantly higher for savannahs burned 0-7 times than those burned 8-14 times (0 – 7 times, Mean = 3.37, SD 0.54, n = 7; 8 - 14 times, Mean = 2.00, SD 0.90, n = 43; ,Mann Whitney U test, W= 972, $p < 0.01$, adjusted for ties).

3. **Consistency of burn effort throughout the fire season:** The fire plan is designed to evenly allocate burn dates across the six-week burn season, however, logistical constraints, errors made by burn operators and accidental fires resulted in actual burn dates frequently differing from those planned.

   Very few fires (2 per cent) were recorded early in the dry season. The majority of all fires (87 per cent) were recorded between 30 July and 16 September, with large variations observed across weeks (Figure 4). No significant difference was found between the frequency of mid and late dry season fires (χ^2 (1) = 3.39, N = 382, NS); 40 per cent of all recorded fires were mid dry season and 48 per cent were late dry season. The remainder were either out of season or no date was recorded. The week of the 6 August had the highest number of fires recorded, and with the exception of the week of 13 August, subsequent weeks

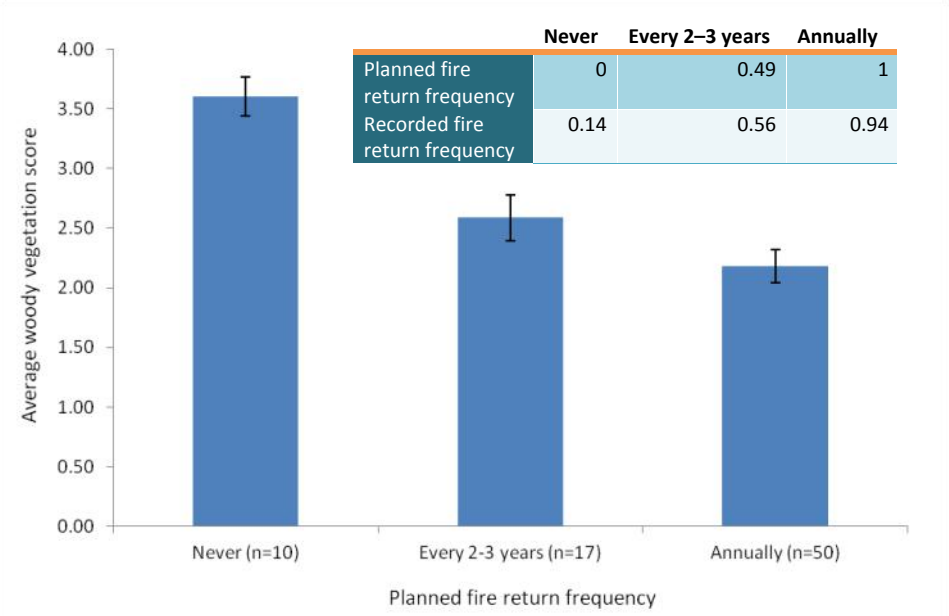

Figure 3: Average woody vegetation scores (+/– 1 SE) in 2008 for 77 locations in savannah grass Type 1 in Lopé National Park, plotted as a function of planned fire return frequencies over 14 years. Recorded fire return frequencies for the same savannah locations are calculated as averages over years where there are available data

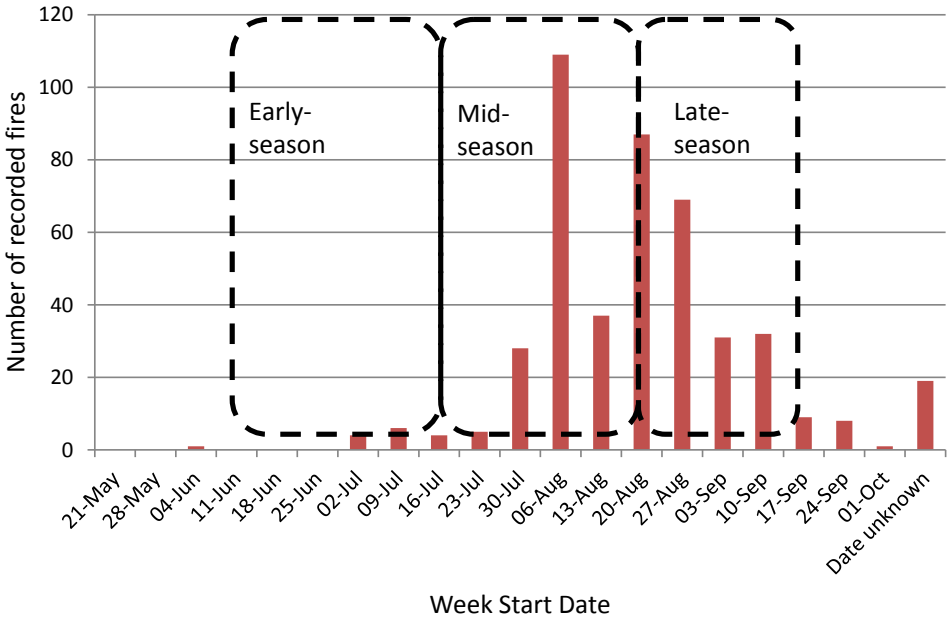

Figure 4: Frequency distribution of recorded fire dates across the long dry season (11th June- 16th Sept) in Lopé National Park, from available data between 1995 and 2008

showed a progressively diminishing number of burns, with a strong negative correlation between burn week and the number of recorded fires from the 6 August onwards (r_s = -0.933, N = 9, p < 0.001). The 13–19 August dip coincides with the mid August national holidays, and is indicative of a lack of available human resources during this week.

4. **Optimal humidity conditions for burning**: Average hourly relative humidity values plotted throughout the day in Lopé savannahs show that they are at their lowest between 11:30 and 14:30 daily, when minimum average values of 60 per cent are observed (range 31–100 per cent; Figure 5a). However, burning was deliberately executed between 15:00–18:00, when average humidity levels are between 63–83 per cent (range 35–100 per cent). Average weekly humidity levels plotted throughout the dry season (Figure 5b) show that while variations in humidity are large for any one week, a general trend of decreasing humidity is observed as the dry season progresses. Humidity is lowest in the late dry season, with the recommended optimal burn period identified between 20 August and 16 September. This part of the late dry season is also when dry matter in grass swards is high and fuel moisture likely to be lowest (Molloy, 1997).

DISCUSSION

The results presented here show a negative relationship between fire return and savannah thickness within savannahs of the same grass type. However, additional photographic evidence suggests that the Lopé forest/savannah boundary is also changing, allowing forest expansion (Nana, 2005) and that savannahs newly protected from fire by forest-edge changes can thicken

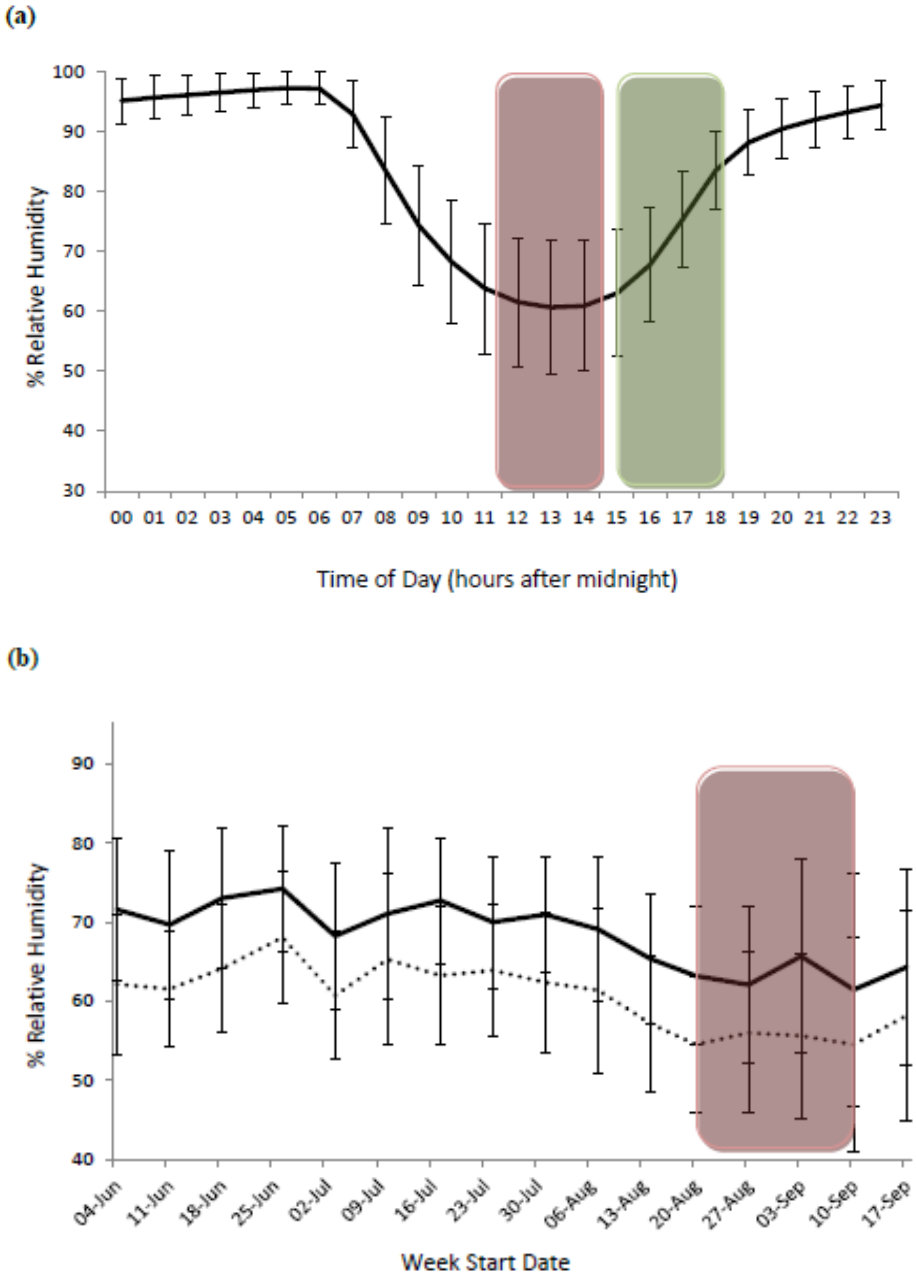

Figure 5: Plots of humidity throughout the long dry season (11th June --- 16th September) in Lopé National Park, 2002-2008. (a) average hourly relative humidity (%) values (+/– 1 SD). Green = current burn time; red = optimal burn time. (b) average relative humidity levels (+/- 1 SD) throughout the dry season (+/- 1 week) for the implemented burn time (15:00-18:00; solid line) and the optimal burn time (11.30-14:30; dotted line). Red = optimal burn dates

sufficiently over a 15 year period to be classed as colonising forest (see Photo 1). Our data demonstrate that whilst fire appears to be having a significant effect on Lopé savannah vegetation, the efficiency of current fire use as a tool to preserve Lopé's savannah habitats is hard to evaluate.

Savannah grass types*:* The significant effect of savannah grass type on savannah thickness shown by our analyses was not taken into account in the original burning plan. Thus the distribution and number of savannah burn units are not stratified across savannah grass types, making statistical interpretation of results problematic. Our experience indicates that the burn plan should be further developed to include explicit monitoring that will permit better analysis of the effect of fire return on savannahs with different grass types, and examine potential differences in fuel loads between savannah grass types.

Fire intensity: The data show that inconsistent burn effort within burn seasons and bias to burning conducted at times of both relatively high daily humidity and high seasonal fuel moisture conditions, are likely to have reduced the intensity of fires.

Our assessment of the environmental conditions during the burning season indicates that there is potential to increase fire intensity and possibly increase the impacts of fire on the observed savannah thickening and forest expansion seen at Lopé. We identify ways in which the existing fire plan, burning practice and environmental

A low intensity fire, Lopé National Park, Gabon © Nicolas Rumboll

monitoring in the park might be improved to make fire a more effective tool for savannah preservation in Lopé and increase managers' ability to evaluate its impacts.

Fire intensity is influenced by fuel moisture, air temperature and wind speed (Trollope et al., 2004), yet the burning plan in Lopé has promoted burns in sub-optimal humidity conditions and not used data on fuel loads, wind or air temperature to inform daily burning practices. Whilst high humidity burn times were chosen as a security measure, they have probably also contributed to a less efficient burn, lower impact against savannah thickening and forest expansion, and ultimately undermined progress toward the management goal.

Although our findings indicate a correlation between past fire frequency and current woody vegetation, data on fire intensity or speed are lacking and thus the effect of increasing fire intensity (heat, completeness of combustion) in these savannahs types cannot be accurately evaluated.

It is likely that favouring more intense fires, by targeting the least humid parts of the day (11:30–14:30) and season (20 August–10 September), and times of lowest fuel moisture would better inhibit savannah thickening and forest expansion. Collection of environmental data on wind speed, wind direction, temperature and measurement of resulting fire heat and speed throughout the burn season, would contribute greatly to more accurate identification of optimal burn conditions enabling adjustment of the weekly burn plan specific to each season (Higgins et al., 2000; Govender et al., 2006). Since 2010, data on wind speed and wind direction have been incorporated into the routine burn data collection protocols in the Park, and future analyses should allow further refinement of optimal burn times.

Fire return period*:* Our data show an effect of fire on savannah woody vegetation in Lopé, with protected savannahs having significantly higher woody values than those regularly burned. However, although woody values are the lowest for annually burned savannahs, our data do not yet suggest that annual burns are significantly more effective at reducing savannah thickening than a 2-3 year fire return period. Elsewhere, fire return period is known to be a critical parameter for maintaining savannah structure (Sankaran et al., 2005), In Gabon, two dry seasons have traditionally allowed twice yearly burns in some savannahs, although this practice was stopped in Lopé in 1993, due to concerns over impacts on nesting birds in the short dry season (White,1995). There is currently debate around the question of whether a twice yearly fire return period (i.e. burns in both the short and long dry seasons) would be more effective for

Savannah fire at night, Lopé National Park, Gabon © David Greyo

savannah management. It may be possible to obtain more intense fires by increasing the fire interval (Higgins et al., 2007); however variations of fire return over 1, 2, and 3 years elsewhere have shown to impact woody stem density both positively and negatively (Higgins et al., 2007) and evidence from elsewhere in Gabon suggests that woody stems may even increase with increased fire frequency (Walters, 2012). In a high rainfall savannah such as Lopé, it is possible that an early, short dry season burn will reduce fuel loads and therefore the intensity and efficacy of the ensuing late season burn (Higgins et al., 2000). A more detailed study of fire return periods and woody stem density in Lopé is recommended, together with assessment of other ecological factors, such as wildlife use of savannahs in the short dry season.

Burn effort*:* The current burning plan demands fires evenly spread across the season from July-September, however, the within-season fire frequency has been heavily biased against mid season burns (at the onset of burning), and uneven across the remaining weeks. This is likely due to staff and logistic disruptions during the holiday week leading to subsequent alterations of the programme, combined with a decrease in motivation to burn as the season progresses.

As both improving fire intensity and reducing the management burden seem desirable, a shorter, later burning season should be implemented.

Extent of fire management*:* Due to logistical constraints, the managed burn plan has been implemented in a restricted area; it is now a park management objective to extend this to cover all savannahs inside the park and its buffer zone (ANPN 2013). Many of these areas are already burned annually by the local community, but without planning, monitoring or involvement by the park authorities. In other countries, wildfire management programmes may be closely linked to local communities (Parr et al., 2009), particularly where fire management is cultural, resources are lacking and fires pose a threat to human safety and livelihoods (Laris, 2002; Myers, 2006). As is the case elsewhere in Gabon, unplanned savannah fires in Lopé can be started deliberately, either to facilitate hunting or to clear land amongst other uses (Walters, 2010), fire safety awareness is lacking and fire damage to infrastructures is often sustained. It is clearly in the park's strongest interests to involve the local community in fire management, not only to improve ecological and landscape level monitoring of fire behaviour and impacts, but also to facilitate park management efforts to control hunting and address local safety issues (Walters et al., in press).

The data on woody vegetation cover presented in this study are preliminary. More accurate measures of change are required, including quantitative measures of above ground biomass and stem density, which will allow pre- and post- treatment comparisons. Several studies have used large-scale methods to establish landscape level biomass: measures from forest plots in Lopé have already been used to quantify satellite imagery for estimating carbon stocks at a landscape level (Mitchard et al., 2011), and this approach could be extended to improve resolution for mapping above ground biomass

in savannah ecosystems. Although rarely used in Central Africa (e.g. Leuthold, 1996; Wigley et al., 2010), the fixed-point photomonitoring methods employed here also permit a simple method of identifying broad differences in vegetation structure over a large area that can be easily repeated to provide robust indicators of change.

Factors such as the surface area of savannahs, their proximity to adjacent continuous forest, and their potential humidity levels as well as those in the forest edge are important in fire regimes established to limit forest expansion. In Lopé these factors co-vary with savannah grass type, making a better understanding of the response of different grass types to fire particularly important for managers. If global climate-induced changes in the savannah/forest dynamic are occurring across Gabon, as seems likely to be the case, then more detailed studies examining how expansion processes are influenced by these factors are critical and urgent.

Unlike other savannah areas where fire management has long been practiced, such as those in South Africa, Australia, or the United States (Bradstock et al., 2002; du Toit et al., 2003; Pyne, 1988), in Gabon, savannah management is rare and poorly funded (Walters, 2010), a common limitation in sub-Saharan African protected areas (Goldammer & de Ronde, 2004). The state of fire management in Lopé highlights several factors more general to park management, in particular when managers are trying to address newly identified threats, for which local technical skills are currently insufficient. If global drivers are indeed responsible for Lopé's savannah thickening, then creative solutions to maintaining savannah habitat may be needed, possibly including manual interventions such as tree removal or more extreme fire management regimes (Parr et al., 2012). Training and investment will be required to implement the recommended modifications and improve fire management practices to meet management goals. Over the past millennia, Lopé's ecosystems have fluctuated according to the prevailing climatic conditions. Over the next century, changes in global temperature are predicted to reduce forest cover in Gabon (Zelazowski et al., 2011) and with it associated fire behaviour is also expected to change (Delire et al., 2008), a phenomenon that may happen globally (Stephens et al., 2013). Lopé's fire management policy will need to be adaptive to these changes, as the landscape continues to evolve.

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RESUMEN

Uno de los objetivos clave de gestión en el Parque Nacional de Lopé, Gabón, es la protección de ecosistemas de sabana raros dentro del bloque continuo de bosque lluvioso. Con el fin de evaluar el impacto de los actuales esfuerzos de protección, se examinaron los datos sobre la temporada de quemas, las condiciones ambientales, los esfuerzos relacionados con las quemas y los valores actuales de las plantas leñosas de las sabanas entre 1995 y 2008. Los resultados mostraron (a) que la heterogeneidad espacial de los valores de las plantas leñosas se correlaciona con el tipo de vegetación de hierba; (b) una relación negativa entre la vegetación leñosa y la frecuencia de incendios sucesivos en una zona específica, lo que sugiere que la disminución de la frecuencia de incendios sucesivos puede favorecer el engrosamiento de la sabana; y (c) que los esfuerzos inconsistentes de quema por parte del personal del Parque y las quemas diseñadas para reducir el calor, pueden limitar la eficacia de los incendios para prevenir el engrosamiento de la sabana o la expansión del bosque. Se identificaron las condiciones óptimas de humedad y humedad del combustible para la quema y se formularon recomendaciones para mejorar el plan de manejo de incendios para alcanzar el objetivo de gestión. Las modificaciones precisarán tanto de una inversión significativa de recursos y capacitación como de un trabajo experimental urgente para separar los impactos directos del fuego de otros procesos de cambio de la vegetación. La política de Lopé en materia de incendios debería ser, en última instancia, una respuesta dinámica a los cambios en el paisaje local movida por los impactos directos de los incendios o por el cambio climático global.

RÉSUMÉ

L'un des objectifs clé de gestion du Parc National de la Lopé au Gabon est de protéger ses rares écosystèmes de savane au sein de la barrière continue de forêt équatoriale. Afin d'évaluer l'impact des efforts actuels de protection, on a collecté sur la période 1995-2008 toute une série de données sur les feux de savane, les conditions environnementales, l'effet des incendies provoqués et la biomasse ligneuse des savanes. Les résultats ont montré que (a) l'hétérogénéité spatiale des valeurs ligneuses est en corrélation avec la végétation composée de graminées, (b) une relation négative existe entre la végétation ligneuse et la fréquence des incendies constatée, ce qui laisse supposer qu'une fréquence moindre dans la périodicité des incendies pourrait favoriser l'épaississement de la savane, et enfin que (c) le manque de programmation dans les incendies déclenchés par les personnels chargés de l'entretien du Parc et les incendies à chaleur contrôlée, pourrait limiter l'efficacité de cette méthode pour empêcher l'épaississement de la savane ou l'expansion de la forêt. Les conditions optimales d'humidité ambiante et d'humidité du combustible ont été établies et des recommandations faites pour améliorer le plan de feu existant en vue de réaliser les objectifs de gestion préétablis. Toute modification nécessitera d'importants investissements en ressources et en formation ainsi qu'un travail expérimental en vue de distinguer les effets directs du feu des autres processus de changement de la végétation. La politique de feu à Lopé devrait constituer au bout du compte une réponse dynamique aux changements dans le paysage local induits par les impacts directs du feu, ou plus globalement, par le changement climatique mondial.

VISITORS' CHARACTERISTICS AND ATTITUDES TOWARDS IRAN'S NATIONAL PARKS AND PARTICIPATORY CONSERVATION

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ABSTRACT

The highly diverse climate and nature of Iran offer a potential to use ecotourism as a tool to support conservation and local development. To realize this potential, the ecotourism experience must be identified to guide management actions. This paper examines ecotourists' attitudes towards conservation and evaluates Iran's national parks (NPs) economically. 2,121 respondents answered an online questionnaire conducted in summer 2012. The majority of respondents had visited at least one of Iran's 26 NPs. The survey revealed the weak condition of NPs both in status and conservation activities. Almost all respondents were willing to voluntarily participate in projects related to nature, environment and biodiversity conservation; pay for protection; increase the area of protected areas; visit NPs in the future; and they were mostly young. They believed that the conservation of biodiversity is not only the responsibility of the government but also society in general. Furthermore, most answerers highlighted ecotourism activities as a tool to benefit local people. The paper concludes that the government should elevate environmental awareness and consciousness, build community capacity for biodiversity management, resurrect the conservation movement, promote ecotourism and sustainable investment, strengthen the capacity of NGOs, look for synergisms, and build opportunities for participatory, cooperative science and stewardship.

KEYWORDS: ecotourism, online survey, environmental awareness, national parks, Iran

INTRODUCTION

Protected areas (PAs) are a key global strategy and serve as one of the most important public goods. Many PAs continue to be established, especially in developing countries (PPW, 2012). PAs have long been the only way to conserve ecological regions from other forms of land use (EEA, 2010). Governments must ensure that their PAs are well managed (IUCN-Jeju, 2012), however, most PAs are not financially self-sufficient (Kolahi et al., 2012a; Leverington et al., 2010). As a result, underfunding hinders conservation or development objectives and activities (IUCN, 2005).

Tourism and recreation will increasingly make use of PAs and other nature areas, "in developed countries as buffer zones from daily urban life and in developing countries as the setting for nature tourism" (Evans et al., 2001). Based on the most commonly used definition, ecotourism or nature-based tourism is "responsible travel to natural areas that conserves the environment and improves the well-being of local people" (TIES, 1993), a definition which emphasizes the view that ecotourism should have positive impacts. However, to realize this potential, the ecotourism experience must be identified to guide management actions and thus to sustain the resources on which ecotourism ultimately depends. In this way, visitors are at the centre of ecotourism management. They represent a valuable resource for gaining information about the presence and extent of impacts, the acceptability of environmental change, and the consequences of management actions for conservation and their experience.

Economic considerations generally play a key role in decisions. Subsequently, the economic valuation of ecosystem services has received special attention in recent years. In fact, the idea of economic valuation of environmental benefits of recreation areas was first considered in 1947 (Majnonian, 1995). Many efforts have been conducted to determine the benefits of ecotourism. In the developing world, economic valuation of environmental services of PAs is increasingly common

(Adamsa et al., 2008). But few economic valuation studies have been conducted in developing countries (Dixon and Hufshmidt, 1986; Hadker et al., 1997).

In the last three decades, a range of economic valuation methods for ecosystem services has been developed to determine their values via people's preferences e.g., their willingness to pay (WTP) (Hein, 2007). One important approach is the Contingent Valuation Method (CVM). CVM has been commonly used as a standard approach to measure and quantify the non-market goods and the non -use values of an ecosystem in monetary terms, such as recreation, wildlife and environmental quality goods (Hanemann et al., 1991; Hanemann, 1994; Hein, 2007). For applying CVM to represent a WTP scenario posed to the respondents at recreation sites, however, entrance fee is the most logical choice and a realistic payment vehicle (Lee and Chun, 1999; Jorgensen et al., 2001; Turpie, 2003).

Population growth and climate change impacts has caused serious degradation of natural reserves and biodiversity in Iran over the past few years (Kolahi et al., 2012a). This has raised concern over the status of endemic species (Kolahi et al., 2012a, 2013a, 2014). In an attempt to preserve biodiversity, some areas were converted into PAs. Iran has four categories of PAs including 'National Park' (NP), 'National Natural Monument', 'Wildlife Refuge', and 'Protected Area', which altogether cover about ten per cent of the total Iran's area according to the Department of the Environment of Iran, GIS and Remote Sensing Section, statistics for November 2011 (BHPAs, 2011). These sites are spread throughout the country. They host habitats for an array of species and associated ecosystems and play an important role in the sustainable utilization of natural resources. The coverage and the challenges facing management in Iran's PAs are noted by Kolahi et al. (2012a). PAs lack management plans and challenges include mismanagement, limited public participation, and conflict between local people and PA management. Only 2 per cent of the country's PAs are effectively protected (Kolahi et al., 2012a). PAs depend completely on a relatively low, annual budget from government. No economic analyses have been undertaken and thus PAs have not optimized possible income (Kolahi et al., 2012a, 2014). Some reports also show that PAs managers considered the local community as a threat and they do not try to give the public opportunities to cooperate in conservation activities (Kolahi et al., 2011, 2013a).

There is a lack of reliable data specifically on ecotourism numbers to Iran and very little information exists regarding the environmental (biophysical and social) impacts of visitor activities and the effect of these impacts on the visitors experiences. Based on an inquiry from the Bureau of the Habitats and Protected Areas (BHPAs) in 2013, the total number of eco-tourists in Iran's NPs is estimated at 100,000 persons per year.

Finding accurate information on visitors' views about PA management, cooperation and the resources that attract them is an important key to effective management of recreation sites. The main objective of this paper is therefore to examine the characteristics and attitudes of ecotourism towards Iran's NPs and biodiversity conservation. An economic valuation of the NPs was carried out, conditions and management of NPs were assessed, relationship between ecotourism and local people and the role of ecotourism in local development were investigated, and environmental awareness was evaluated.

METHODS

Study areas: The authors selected Iran's NPs as their study areas. Iran has 26 NPs, totally 1,960,537 hectares, covering 1.19 per cent of Iran's area (BHPAs, 2011). Because of their environmental characteristics and high biodiversity NPs have the greatest variety of management zones compared with other types of PAs in Iran. In addition, they have the greatest variety of natural attractions and opportunities for visitors, and the most developed tourist facilities (BHPAs, 2011).

Survey approach: An online questionnaire was administered to Iran's e-society between July and September 2012 to collect responses to primarily closed-ended questions. The questions were about NPs and biodiversity conservation in Iran. They were designed so that all participants could answer them. Those who had visited at least one of Iran's NPs were asked more questions than others. The questions were divided into seven sections: 1) environmental activities and attitudes; 2) awareness about NPs and other PAs; 3) the relationship between local people and ecotourism; 4) volunteer measures; 5) satisfaction; 6) WTP; and 7) demographic information. The survey consisted of multiple-choice, dichotomous yes/no, and ordered-rank responses, though a few open-ended questions were also posed to offer further explanations for checked responses.

After the questionnaire was structured and standardized, Iranians were informed by emails and advertisement (in some web sites). This call for information went viral (e.g. an email which rapidly propagates from person to person) and within a few days it had been sent to more than 3,000 people.

Table 1: A summary of variables used in all Logit Regression Models

Variables	Description	Mean±SD
Age	Ratio scale: respondents were asked to write their actual ages based on calendar years.	32.4±8.22
Gender	Binary scale: males=1 and females=0.	0.58±0.49
Marital status	Binary scale: married=1 and single=0.	0.49±0.50
Family size	Ratio scale: total number of people living in respondent's household.	3.69±1.48
Education	Ordinal scale (1 to 6): Under high school=1, high school=2, Associated degree=3, Bachelor=4, Master=5, Doctor and upper=6.	4.75±0.95
Field related	Binary scale: field related to environment, natural resources or similar issues=1, otherwise=0	0.48±0.50
Member	Binary scale: a member of any environmental supported organization=1, otherwise=0	0.31±0.46
Number of available information	Ratio scale: respondents were asked how they were informed about NPs at their last visit: Friends/relatives; Living nearby; Publications; Internet/website; School class/program; Television/radio; and Other. Each item gave 1 score. Higher scores indicate greater available information.	1.37±0.82
Total visitors' satisfaction	Index: Respondents were asked to rate ten statements on a 5-point Likert scale from very dissatisfied (1), dissatisfied (2), neutral (3), satisfied (4), and very satisfied (5). Six statements were about status satisfaction (Component 1 of PCA; annex 1) and four statements about Enjoyment satisfaction (Component 2 of PCA). An index was developed by summing the responses on all ten statements about satisfaction of status and enjoyment. Reliability analysis revealed Cronbach's α=0.82, suggesting a valid index. Theoretically, the index score can range from 10 to 50. Higher scores indicate greater visitors' satisfaction.	17.40±7.48
Status satisfaction	Ratio scale: Six statements of component 1; annex 1; the index score can theoretically range from 6 to 30. Higher scores indicate greater status satisfaction.	13.96±4.95
Enjoyment satisfaction	Ratio scale: Four statements of component 2; annex 1; the index score can theoretically range from 4 to 20. Higher scores indicate greater Enjoyment satisfaction.	13.44±3.63
Group size	Ratio scale: The number of visitors including respondents travelling together.	9.57±10.14
Monthly income (Rials)	Ordinal scale (0 to 6): Nothing(0), less than 5,000,000(1), 5,000,000-7,500,000(2), 7,500,000-10,000,000(3), 10,000,000-15,000,000(4), 15,000,000-20,000,000(5), over(6)	2.54±1.87
Family monthly income (Rials)	Ordinal scale (0 to 6): Nothing(0), less than 5,000,000(1), 5,000,000-10,000,000(2), 10,000,000-15,000,000(3), 15,000,000-20,000,000(4), 20,000,000-25,000,000(5), over(6)	3.47±1.58
Number of visited NPs	Ratio scale: number of visited NPs in Iran including 1 (1), 2-5 (2), 6-10 (3), 11-15 (4), and more than 15 (5).	3.92±3.48
WTP	Binary: Willing to pay=1, not willing to pay=0.	0.90±0.30
Paying amount	Ratio scale: The maximum of paying amount including 0, 10,000, 20,000, 30,000, 40,000, 50,000 Rials or other (?).	43,586±62,323
Benefited to local	Binary: Benefited to local people= 1, not benefited=0	0.45±0.50

Alborz red sheep (*Ovis orientalis*), Central Alborz Protected Area © Fariborz Heidari

The authors did not seek to represent objectively the opinion of the Iranian public but to investigate the opinion of Iran's e-society. A total of 2,121 usable questionnaires were collected from the survey. In this paper only respondents' who had visited at least one of Iran's NPs have been presented. Data cleaning, checking and coding were carried out, followed by data analyses. The authors used factor analysis to reduce ten statements of satisfaction into smaller sets of underlying factors (see annex 1).

Contingent valuation method and payment option: In this study, the authors designed the CVM to simulate as closely as possible a real market. We designed bids based upon previous studies (Kolahi et al., 2013b; Qorbani and Sadeghi, 2011; Amirnejad, 2007) and inflation, using an entrance fee as a familiar vehicle for payment. It was felt that respondents would have little trouble visualizing the contingent market specified, since Iranian people are familiar with paying entrance fees for activities at recreation sites and many local facilities actually charge entrance fees. In this way, respondents had a real-world baseline against which to judge their responses. A set of six different offers and an open-end offer were selected. The offers included *nothing; 10,000; 20,000; 30,000; 40,000; 50,000 Rials; and others (?)* (US$ 1=12,260 Rial; CBI, 2012). In the open-ended bid format (*others (?)*) respondents were asked to state directly their maximum WTP[1].

Logit regression model: The authors used logit regression to model the relationship of the binary dependent variables (WTP – yes/no and benefiting local people – yes/no) to the independent variables by using the Conditional Backward method. A statistical summary and explanation of all variables included in the logit models are provided in Table 1.

Finally, to measure WTP, the following equation was applied (see annex 1):

$$E(WTP) = \int_0^{Max\ A} \frac{1}{1+e^{-(\alpha^* + \beta A)}}\, dA \quad \text{(I)}$$

where E(WTP) is the expected value of WTP, β is a coefficient to be estimated, A is an offer, and α^* is the adjusted intercept which was added by the socioeconomic term to the original intercept term of α. The area under the curve in Eq. (I) can also be used to make inferences of truncated mean of WTP.

RESULTS

Sample characteristics: Out of 2,121 respondents, 61.7 per cent (1,308) had visited at least one NP. The sample represented visitors across all Iran's NPs. Available information resources about the last visited NP were low with 76.5, 15.6, and 4.4 per cent of respondents

Table 2: Frequency distribution of perception variables

Statements: SD=Strongly Disagree, D= Disagree, N= Neutral, A= Agree, SA= Strongly Agree	Rate of agreement (%)				
	SD	D	N	A	SA
Local people economically benefit from ecotourism activities.	3.8	13.7	5.8	45.9	30.7
Everyone should conserve wildlife of NPs.	0.9	0.8	0.8	13.2	84.3
Government should allow stakeholders to participate in management of NPs.	3.7	11.9	9.3	34.2	40.8
There is trust between NPs administrators and local people.	16.3	39.1	23.6	14.4	6.6
Current preservation and management activities in NPs are successful in conserving Iran's natural areas and wildlife.	24.9	40.9	13.5	16.7	4.0
Local people like establishing of NPs.	4.7	19.2	34.7	30.0	11.5
Ecotourism activities contribute to conserve NPs and their biodiversity.	10.8	27.3	12.7	34.3	14.9

Table 3: Knowledge about biodiversity conservation and national parks

Statements (knowing of/agreement)	%	
	No	Yes
NPs may include private lands and some people are living in.	37.3	62.7
NPs are scenic outstanding areas of natural landscape which would be sufficient to represent the nature of our country.	16.7	83.3
The purposes of designing a national park are "protection and improvement of biodiversity and sites" and "recreation".	22.2	77.8
About 1% of the country is selected as NPs.	68.9	31.1
All countries have confirmed to increase their PAs at least to 17% of their country's area by 2020 at the last international convention in Nagoya (2010).	88.8	11.2
About 10% of Iran's land has been progressively selected as PAs.	73.7	26.3
To increase the percentage of PAs to conserve Iran's biodiversity.	3.8	96.2

having been informed by just one, two or three sources, respectively. Among, friends/relatives (35.0 per cent), living nearby (16.5 per cent), school class/programme (13.9 per cent), television/radio (7.8 per cent), internet/ website (7.4 pr cent), publications (7.3 per cent), and other (12.0 per cent) were available information resources. Only 0.3 per cent of respondents lived inside NPs. While 11.9 per cent lived less than 10km from a NP, 25.9 per cent were 10-50 km from a NP, 45.0 per cent lived more than 50km away, and 17.0 per cent did not know the distance to their closest NP.

0.8 per cent of respondents were 19 years of age or under; 42.5 per cent were between 20-29; 38.4 per cent between 30-39; 13.6 per cent between 40-49; 3.9 per cent between 50-59; and 0.8 per cent were over 60. About 0.3 per cent of responders did not complete high school, 2.9 per cent completed high school, 4.1 per cent had the associate degrees, 28.1 per cent had the bachelor degrees, 43.5 per cent had the master degrees, and 21.1 per cent had the doctorate degrees or upper.

Environmental activities and attitudes: With respect to visitation: 32.5 per cent of respondents had visited one NP; while 54.5 per cent had visited 2-5, 8.9 per cent had visited 6-10, 1.9 per cent had visited 11-15 and 2.1 per cent had visited more than 15 NPs. Over half (54.3 per cent) had voluntarily participated in at least one activity related to nature conservation and environmental protection, while 45.7 per cent had not had this experience. However, 89.8 per cent were willing to voluntarily participate in projects related to nature conservation and environmental protection. Almost a third (30.6 per cent) had participated in at least one project related to NP planning and management including meetings, enforcement and/or monitoring.

The proportion of respondents who reported a desire to visit NPs of Iran again in the future was high (99 per cent). With respect to governance, 56 per cent believed participatory conservation as the more suitable structure for Iran's NPs management system, others noted private management (28.6 per cent), while only 6.4 per cent thought governmental management appropriate.

A quarter of visitors (27.1 per cent) had bought at least one local product when visiting a NP. The frequency distribution of the respondents' perception on environmental issues, local people, ecotourism, and NPs management are shown in Table 2. Awareness of the respondents about biodiversity conservation and NPs are presented in Table 3.

Explanatory variable	Coefficient	Std. error	Sig.
Number of available information resources	0.369	0.168	0.028
Total visitors' satisfaction	0.046	0.013	0.000
Member of environmental organization	0.632	0.235	0.007
Respondents' monthly income	0.171	0.054	0.001
Constant	-0.027	0.419	0.948
Likelihood-ratio χ^2_{10}=38.35, p<0.001, N=1,308; -2 log likelihood: 795.25			
Correctly classified: 90.3%			

Table 4: Results of the logit model for WTP of Iran's national parks

Explanatory variable	Coefficient	Std. error	Sig.
Enjoyment satisfaction	0.054	0.016	0.001
Education level	0.114	0.063	0.072
Respondents' monthly income	0.104	0.032	0.001
Constant	-1.720	0.361	0.000
Likelihood-ratio χ^2_{11}=31.68, p<0.001, N=1,308; -2 log likelihood: 1770.57			
Correctly classified: 57.3%			

Table 5: Results of the logit model for benefited local people by ecotourism

Some 23 per cent of respondents commented in the open -end question. Almost all the respondents worried about the destruction of Iran's nature and reduction of biodiversity. The comments contained a lot of useful information about threats to Iran's ecological regions. The main threats can be grouped as: 1) mismanagement and lack of support from the Government, the Legislature and the Judicature (48 per cent); 2) lack of people's cooperation in environmental issues (29 per cent); and 3) lack of knowledge and information related to biodiversity, NPs, environmental impacts, NGOs, and conservation activities (21 per cent).

Almost 73 per cent (1,547) of respondents asked to receive the results of the research and 10 per cent noted they had learnt more about the NPs and conservation in Iran.

Regression for WTP estimation: Almost 90 per cent of the respondents were willing to pay the bid amount specified in the survey. The logit regression model was robust in fitting the data with almost 90.3 per cent of respondents correctly allocated to predicted WTP either 'yes' or 'no' in the model, indicating a relatively good-fit to the data (χ^2_{10} =38.35, p<0.001, Table 4). Of the 13 variables, four were significant predictors of WTP in our model: the number of available information resources, the total visitors' satisfaction, membership of an environmental organization, and respondents' monthly income. Their signs were positive as expected. These indicate that the probability of WTP 'yes' increases with more available information resources, larger satisfaction, being a member of environmental groups and higher monthly income, under the hypothetical market scenario.

Estimating logit model for relationship between local people and ecotourism: Significant variables were included in the logit model for measuring whether local people benefited by ecotourism (χ^2_{11} =31.68, p<0.001, Table 5). The estimated coefficients of enjoyment satisfaction (component 2 of PCA; see annex 1) and respondents' monthly income were found statistically significant at the one per cent level with the expected positive signs. The coefficient of education level was also statistically significant but at the ten per cent level with the expected positive sign. The positive signs of enjoyment satisfaction, education level, and respondents' monthly income, indicated that the higher enjoyment satisfaction, more educated, and higher respondents' monthly income, the higher chance of benefiting local people.

Measuring use value of Iran's national parks: Equation (II) shows the expected value of truncated mean WTP, which represents use values of Iran's NPs. It was calculated by numerical integration, ranging from zero to Maximum Bid (see Eq. (I)) after parameters from WTP logit model were estimated using the maximum likelihood method. The socioeconomic term of θ was estimated and added to an adjusted intercept together with the original intercept term of $\propto$. Iran's NPs, in general, were estimated to have the highest use value of 49,404 Rials (approximately US$ 4; CBI, 2012) per visitor.

$$E(WTP) = \int_0^{50,000} \frac{1}{1+e^{-(-12.061+0.020A)}} dA = 49,404$$

Rials (US$ 4) (II)

Miyankale Protected Area © Mohammad T. Zakeri

DISCUSSION

The results of the survey are discussed based around four issues: conditions of NPs and management, information about biodiversity conservation and NPs, ecotourism as a tool for conservation and local development, and the potential of people participation in national park management.

Conditions of National Parks and management: The conditions of infrastructure and primary services, facilities and available information of the NPs were reported to be weak (Table 1; annex 1). Respondents were more satisfied with accessibility of roads and parking, but complained strongly about lack of shop, restaurant, hotel, hut, toilet and walking tracks/trails. An increase in resources showed an increase in the probability of WTP (Table 4).

Respondents believed that management activities aimed at building trust with local people were weak (Table 2). The majority of respondents also noted that current preservation and management activities were not successful in conserving natural areas and biodiversity. They worried about the future of Iran's biodiversity and habitats. The majority of the respondents (84.6 per cent) pointed out that the current governmental management structure of the NPs needs to be changed; participatory conservation was seen as the best structure (according to definitions by Borrini-Feyerabend et al., 2004; IUCN, 2012).

Information about biodiversity conservation and National Parks: Most respondents had no information about the percentage of Iran in NPs and other PAs (Table 3). The majority were not informed about the last international convention related to PAs and biodiversity (Table 3). Furthermore, it was clear that media resources were not disseminating knowledge and awareness of nature conservation and environmental issues to the public. As most respondents were educated and had access to internet and read news online this shows the weakness in spreading knowledge and information to the public. TV and newspapers have little coverage of water, air, PAs, threatened species or habitat loss; and even climate change and renewable energy receive scant attention.

Clearly there is a need to develop Iran's environmental awareness and consciousness, build community capacity for biodiversity management, resurrect the conservation movement, promote ecotourism and sustainable investment, and strengthen the capacity of NGOs. Village and urban areas need to have nature centres and schools with environmental education programmes that contribute to a conservation ethic which increases the political value of biodiversity. More media space (e.g. TV, radio, etc.) reserved for environmental education will also benefit protection. Creating a biodiversity ethic, however, requires changing the perception of distant biodiversity loss into one in which people all share personal responsibility for, locally and globally.

Ecotourism as a tool for conservation and local development: Ecotourism potentially provides a sustainable approach to tourism development across the world. Visitors in PAs can generate both positive and negative environmental impacts (McCool, 2006). But some efforts show that through developing sustainable ecotourism it can be possible to change attitudes and increase conservation (e.g., Buckley 2012; Hussain et al.,

Parvar Protected Area © Hamid Esmaeil Zadeh

2012; Miller et al., 2012; Kolahi et al., 2012b). There are no statistics about ecotourism in Iran's. However, it is estimated to be very low (BHPAs, 2013), mainly due to the lack of basic infrastructure, facilities and information.

The relationship between nature conservation and ecotourism can be classified into three categories: coexistence, conflict and symbiosis (Budowski, 1976). The survey results showed that there is a potential 'symbiosis' relationship between Iran's NPs, conservation and ecotourism with environment protection enhanced by interactions between conservationists and the ecotourism industry. While responders rejected current unplanned and uncontrolled ecotourism, nearly half believed ecotourism could contribute to the conservation of NPs and associated biodiversity (Table 2).

Almost all respondents were willing to pay an entrance fee (Table 1), and the probability of paying more, unsurprisingly, increases with higher incomes and visitor satisfaction (Table 4). The need for the government to improve incomes and welfare was noted, particularly in the rural sector (Table 5). Most respondents highlighted ecotourism activities as a tool to benefit local people through increased income, education opportunities etc. (Table 1 and 2).

Recreation and ecotourism in Iran's NPs could be sustainable if managers were equipped with sufficient information about the visitors' views and needs. In other words, knowledge of visitor characteristics is essential for recreation planning and management. Informed decision making and sound management of the site and facilities would help, in the long term, to sustain economic benefits of ecotourism in Iran's NPs.

The potential of people' participation in National Park management: The spatial coincidence of people and biodiversity poses a problem for conservation biologists, but also provides an opportunity (Schwartz, 2006). Rosenzweig (2003) presents several successful examples of involving the public in biodiversity conservation.

The survey showed that people were interested in conserving nature and biodiversity, and supported an increase in Iran's PAs (Table 3). Respondents believed

that the conservation of biodiversity is not only the responsibility of the government but also others and that government authorities should allow for more participation in conservation management (Table 2).

Volunteer stewardship programmes are an important way to engage society (Schwartz, 2006), yet relatively a few organized efforts exist in Iran. Given that most of the respondents were willing to participate voluntarily, it is up to the government to consider how participatory conservation between NPs' administrations and the public could be successfully applied. PAs managers should consider mechanisms to help increase public participation by building opportunities for participatory, cooperative science and stewardship. Volunteers can be registered with each national park and be engaged in providing nature interpretation programmes, participating in clean-up operations, undertaking simple repairs of facilities, carrying out nature surveys, etc.

CONCLUSION

Given the speed of degradation of Iran's biodiversity is at least 166 per cent greater than the global average (Darvish, 2006) and all Iran's 'environmental alarm lights' are red (Kolahi et al., 2012a) it is clear the government must quickly act and carefully improve its biodiversity management activities.

NPs and biodiversity conservation in Iran are threatened by mismanagement, lack of funds, park-people conflict, park-other organization conflict (Kolahi et al., 2012a, 2013a, 2014), lack of biodiversity awareness, and lack of public participation. This is highlighted by several respondents to the survey believing that Iran's NPs are 'paper parks', (*sensu* Dudley and Stolton, 1999). The government needs to improve the conditions of NPs and management through financial and active planning support, to hire well-trained staff, enhance infrastructural and service facilities, etc. The government must also try to improve incomes and welfare, particularly in the rural sector.

People should be seen not as a threat but as an opportunity to help achieve broader nature conservation goals. The government should see the human and environmental condition as intricate linked system. If Iran's environmentalists are to move beyond their current isolation, they must reach out and connect to new audiences across the social spectra. Conservation biologists can help engage Iran's society in conservation efforts by striving to achieve three goals: adjusting the public's perception of biodiversity, increasing public participation in biodiversity conservation, and encouraging ecotourism by tour packages to develop conservation and local.

This study, with its socio-political approach, contributed to a greater understanding of the implications of ecotourism management in Iran. In summary, almost all respondents were willing to voluntarily participate in projects related to nature, environment and biodiversity conservation; were willing to pay for protection; wished to see an increase the area of PAs; wanted to visit NPs in the future; and they were mostly young.

Finally, it should be noted that studies in the past used the direct face-to-face interview as their main survey method. We would like to see more online questionnaires in future for the evaluation of environmental problems as these can reach a far wider audience in a far more cost effective manner.

FOOTNOTE

[1] The authors are not supporting the implementation of entrance fee to PAs per se, but the government could, for example, consider payments for tour groups etc.

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Asiatic (Persian) Cheetah (*Acinonyx jubatus venaticus*), Miandasht Wildlife Refuge © Fariborz Heidari

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ANNEX 1: STATISTICAL ANALYSIS

The authors used factor analysis to reduce ten statements of satisfaction into smaller sets of underlying factors. This helped to detect the presence of meaningful patterns among the original variables and to extract the main opinion factors. The authors analyzed answers to the statements related to visiting satisfaction of services, facilities, information, and enjoyment by using principal component analysis (PCA) with varimax orthogonal rotation on ten statements measured by using the five-point Likert scale: (1) strongly disagree, (2) disagree, (3) neutral (neither agree nor disagree or do not know), (4) agree, and (5) strongly agree. We used two factors having an Eigenvalue of more than one in our analysis. PCA was used to identify key dimensions. In the interpretation of the dimensions, only variables with a factor loading greater than 0.40 were extracted (Kim and Muller, 1978, Hair et al., 1995). These data were appropriate for factor analysis according to the Kaiser-Meyer-Olkin measure of sampling adequacy value of 0.858 (Hair et al., 1995). The Bartlett Test of Spherity was significant ($\chi^2 = 3502.590$, $p < 0.001$), indicating that correlations existed among the statements. Two components were found that were rotated into interpretable factors. The two key dimensions identified approximately 52 per cent of the total variance. According to correlations between

component loadings and statements, the first PCA axis represented questions related to NPs' status and the second questions related to enjoyment. Component 1, a status dimension, consisted of six statements (Infrastructural Facilities (e.g., accessible road, parking); Service facilities (e.g., shop, restaurant, hotel, hut); Clean, well presented toilet facilities; Well designed and maintained walking tracks/trails; Collected human waste; and Provided useful guides/maps/information on plants and animals of national park), and component 2, an enjoyment dimension, comprised four statements (Essence, friendly and responsive national park staff and provided information by them; Feeling safe; Able to enjoy nature; and Overall, how happy are you with your visit?). Component 1 accounted for 38.8 per cent of total variance, and component 2 accounted for 13.4 per cent of total variance.

MODEL SPECIFICATION FOR MEASURING WTP

It is assumed that an individual will accept a suggested admission fee for recreation activities (or a suggested tax for preservation), to maximize her/his utility under the following condition (Hanemann, 1984):

$$v(1, Y - A; S) + \varepsilon_1 \geq v(0, Y; S) + \varepsilon_0 \quad (1)$$

and reject it otherwise. Here, v is the indirect utility which is assumed to equal the utility u; Y is income, A is an offer (admission fee or tax), S is other socio-economic characteristics affecting individual preference, and ε_0 and ε_1 are the identically, independently distributed random variables with zero means.

The utility difference (Δv) can be described as follows:

$$\Delta v = v(1, Y - A; s) - v(0, Y; s) + (\varepsilon_1 - \varepsilon_0) \quad (2)$$

The CVM has a binary choice dependent variable which requires a qualitative choice model. The probit and logit models are commonly used qualitative choice methods (Capps and Cramer, 1985). Because of its relative simplicity to compute, the logit model is used in this research. The probability (P_i) that the individual will accept an offer (A) can be expressed as the following logit model (Pindyck and Rubinfeld, 1981; Hanemann, 1989):

$$P_i = F_\eta(\Delta v) = \frac{1}{1 + exp^{-\Delta v}} = \frac{1}{1 + exp^{-(\propto + \beta A + \gamma Y + \theta S)}} \quad (3)$$

where $F_\eta(\Delta v)$ is the cumulative distribution function of a standard logistic variate and some of socio-economic variables are included in this research. $\beta, \gamma,$ and θ are coefficients to be estimated.

Three methods are usually used to compute the value of WTP: the first method, called mean WTP is to calculate the expected value of WTP by numerical integration, ranging from 0 to ∞; the second method, called overall mean WTP is to calculate the expected value of WTP by numerical integration, ranging from -∞ to +∞; and the third method, called truncated mean WTP, is to calculate the expected value of WTP by numerical integration, ranging from 0 to Maximum Bid (A). The last method is preferable because it satisfies consistency with theoretical constraints, statistical efficiency, and ability to be aggregated (Duffield and Patterson, 1991). Thus, the truncated mean WTP is used in this research.

The logit model in Eq. (3) is then estimated using the maximum likelihood estimation method, the most common technique for estimating the logit model (Capps and Cramer, 1985). Once the parameters have been estimated using the maximum likelihood method, then the expected value of WTP can be calculated by numerical integration, ranging from 0 to Maximum Bid (A) as follows:

$$E(WTP) = \int_0^{Max\ A} F_\eta(\Delta v)\, dA = \int_0^{Max\ A} \frac{1}{1 + e^{-(\propto^* + \beta A)}}\, dA \quad (4)$$

where E(WTP) is the expected value of WTP, and $\propto^*$ is the adjusted intercept which was added by the socioeconomic term to the original intercept term of $\propto$. The area under the curve in Eq. (4) can also be used to make inferences of truncated mean of WTP.

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RESUMEN

La amplia diversidad de climas y medios naturales de Irán ofrece posibilidades para utilizar el ecoturismo como herramienta para apoyar la conservación y el desarrollo local. Para sacar provecho de este potencial, es preciso identificar la experiencia del ecoturismo para dirigir las acciones de gestión. Este artículo examina las actitudes de los ecoturistas hacia la conservación y evalúa el valor económico de los parques nacionales de Irán. Dos mil ciento veintiún personas respondieron un cuestionario en línea llevado a cabo en el verano de 2012. La mayoría de los encuestados había visitado al menos uno de los 26 parques nacionales de Irán. La encuesta puso de manifiesto la débil condición de los parques nacionales tanto en términos de su estado como de las actividades de conservación. Casi todos los encuestados, jóvenes en su

mayoría, estaban dispuestos a participar voluntariamente en proyectos relacionados con la naturaleza, el medio ambiente y la conservación de la biodiversidad, a pagar por la protección, aumentar la superficie de las áreas protegidas, y visitar los parques nacionales en el futuro. Opinaron que la conservación de la biodiversidad no es solo responsabilidad del Gobierno sino también de la sociedad en general. Por otra parte, la mayoría de los entrevistados destacó las actividades ecoturísticas como herramienta para beneficiar a la población local. El documento concluye que el Gobierno debería elevar el nivel de conciencia ambiental, desarrollar la capacidad comunitaria para la gestión de la biodiversidad, resucitar el movimiento conservacionista, promover el ecoturismo y la inversión sostenible, fortalecer la capacidad de las ONG, buscar sinergias y crear oportunidades para la gestión participativa y la cooperación científica.

RÉSUMÉ

Le climat et la nature très diversifiés de l'Iran permettent au pays de bénéficier de l'écotourisme comme outil de conservation de la biodiversité et de valorisation du développement local. Afin de réaliser ce potentiel, il faut tirer les enseignements de l'écotourisme et les utiliser pour piloter des actions de gouvernance. Ce document examine les attitudes des écotouristes envers la conservation et évalue les parcs nationaux (PN) Iraniens sur le plan économique. 2121 personnes ont répondu à un questionnaire en ligne réalisé durant l'été 2012. La majorité des répondants ont visité au moins l'un des 26 PN d'Iran. L'enquête a révélé un déficit des PN tant au niveau de leur statut que des activités qui y sont menées pour leur conservation. Presque tous les répondants, la majorité étant des jeunes, se disent prêts à participer bénévolement à des projets liés à la nature, à l'environnement et à la conservation de la biodiversité. Ils se disent également prêts à accroître la superficie des aires protégées, à visiter les PN à l'avenir et à contribuer financièrement à leur promotion. Ils considèrent que la conservation de la biodiversité n'est pas seulement la responsabilité du gouvernement, mais aussi celle de la société en général. En outre, la plupart des répondants mettent en avant l'importance de l'écotourisme en tant qu'outil bénéficiant aux populations locales. Le document conclut que le gouvernement devrait sensibiliser d'avantage la population aux questions environnementales, renforcer les moyens au niveau local pour gérer la biodiversité, ressusciter le mouvement de conservation, promouvoir l'écotourisme et l'investissement durable, renforcer le champ d'action des ONG, rechercher les synergies, et ouvrir la voie à un modèle de gouvernance participatif et communautaire.

REALIZING THE POTENTIAL OF PROTECTED AREAS AS NATURAL SOLUTIONS FOR CLIMATE CHANGE ADAPTATION: INSIGHTS FROM KENYA AND THE AMERICAS

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ABSTRACT

Protected areas play a fundamental role in national, regional, and global climate change adaptation strategies. They safeguard and enhance the resilience of ecosystems and protect clean water and other vital services that human communities rely on for their well-being. This paper highlights how protected areas agencies and their partners in four countries have begun working together to implement ecosystem-based approaches to climate change adaptation. By sharing experiences and knowledge, protected area agencies in Kenya, Mexico, Chile and Colombia have increased local and national capacity to contribute to climate adaptation strategies through research, monitoring, planning, active management and ecological restoration projects. By also identifying opportunities to engage communities and offer meaningful visitor and learning experiences as part of on-the-ground activities, the projects are inspiring citizens and building understanding of how protected areas help address global challenges like climate change.

KEYWORDS: climate change, Kenya, Mexico, Chile, Colombia, adaptation strategies, communities, visitors

INTRODUCTION

Families living near the Tsavo National Parks worry how the changing climate will harm food security and tourism. Downstream communities wonder what increasing droughts mean for their drinking water and livelihoods. Our efforts are strengthening the ecological values of our protected areas to help these communities cope with climate impacts, and are at the same time building support for our protected areas. [Edwin Wanyonj Kenya Wildlife Service]

This paper highlights how ecosystem-based management approaches undertaken by protected area agencies in four countries, in partnership with Parks Canada and in-country partners, are strengthening ecological and societal resilience to climate change. Drawing on examples from Kenya, Mexico, Chile and Colombia, it demonstrates how challenges associated with climate change are being addressed through projects in and around national parks and other protected areas in these countries. These projects are being implemented such that they also broaden public understanding of the role and contribution of protected areas to addressing global challenges and, in doing so, improving human well-being and inspiring people with hope for the future.

THE ROLE OF PROTECTED AREAS IN CLIMATE CHANGE ADAPTATION

Climate change is having marked impacts on the health of ecosystems and the ecosystem services they support. In many areas, it is already causing changes in

Community members participated in removal of invasive plant species in Aberdare, Amboseli, Tsavo East and Lake Nakuru National Parks in Kenya © Kenya Wildlife Service

precipitation patterns, water levels, and frequency and severity of droughts, floods, and fires (IPCC, 2007). In response to changing climatic conditions, species movement and distribution patterns are shifting, the timing of lifecycle events is changing, and pest and disease outbreaks are becoming more frequent, with concomitant effects on wildlife health (Starzomski, 2013). These climate impacts, compounded by habitat loss and fragmentation, pollution, spread of invasive species, and other stressors, are likely to exceed the resilience of some ecosystems to adapt naturally (Fischlin, 2007). Human communities, likewise, increasingly will be affected by changes in the availability of fresh water for drinking or agriculture, loss of crops to disease, and damage to property from storms and floods (IPCC, 2007).

Protected areas are critical for the conservation of biodiversity in periods of rapid environmental change and are predicted to continue to play this role into the future (Johnston et al., 2013). Protected areas provide habitat for native species and opportunities for autonomous adaptation, migration and natural selection processes (e.g., through maintenance of genetic diversity) (Hannah et al., 2007; Hannah, 2009; Environment Canada, 2009; SCBD, 2009). This in turn enhances the resilience of ecological systems and their capacity to respond to climate change impacts such as changing disturbance regimes (Dudley et al., 2010; NAWPA, 2012; CPC, 2013).

Protected areas are also key components of ecosystem-based adaptation (SCBD, 2009; Colls et al., 2009), playing a fundamental role in assisting human adaptation (e.g., SCBD, 2009; Staudinger et al., 2012; Hounsell, 2012; Munang et al., 2013 MacKinnon et al., 2012; NAWPA 2012; Dudley et al., 2010; World Bank, 2009; Mooney et al., 2009). It has long been recognized that healthy ecosystems provide a multitude of ecosystem services that support, for example, food security, clean air and water, and climate regulation (MEA, 2005). They also act as buffers and reduce vulnerability to extreme events. Through their role in maintaining ecosystems and the services they provide, protected areas offer a 'natural solution' for climate change adaptation (e.g., Dudley et al., 2010; NAWPA, 2012; CPC, 2013).

Increased attention to the climate change adaptation benefits of protected areas is occurring at the same time that we are seeing a shift in the role of protected areas in general (Ervin et al., 2010). Whereas historically they were seen as places that were set aside to protect key natural and cultural values, more and more they are expected to provide a diverse range of benefits for biodiversity and for people. As efforts are made to maintain this range of benefits, management intervention is becoming more common (Ervin et al.,

2010; Keenleyside et al., 2012). This is both an opportunity and a challenge for protected area agencies and managers who need to be able to make decisions about how to intervene effectively in an era of rapid change.

Protected areas can also contribute to climate change mitigation through their role in storing and sequestering carbon in healthy ecosystems (e.g., Sharma et al., 2013). We recognize that many of the adaptation actions discussed in this paper (e.g., reforestation efforts in Chile and Kenya, and forest fuel management in Mexico) also have mitigation co-benefits; however, our focus here is on the role of protected areas and their effective management in helping ecosystems and people adapt to change. We focus on projects in Kenya, Colombia, Chile, and Mexico– where protected areas agencies, managers, strategic partners and local stakeholders are taking steps to not only manage the ecological effects of climate change on protected areas and the benefits they provide, but also to do so in a way that engages local communities, users, visitors, and the wider public.

RISING TO THE CHALLENGE: EXAMPLES FROM KENYA AND THE AMERICAS

Protected areas have great potential as natural solutions for climate change adaptation. However, the scope and scale of climate change demands that action be taken in order for that potential to be realized fully. Several frameworks (e.g., MacKinnon et al., 2012; CPC, 2013; NAWPA, 2012) call for protected area agencies around the world to rise to this challenge, by collaborating, regionally, nationally and internationally to:

1. Expand protected areas coverage through enlargement, establishment of new areas, and improved connectivity;
2. Integrate protected areas into wider sectoral development strategies;
3. Improve our understanding of climate change impacts, vulnerabilities, and solutions for parks and protected areas;
4. Improve management and governance of existing protected areas, including actively managing and restoring the ecological integrity of ecosystems;
5. Share knowledge to help grow capacity and ensure effective management of parks and protected areas nationally, regionally, and globally; and
6. Engage and inspire people with hope for the future.

(This 'framework' was modified from MacKinnon et al., 2012 and Canadian Parks Council, 2013)

Thanks in part to a partnership opportunity with Parks Canada provided by the Government of Canada's 'Fast Start Financing' programme, protected area agencies in Kenya, Colombia, Chile, and Mexico are taking actions to meet this challenge. Beginning in mid-2012, and early 2013, protected areas agencies in these countries developed and began implementing climate change adaptation projects that illustrate the role that national parks and other protected areas can play in helping vulnerable communities around the world adapt to climate change. These projects are now at various stages of completion and while their ultimate outcomes have yet to be achieved, work to date provides insights from which other protected area agencies and organizations may benefit.

The adaptation approach adopted in each country was *modelled* on the framework described above, with an emphasis on elements *three through six*. This approach recognizes the importance of achieving conservation success through actions that maintain or restore the natural and cultural values of protected areas while simultaneously facilitating meaningful visitor experience and learning opportunities (e.g., Parks Canada, 2013).

A contextual overview for each of these projects is shared below, followed by highlights of their contributions to realizing the potential of protected areas as natural solutions for climate change adaptation.

COUNTRIES AND PROJECT CONTEXT

Kenya: Higher temperatures and more variable precipitation, along with other climate change effects such as increasing incidences of fire, pests and disease, and human-wildlife conflict, are having adverse affects on the health of wildlife and human communities in Kenya (NEMA, 2013; Herrero, 2010). Rural Kenyans, who rely largely on rain-fed agriculture for their livelihoods and food security, are particularly vulnerable to variations in precipitation that result in more frequent and prolonged droughts, flooding and diminishing water resources (Herrero, 2010). Unsustainable land uses, such as overgrazing, and the spread of invasive species, compounded by climate changes, are degrading ecosystems and the ecosystem services they support (NEMA, 2013).

The Kenya Wildlife Service (KWS), in partnership with the Water Resource Management Authority, and Forest Research Institute, has focused on restoring wetlands, mountain forests and savannah bush ecosystems in six national parks (Amboseli National Park, Tsavo East and Tsavo West National Parks, Mt. Kenya and Aberdare National Parks, and Lake Nakuru National Park). Ecological restoration of these degraded park ecosystems

Páramo ecosystems in Chingaza National Park, Colombia © Parks Canada

is enhancing ecological integrity with benefits for biodiversity, water supply, food security and local livelihoods. Many of these parks are in regions particularly important for water security, with the Mount Kenya and Aberdare forests protecting the headwaters of rivers that supply water for about half of the country's population.

Chile: Glacial melt, shifts in rainfall patterns, expanding deserts, and fluctuations in El Niño impact Chile's water supply, food production, tourism industry and migration, and thereby the country's economy and national security (Ministry of the Environment, 2011). Chile's national territory, which includes the world's driest desert, the high altiplanic plateau, a very long Pacific coast, temperate rainforest and southern Patagonia land, has very high species endemism. The public protected areas system is one of the most important conservation mechanisms in the country. Protected areas are enshrined in the Climate Change Sector Plan, which is part of the National Action Plan for Climate Change, in recognition of the role they play in helping the country adapt to climate change impacts. Chile's Ministry of the Environment (MME), working in close cooperation with the National Forest Corporation (CONAF), has been conducting research and monitoring and planning on-the-ground restoration activities in three public protected areas: the Patagonian ecosystems of the Torres del Paine National Park, high Andean wetlands of Nevado Tres Cruces National Park and the coastal wetlands of El Yali National Reserve. As is described more fully below, these activities are helping to maintain biodiversity in the face of change and are also having important economic and educational benefits.

Colombia: In Colombia, which is one of the world's 'megadiverse' countries, especially for bird species, many natural ecosystems have been degraded, primarily in the Andean and Caribbean regions, as climate change converges with deforestation and other stressors (SCBD, 2014). The National Natural Parks System of Colombia (PNNC), in partnership with *Patrimonio Natural – Fondo para la Biodiversidad y Areas Protegidas*, has been leading multiple initiatives related to protected areas and climate change, including development of a climate change strategy for the PNNC. Work has focused on assessing and reducing the vulnerability of protected areas ecosystems to climate change by integrating climate change considerations into updated management plans for more than 25 protected areas. Detailed plans

are currently being developed for implementation of specific management actions that address identified vulnerabilities in several parks and in some cases action is already being taken.

Mexico: Increases in the frequency and intensity of extreme weather events (e.g., hurricanes and floods) are already having significant impacts in Mexico; particularly in the Caribbean Sea, the Gulf of Mexico and the Mexican portion of the Pacific Ocean. In central and northern regions, the frequency of extreme drought events has increased over the past decade, with water supply expected to decrease by up to 20 per cent over the next 50 years. In 2010, Mexico's National Commission for Protected Areas (CONANP) through its Climate Change Strategy for Protected Areas (CONANP, 2010) has implemented specific mitigation and adaptation goals and actions as part of the country's overall climate change policy. In this project, CONANP, in partnership with Fondo Mexicano para la Conservación de la Naturaleza A.C. (FMCN) is replicating and building on climate adaptation programmes that have been completed in other regions of the country, in alignment with Mexico´s National Climate Change Strategy. In the Northeast and Eastern Sierra Madre region, one of the driest and most vulnerable areas of the country (ENCC, 2013; Government of Canada, 2013), CONANP and FMCN have undertaken four vulnerability assessments with a landscape approach of ecosystems and human communities considering their productive activities to determine concrete and robust adaptation measures. For each adaptation measure one 'on the ground conservation or management project' was defined in addition to the on the ground restoration work undertaken in the five protected areas of the project.

REALIZING THE POTENTIAL

In various ways, these four countries are applying the above framework for realizing the potential of protected areas as natural solutions for climate change adaptation. As is described below these projects are improving our understanding of, and capacities to respond to, climate change impacts and vulnerabilities. That new knowledge is being integrated into protected area management strategies, policies, and plans and, in some cases, action is already being taken to improve protected area management through active management and restoration projects that are aimed at strengthening ecological, institutional, and societal resilience to change. These on-the-ground restoration activities in turn are offering opportunities to engage and inspire people by connecting them to nature and their own communities and giving them the chance to create positive change. As results of these projects unfold, monitoring of climate change impacts and project outcomes will help to inform protected area managers so that project activities can be adjusted appropriately.

Improving understanding: Improving understanding of the likely impacts of climate change, how ecosystems are likely to respond, and the effects of various management approaches, is fundamental to enhancing individual and institutional capacities to adapt to climate change (e.g. Glick et al., 2009; Watson et al., 2012; MacKinnon et al., 2012). In Chile, the MME, in collaboration with CONAF and university researchers, has been increasing baseline knowledge about the hydrological and ecological functions of the wetland complexes of the Nevado Tres Cruces National Park and the El Yali National Reserve (both RAMSAR sites). This knowledge will be fundamental for projecting how these wetlands systems are likely to be affected by climate change and other stressors. As the MME, CONAF, researchers, community members, and other stakeholders collectively understand more about these systems, they are also better equipped to make realistic, practical management decisions and take actions that will enhance the resilience of the wetlands to maintain bird and wildlife populations and water supply, and support the aesthetic and recreational values of the sites.

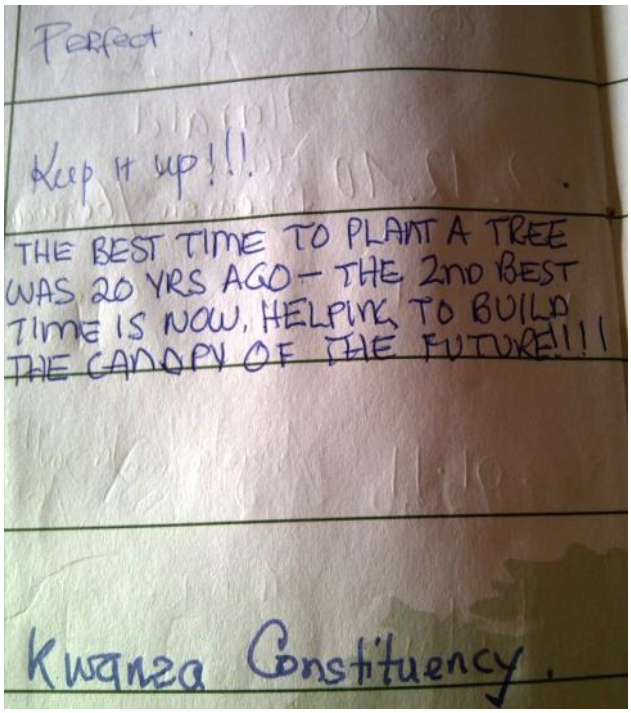
Similarly, in Mexico and Colombia, a solid knowledge base is fundamental to informing climate change vulnerability assessments and park management planning. Outreach activities have helped communities living in and around protected areas to understand the benefits they provide, and how climate change, as well as their own actions (e.g., agricultural practices) can affect the ecosystem services they rely on. Park managers in all countries are also identifying opportunities, for example through citizen science and communication programmes, to engage with the public and visitors in ways that also build knowledge and capacity of institutions and local communities to adapt to climate change.

Improving management through ecological restoration that engages and inspires: In an era of rapid environmental change, ecological restoration is increasingly required to maintain and strengthen resilience of ecosystems (Keenleyside et al., 2012, Hobbs et al., 2010). Overall, ecosystems with high integrity and complexity are more likely to maintain ecological function in face of rapid change (Lemieux et al., 2010; Hooper et al., 2005). Ecological restoration strengthens resilience to climate change by reducing non-climatic stressors and recovering ecosystem processes and functions, as well as by engaging communities in a meaningful way to build their capacity to adapt to

changes (Keenleyside et al., 2012; Heller and Zavaleta, 2009). Best practice principles call for restoration to be *effective*, *efficient* and *engaging* (see Keenleyside et al., 2012; Parks Canada & CPC, 2008).

On-the-ground restoration is an important focus of the projects, particularly in Kenya where park managers undertook a wide range of activities, such as modernizing tree nurseries, planting seedlings removing invasive species, and protecting riparian zones (see Box). In Colombia, Chile and Mexico, ecological restoration activities have also been initiated to reduce the vulnerability of ecosystems and human populations to climate change. For example, in Colombia's Chingaza National Park, park managers are restoring the páramo ecosystem that has been degraded by cattle grazing and other uses. A non-permanent nursery is being constructed to produce material for re-planting native species. The restoration of this site will help maintain the source of drinking water supply for eight million Colombians, including the residents of Bogotá (Buytaert, 2007; Crespo, 2010).

In Chile, accidental fires burned approximately 20,000 ha of Torres del Paine National Park (one of the most visited parks in South America and a UNESCO Biosphere Reserve) during December 2011 and January 2012. A detailed ecological restoration plan has been developed for the park which, when implemented, will help to ensure that the ecological and tourism benefits of the park are maintained despite this potentially-devastating loss. This plan not only addresses recovery from the single fire event, but also a broader strategy to understand and reduce wild-fire risk and increase resilience of the forest ecosystem. The project already has enhanced capacity for ecological restoration efforts in the park. Project partners have expanded and modernized tree nurseries in nearby Puerto Natales, established protocols for growing and planting seedlings, and increased production from approximately 49,000 to approximately 150,000 seedlings per year.



Page from the guest book at Treetops Lodge, Aberdare National Park, Kenya © Parks Canada

Engaging restoration: Ecological restoration that is engaging recognizes and embraces the interrelationships between culture and nature. It encourages people to connect with nature in ways that deepen their sense of attachment to protected areas, and gives them opportunities to discover nature and experience its many benefits, including strengthening their own spiritual balance and well-being. Engaging indigenous/aboriginal and local communities also helps maintain or revive cultural practices as part of the ecological restoration. There is growing scientific evidence that human engagement with and connection to nature has a positive effect on human health and physical and mental well being (e.g., Maller 2005; White et al. 2013; Kuo 2011). In addition, fostering opportunities to connect people with nature and engage visitors and communities in park activities builds support for stewardship of protected areas and their role in climate adaptation (CPC, 2013).

RESTORING MZIMA SPRINGS TO INCREASE WATER SECURITY

Activities to restore the riparian areas of a major water source in Tsavo West National Park in Kenya illustrate how restoration can reduce the influence of non-climatic stressors, protect ecosystem services and help wildlife and human communities adapt to climate impacts, such as drought (see Stolton & Dudley, forthcoming). The Mzima Springs supply 360 million litres of water daily to about 2.5 million people downstream, including residents of the city of Mombasa. Over-grazing by wildlife, particularly by elephants, around the springs was leading to severe habitat degradation, soil erosion and siltation. The installation of a solar-powered electric fence to exclude wildlife is allowing the riparian vegetation to regenerate. In addition, watering sites constructed as alternatives for wildlife about one kilometre away from the springs and away from human populations are helping to reduce human-wildlife conflicts outside the park. Signage installed to explain the restoration project is informing park visitors and the local community about the benefits of healthy wildlife populations to the long-term success of tourism and economy, and of protection of the water supply source for local and downstream communities.

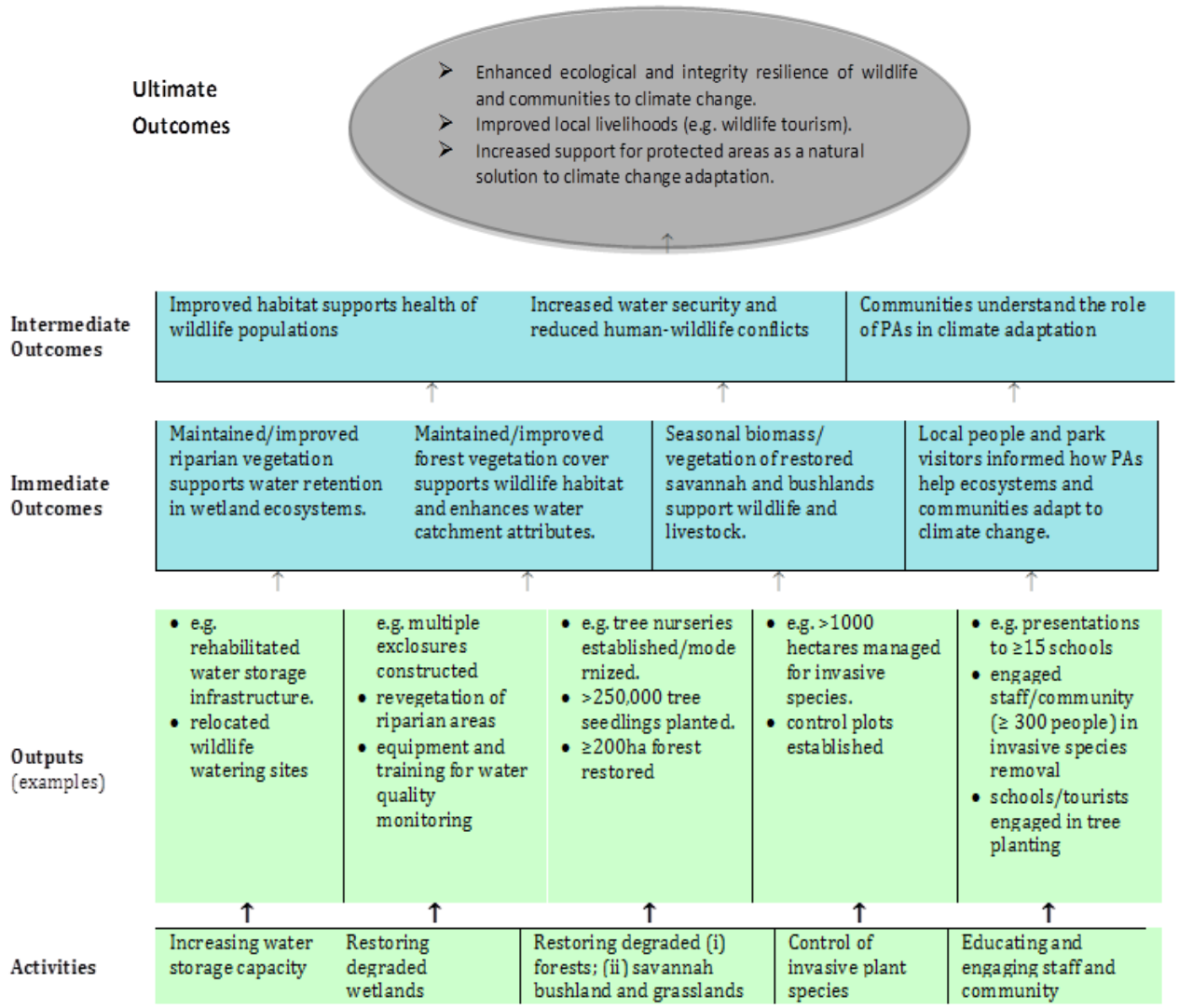


Figure 1: Illustrative linkages between project activities and the short term and long term outcomes of climate adaptation project in Kenya (adapted from Project Logic Model)

In Kenya, Chile, Mexico and Colombia, restoration activities have incorporated opportunities to engage and inform land owners, locals, visitors, and the public about the value of restoring protected areas and how this contributes to climate adaptation. For instance, media coverage of forest restoration in Chile's Torres del Paine NP, where tourism supports many local businesses and families, has heightened public awareness of how healthy park ecosystems contribute to healthy local economies. In addition, youth volunteers are participating in the Torres del Paine restoration project through the engagement of a local ENGO.

In Mexico, adaptation measures of priority conservation targets within the landscape were identified through a participatory vulnerability analysis that incorporated the knowledge and expertise of local communities and key stakeholders, and a public awareness component was added to the on-the-ground restoration activities to inform Mexican and international visitors about the roles protected areas can play in response to climate change.

In Kenya, not only were interpretive signs displayed to inform the public about restoration activities, but in several cases the restoration efforts were identified as visitor attractions, and proposals such as extending game viewing tracks to rehabilitated wildlife watering sites were made. Hundreds of volunteers and school groups participated in invasive species removal and tree planting in different parks, learning from and being inspired by hands-on experience. Visitors to Aberdare National Park were invited to plant trees, and share their reflections in a guest book at Treetops Lodge. The messages left are a testament to the power of engagement, as entry after entry proclaims the deep pleasure experienced by visitors when they contributed to a green future for the country by planting trees as part of restoration efforts in the park.

Figure 1, which is adapted from a project logic model, illustrates how specific activities, outputs, and outcomes are linked with the achievement of the ultimate outcome of enhanced ecological and societal resilience to climate

Fifteen rural communities have been trained in climate change adaptation and mitigation in the Northeast and Eastern Sierra Madre Region, Mexico © Comisión Nacional de Áreas Naturales Protegidas

change. Similar logic models were developed and used to guide project planning and implementation in all four countries.

Sharing knowledge and growing capacity: By collaborating on these projects, our institutional capacities to adapt to climate change have grown, as we have developed and implemented monitoring, research, assessment, planning and active management and restoration programmes that help us better understand and respond to change. In Chile, knowledge gained through research and monitoring of wetland complexes has enhanced the capacity of the Ministry of the Environment and CONAF to manage for change. Similarly, in Colombia, the integration of information on climate change into park management plans, has positioned the PNNC to implement appropriate adaptive management strategies.

Through our work with our partners and communities local capacity is growing too. In Aberdare and Mt Kenya National Parks, for example, 180 community forest association members were trained in modern seedling production to assist with re-forestation of degraded areas inside and outside protected areas. In Mexico, communities in and around Cumbres de Monterrey National Park and other protected areas in the Northeast and Eastern Sierra Madre region have learned about how climate change is likely to affect agriculture and in turn how they may need to adapt their farming practices to cope with these changes. The participatory approach implemented by CONANP and FMCN has also facilitated the exchange of knowledge and lessons learned with other key stakeholders and state governments.

Through collaboration, we also have learned from each other. We have learned that, while climate change and other global changes put immense pressures on protected areas, we can take steps to reduce the impacts of those pressures. We can be part of the solution. In fact, effective management of protected areas is a cost-effective and essential part of the solution. With a solid base of information, drawn from science and other forms of knowledge, we can plan appropriate management interventions that strengthen the resilience of our protected areas and human communities to change. We can implement those actions in a way that engages our visitors, our communities, and other sectors of society. Through participatory engagement, we can build support for project objectives at the outset and help to ensure the sustainability of their results into the future. Perhaps most importantly, we have learned that we can inspire

our communities and other stakeholders with hope for the future as they experience how their protected areas can help them deal with one of the world's most daunting challenges.

Engaging and inspiring people with hope for the future: Fundamentally, delivering on the potential of protected areas as natural solutions for climate change is about increasing the relevance of protected areas to people. By engaging people in activities to enhance resilience of our protected areas and the communities that depend on them, we can connect with their hearts and minds around a complex issue. We know that these emotional and intellectual connections with nature, and with protected areas, are essential for ensuring that people value their protected areas over the long term and take steps to conserve them into the future. Our creativity and innovation can foster and rekindle a passion for nature and allow the emergence of communities, locally to globally, that know that by strengthening the values of our protected areas we also support the well being of current and future generations. Our efforts are protecting 'a future of hope' and the opportunity for the next generations to experience these special places (Latourelle, 2010). In rising to one of the greatest global challenges, we are finding one of our most hopeful solutions.

CONCLUSION

Our four countries have had a special opportunity to work together and learn from each other. Together, we have improved our understanding of challenges and opportunities associated with climate change adaptation, and have developed and implemented active management and restoration projects accordingly. We have built our capacities to manage our protected areas, and by sharing our knowledge and experiences, we are improving capacity locally, regionally, and globally, for protected areas agencies to address climate change impacts. We have worked together in a way that has inspired us about the role that we can play, as protected area managers, in addressing global challenges like climate change; and we have worked with our protected area communities and other stakeholders in a way that has inspired our citizens about these treasured places.

ACKNOWLEDGEMENTS

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RESUMEN

Las áreas protegidas desempeñan un papel fundamental en las estrategias nacionales, regionales y mundiales de adaptación al cambio climático. Aseguran la conservación y resiliencia de los ecosistemas y protegen el agua y otros recursos y servicios que son vitales para el bienestar de las comunidades humanas. En este articulo se destaca la manera en que los responsables de las áreas protegidas y sus socios, en cuatro países, están trabajando conjuntamente para implementar enfoques ecosistémicos, con el objetivo de favorecer la adaptación al cambio climático. Mediante el intercambio de experiencias y conocimientos, las entidades encargadas de áreas protegidas en Kenia, México, Chile y Colombia han ampliado sus capacidades a escala local y nacional en torno al desarrollo de estrategias de adaptación al cambio climático. Estas incluyen el reforzamiento de actividades de investigación, supervisión, planificación y gestión activa así como la implementación de proyectos de restauración ecológica. Paralelamente también se ha identificado vías para reforzar y ampliar la participación comunitaria, ofreciendo a los visitantes atractivas y nuevas experiencias de aprendizaje como parte de las actividades realizadas en el terreno. Estos proyectos se han convertido en una fuente de inspiración para la ciudadanía y han facilitado la comunicación sobre como las áreas protegidas contribuyen a responder a los desafíos mundiales, tales como el cambio climático.

RÉSUMÉ

Les aires protégées jouent un rôle fondamental dans les stratégies d'adaptation au changement climatique au niveau national, régional et mondial. Elles permettent la préservation des écosystèmes, assurent leur résilience et protègent l'eau potable et les autres services essentiels dont dépendent les collectivités humaines pour leur bien être. Cet article met en lumière la façon dont les agences responsables des aires protégées et leurs partenaires, dans quatre pays, ont commencé à collaborer à la mise en place d'approches écosystémiques pour favoriser l'adaptation au changement climatique. En mettant en commun leurs expériences et leur savoir, les agences nationales responsables des aires protégées du Kenya, du Mexique, du Chili, et de la Colombie ont renforcé leur capacité locale et nationale de contribuer aux stratégies d'adaptation au changement climatique par la réalisation de projets de recherche, de surveillance, de planification, de gestion active et de restauration écologique. En mobilisant les collectivités et en offrant des expériences d'apprentissage significatives aux visiteursdans le cadre d'activités sur le terrain, les projets contribuent à inspirer les citoyens et les aident à comprendre le rôle que peuvent jouer les aires protégées face aux enjeux planétaires comme le changement climatique.

THE EUROPEAN NATURA 2000 PROTECTED AREA APPROACH: A PRACTITIONER'S PERSPECTIVE

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ABSTRACT

Natura 2000 is the first and only regional biodiversity protected area approach in the world. Over its 20 years of existence it has been a positive force for conservation, but it has certain limitations. This paper assesses some of its strengths and weaknesses from a practitioner's perspective. Overall, the assessment is positive as without it biodiversity loss would probably have been greater, and with it there is a unique transnational approach. The positive aspects identified are the biogeographical framework, pan-European classification of species and habitats, and the political will to implement it. The negative aspects are that it is a static approach to species and habitat conservation, the Natura approach to biodiversity conservation is being undermined by perverse subsidies from other EU funding mechanisms, especially the Common Agricultural Policy, and the effects of development on the fragmentation of habitats are dominant. Also, in practice, there has been a failure to implement wider countryside and connectivity measures. Lessons relevant to other parts of the world are discussed.

KEYWORDS: Natura 2000, practitioner's perspective, perverse subsidies, connectivity, lessons learned

INTRODUCTION

The European Union (EU) programme for the protection of birds, and of species and habitats has been implemented primarily through Natura 2000. The paper sets out the basis of the approach, assesses the strengths and the weaknesses, identifies some improvements needed and provides lessons for other parts of the world. It is not a definitive and objective assessment. It is written from the perspective of a practitioner involved in implementation of the approach in one EU Member State and with knowledge of protected areas systems around the world (see Crofts, 2008a and 2008b), in the hope of stimulating debate in future issues of *Parks* on this globally significant protected area approach.

THE DIRECTIVES

Natura 2000 is a key element in the implementation of two European Union Directives. Their essential components are as follows.

The Birds Directive*:* Council Directive 79/409/EEC on the Conservation of Wild Birds was approved by the Council of Ministers in 1979 (European Commission, 1979); it is now known in its amended form as Directive 2009/147/EEC. The Directive provides for the protection, management and control of all species of naturally occurring wild birds on the European territory of EU Member States. It has a number of requirements. Member States have to identify areas to be given special protection: for the rare or vulnerable species; for regularly occurring migratory species; and for the protection of wetlands, especially wetlands of international importance. These areas are known as Special Protection Areas (SPAs). There are 195 species and sub-species listed in Annex I.

There are now 5,372 terrestrial SPAs covering 768,141 km² and 874 marine SPAs covering 125,262 km² (European Commission, 2013).

The Habitats and Species Directive*:* The 'Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna' (European Commission, 1992) (called the Habitats Directive hereafter) is much broader than the Birds Directive. Its purpose is 'to promote the maintenance of

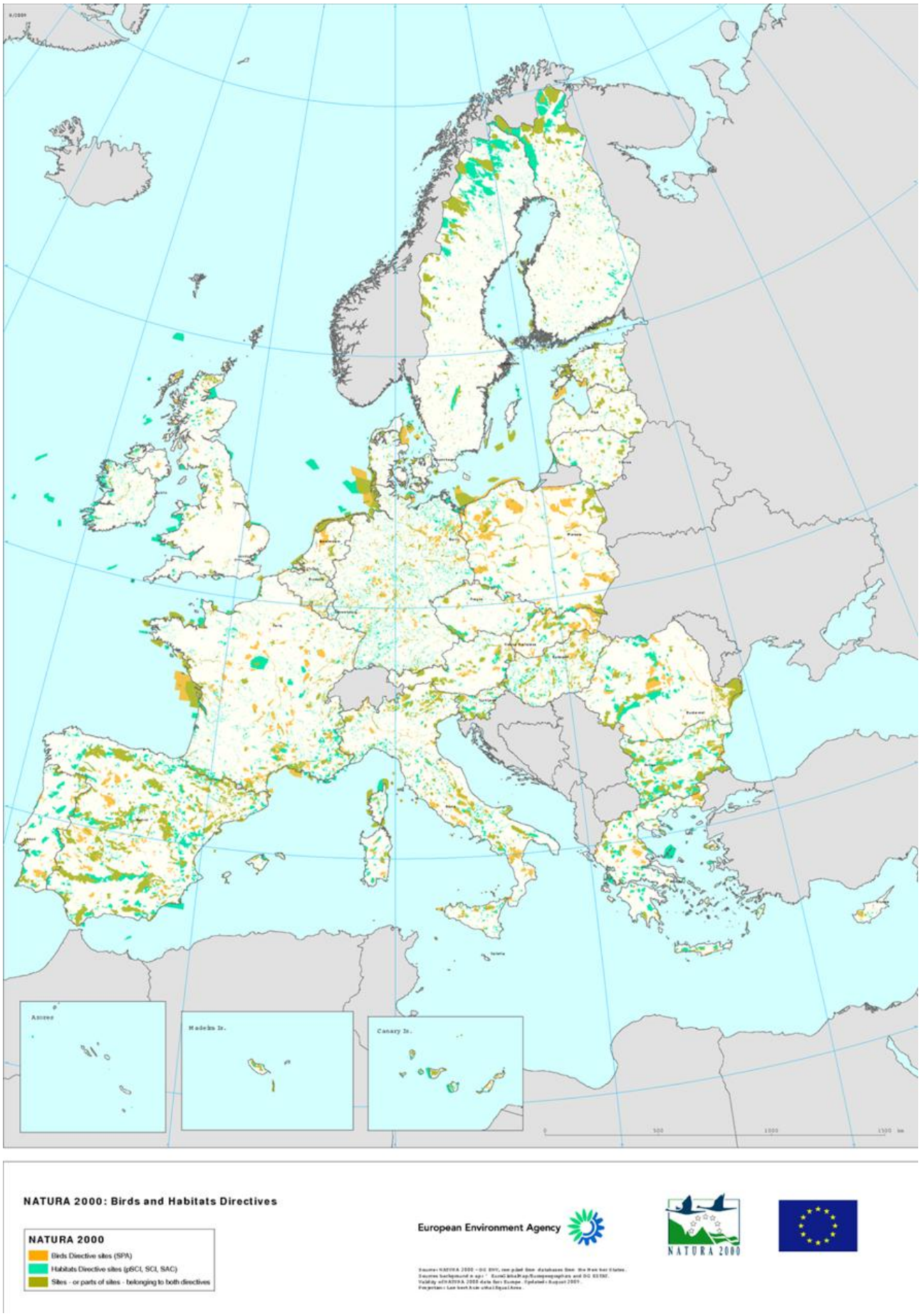


Figure 1 Natura 2000 network in Europe.
Source: www.eea.europa.eu/data-and-maps/figures/natura-2000-birds-and-habitat-directives-1

biodiversity, taking into account economic, social, cultural and regional requirements'. Its aim is to contribute to ensuring biodiversity through the conservation of natural habitats and wild fauna and flora. It provides for the preservation of habitats and species of interest at the regional level of the European Union Member States. It requires Member States to identify sites to be given special protection for the species and habitats listed in the Annexes to the Directive. Sites are identified by Member States. Following scrutiny by the EC, assisted by the European Topic Centre for Nature Conservation in Paris and in consultation with Member States, the selected sites are classified as Sites of Community Importance (SCI). When approved by the EC, the sites are designated by the Member State as a Special Area of Conservation (SAC). Around 200 types of natural and semi-natural habitat, almost 200 animal species and over 500 plant species in need of protection are identified in the Annexes; these include those habitats that have shrunk considerably and those that are outstanding examples of the typical characteristics of the biogeographic regions of the EU. The Directive places special attention on those natural habitats and species that are in danger and defines these as priorities. It requires the implementation of measures to maintain and restore the favourable conservation of all of the species and habitats listed in Annexes I and II. The whole suite of sites for the natural habitats and the habitats of the species listed in the Annexes I and II should form a 'coherent European ecological network of special areas of conservation under the title Natura 2000'.

Sites are selected on the basis of species and habitats being endangered or sensitive at the EU scale within the framework of biogeographical regions, focusing especially on representivity, ecological health, and the size and density of population.

There are now 22,593 terrestrial SCIs covering 585,900 km² and 1,769 marine SCIs covering 202,929 km² (Figure 1). The total number of Natura sites designated under the two Directives is 26,444 with a total area of 1,009,930 km² representing 17.9 per cent of the land area of the 27 Member States. Information on the sites is available at natura2000.eea.europa.eu/#.

POSITIVE COMPONENTS

From the author's practical experience, there are many positive attributes of the Natura 2000 system.

A regional approach*:* Most protected area systems around the world are developed at national level by the national authorities. The Natura 2000 network is the largest and most comprehensive system applied to any region in the world. This is not only important in its own right, but it recognises that species and habitats do not recognise political boundaries. A unified approach across 28 countries is a major achievement.

'Directive' approach*:* The EU Member States have no discretion about whether to implement the Directives. They have to translate the Directives into national legislation, although precisely how that is done is for the national legislature to determine. Member States also have very limited discretion on the number and distribution of sites to be classified in each country as their submissions are scrutinised on a biogeographical region basis by the European Environment Agency. For any development that might be in or impinge on the interests of the species and habitats in a Natura 2000 site, an *appropriate assessment* must be undertaken by the state authorities before any decision is taken. There have been no set timescales for the implementation of the Birds Directive, and although timescales for implementing some of the provisions of the Habitats Directive were set by the European Commission, individual Member States largely ignored them, and were challenged either through the courts or as part of the accession negotiations for new members wishing to join the EU. What freedoms there are relate to the instruments for securing management, the processes for interaction with stakeholders, and the financial instruments used for implementation.

Non-government organisations have complained about slow and weak implementation and called for tougher approaches and decisive implementation. These organisations are ready and willing to take state parties to national courts, or report them to the European Commission, who could take them to the European Court of Justice (ECJ). Critical cases are where state parties have wished to develop major infrastructure projects on existing or proposed Natura 2000 sites on the grounds of overriding public interest. 'Appropriate assessments', under the terms of Article 6 (2), have to be undertaken to assess the implications of the proposals for the integrity of the site. It is possible for development to go ahead if the public interest can be achieved without adversely affecting the integrity of the interests for which the site is designated. In some cases, there have been proposals to modify the boundaries to ensure that the proposed developments are outside the designated area; see for example, the proposed development of the funicular railway in the Cairngorm Mountains of Scotland (Scotland Court of Session, 1998). The resolution of continuing disputes has to be through the courts; in the first instance through courts in the Member State, and if no resolution is found or if the court's judgement is

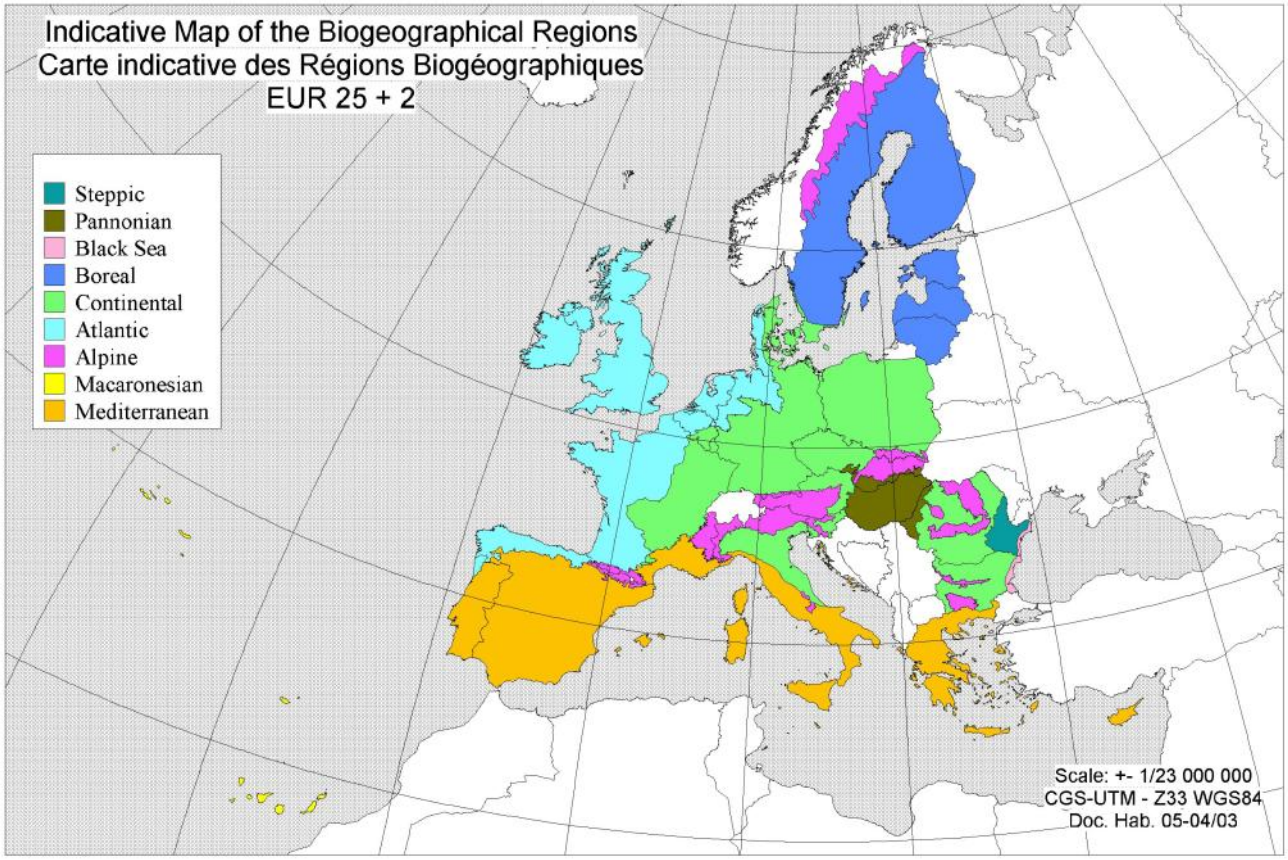


Figure 2: Map of EU bioregions used as basis for site selection
Source: http://ec.europa.eu/environment/nature/natura2000/sites_hab/biogeog_regions/index_en.htm

contested, the case will go to the ECJ. See, for example, the Court of Justice of the European Communities. 1993 case on the Santoña marches, Spain and the Court of Justice of the European Communities 1996 case on Lappel Bank, England. Most of these judgements have clearly articulated the primacy of nature protection and determined that, providing an 'appropriate assessment' under Article 6 has been undertaken and it can be demonstrated that there will be no significant impacts on the species or habitats of the site, a development can go ahead.

The approach is relatively tough, especially when set alongside the oft-stated international concern about the weakness of nation states in implementing their own protected areas mechanisms. On many occasions in different countries, the power of the Directives, the strength of purpose of the European Commission in seeking to influence the Member State's attitude towards protecting sites, and the power of the environmental charities acting as informal policemen, have all been evident and valuable.

Spatial framework*:* In defining a network of protected areas, best international practice is to take a systematic and strategic approach across the whole territory based on biogeographical regions. Within these regions both representative and unique species and habitats are identified, and spatial connectivity between the sites, through corridors and networks, is assessed (see Crofts, 2004).

Natura 2000 goes someway in the direction of best practice. The land territory of the Member States has been subdivided into nine biogeographical regions (Figure 2). Analysis of the distribution of species and habitats is undertaken within this spatial framework and the best and most representative sites and areas chosen to be part of the Natura 2000 network. This is a major step forward in many EU Member States. It has also encouraged informal knowledge networks.

Wider countryside mechanisms*:* It is generally recognised that protected areas can only play their role of protecting species and habitats in good ecological condition if the management of the surrounding territory is sympathetic to the management objectives within the protected areas (see, for example, Worboys et al., 2010).

The provision under Article 10 of the Habitats Directive to develop and implement 'wider countryside measures', which is advisory and not compulsory, is particularly

necessary in the EU as natural habitats and the species dependent on them have been reduced in size and become fragmented by intensive agricultural practice through the implementation of the EU Common Agricultural Policy, the development of transport and other infrastructure, and in some countries by the development of commercial forestry (EEA, 2012). This was a far-sighted provision and has since been supported by the provisions for whole catchment management in the Framework Water Directive (European Commission, 2000).

Species and habitats and link to biodiversity*:* The best protected area systems should ensure that there is a direct link between species and habitat protection and the safeguarding of biodiversity and stemming the loss of species and the fragmentation of habitats (see Adams, 1996). The Birds Directive focussed entirely on this species, perhaps as a result of the greater organisation and influence of the bird protection NGOs in the 1970s. Birds are also species whose population trends are more easily monitored and more generally noticed by the general public. However, the Habitats Directive moved beyond the purely species protection approach to a combination of specific species protection alongside protection of major habitats of European significance. This enabled the individual species, irrespective of whether they were rare, endemic or commonplace, to be protected.

The Directives and subsequent decisions by the Council of Ministers, such as the Sixth Environmental Action Programme (European Commission, 2002) and the El Teide Declaration (European Commission, 2002) and the Malahide Declaration (European Commission, 2003), have all reinforced the central importance of Natura 2000 in delivering the European Union's biodiversity strategy. The latter has reinforced the importance of the two Directives as crucial instruments in the delivery of the biodiversity strategy. It also represents a strengthening of the political will of the EU to deliver improved biodiversity conservation through protected areas.

Terrestrial and marine: Many protected area systems around the world treat terrestrial systems separately from marine, partly a reflection of the early date of many systems and partly a lack of recognition of the importance of linkages between terrestrial and marine ecosystems.

Both EU Directives protect terrestrial and marine species and habitats. The Birds Directive is dependent for its implementation on identifying and classifying bird feeding and seasonal roosting areas at sea for species that nest and breed on land. The Habitats and Species Directive identifies a number of habitats and also species that are entirely marine. A legal challenge was made by the NGO Greenpeace in the UK to clarify whether the Directive applies only to the territorial limits up to 12 natural miles, or throughout the waters where Member States exert their powers. The UK High Court concluded that the Directive is applicable to the UK continental shelf and the waters above the sea bed up to the limit of 200 nautical miles from the baseline. This was a valuable legal clarification and has probably forced the hand of other Member States to designate Natura 2000 marine sites.

Ecological maintenance and restoration*:* A great deal of effort on protected areas around the world has been on their identification and designation, and relatively much less on their maintenance and even less still on their restoration (see, for example, Hockings et al., 2006). Natura 2000 breaks new ground on restoration and maintenance in two respects. First, the Habitats Directive makes specific provision for the maintenance of ecological quality in requiring the achievement of *favourable conservation status*. This is vitally important in countries which have been settled for a number of millennia where many of the habitats are not wholly natural, as they have been subject to human intervention at some stage in their history. Also, some habitats are a result of human intervention so that if this is withdrawn the attributes of nature conservation significance will be lost; an example is the moors and heaths of western Europe dominated by *Calluna* and *Erica* species.

The second important respect is the concept of restoration. Here the Habitats Directive breaks new ground by providing for the possibility of the identification and designation of habitats that are currently degraded and not at the appropriate level of ecological health. This is recognition of the attrition which certain types of habitat have experienced, especially the various types of mire systems through drainage, and the possibility of active management returning them to a better ecological state.

In addition, Article 17 of the Directive places a requirement on Member States for reporting on conservation status.

Use of existing protected areas*:* In many parts of the world, an individual protected area can have many designations and labels attached to it in fulfilment of the national, regional and international status of the site.

The two Directives require selection of sites without reference to existing designations. But one of the practical aspects of the implementation of Natura 2000 sites is the use of existing protected areas in many Member States. This has the advantage of building on already tried and tested approaches, using existing management objectives and management experience, and building on existing relationships with owners and occupiers of the sites. However, from the experience in the UK and Finland, for example, national governments have often been keen to use existing sites to reduce the possibility of further protected area designation which are often unpopular with business interests and local communities, as well as with politicians.

A CRITIQUE

There are aspects of Natura 2000 which do not compare favourably with the lessons learned globally by practitioners within the WCPA network (see for example, Lockwood et al., 2006). Three basic criticisms are identified: it is a narrow approach to species and habitat protection, it fails to stimulate the engagement of key stakeholders, and the implementation mechanisms are totally inadequate.

(1) Narrow approach

Natura is not the most modern approach to the protection of species and habitats. The up to date approaches ensure that sites are buffered from activities and their effects beyond their boundaries, and are networked in practice through linking corridors especially to allow migration of species (see review in Crofts, 2004). Modern approaches also recognise that changes will occur, as a result of natural and/or human-induced changes, which will necessitate additional sites and in places de-designation where the interests are no longer there (see Adams, 1996). And protected areas are recognised as providing vital ecosystem services (Lockwood et al., 2006). By contrast, Natura 2000 focuses on site based protection, with little emphasis on buffering sites and only weak advice on developing linked networks. So the term 'network' applied frequently to Natura 2000 by the European Commission is incorrect.

There are a number of specific weaknesses.

Wider countryside and ecosystem scale measures given inadequate attention*:* Natura 2000 has been implemented by Member States as a largely a site-based approach, rather than a whole landscape approach. Although the 'wider countryside' provisions exist, these have not been a factor in the remorseless battle between Member States and the European Commission on the identification of sites. Linkages and stepping stones are only considered in the narrow context of the specific species and habitats which are protected within the Natura 2000 sites. The Directives do not demand the use of these provisions: they are discretionary. This is an important issue in Europe where habitat fragmentation has been a major cause of habitat and species loss (Crofts, 2008a). It is a pity that Member States and the Commission have not used the lessons from the exemplary approaches taken in The Netherlands and in some central and east European Member States in developing ecological corridors and networks. Despite the good work of individual Member States, a coherent approach across the regional 'network', in the real sense of the term, has not been achieved.

Static approach to biodiversity conservation*:* The exemplary approach to protected areas is to recognise that the species and habitats are subject to natural changes (see Hockings et al., 2006). In addition, the impacts of human activity directly on the sites and indirectly through climate change should be taken into account in the management strategy and action (see, for example, Dudley et al., 2010). The concepts underlying the Natura system are a static approach with no recognition given to the likely loss of habitats and species due to a combination of natural and/or human induced changes.

(2) Lack of stimulus to involve key stakeholders

The best protected areas systems have the following characteristics: a combination of top/down and bottom/up approaches; engagement of key stakeholders at all stages in the process of identification, designation and management; and recognition of the different levels of authority in devolved systems of administration of nature protection in some countries (Phillips, 2003; Lockwood et al., 2006). In contrast, the Natura 2000 sites have been identified and designated in a manner which ignores best practice, with a number of consequences.

Top/down approach*:* First and foremost, Natura 2000 is very dirigiste approach to nature conservation. It was left to each Member State to determine whether to establish means of consultation with key stakeholders, however informal. It was a major oversight by the European Commission not to include such a facility in the original prescription for the Habitats Directive. In the diverse societies within the EU, it is difficult to stop those who consider that their interests have been or are likely to be affected not having a voice in the decision-making process. More direction from the Commission to Member States itself would have been of benefit in allaying the fears and concerns of stakeholders.

Coastal lagoon habitat for bird protection; greater flamingo (*Phoenicopterus ruber*) flock. Camargue, France © Roger Leguen / WWF-Canon

The only way forward in some countries was for the implementation agency to take the matter into its own hands and establish a consultation process. However, the consultation could only be on a limited basis because of the way the Directives are worded: did those consulted agree or otherwise with the scientific case for classification of the site? This was a very difficult question for many stakeholders to answer as they had neither the scientific expertise nor the information to challenge the conservation experts. This lead in some instances in Scotland, for example, to protestors hiring their own nature conservation experts to challenge the case put forward by the state agencies. In retrospect, this was a valuable exercise as it forced a more rigorous approach to be taken by the state agencies. Although use of formal procedures for effective engagement with key stakeholders would have would have lengthened the timescales for agreeing sites to be designated, it would have probably resulted in more durable agreements between the interests.

Failure to recognise delivery on private land*:* The scale of requirements for sites and areas under the two Directives meant that in many EU Member States it has not been possible to satisfy them purely on land owned by the state. In some countries, protected areas on private land have been a long tradition, for example in the UK and in Finland.

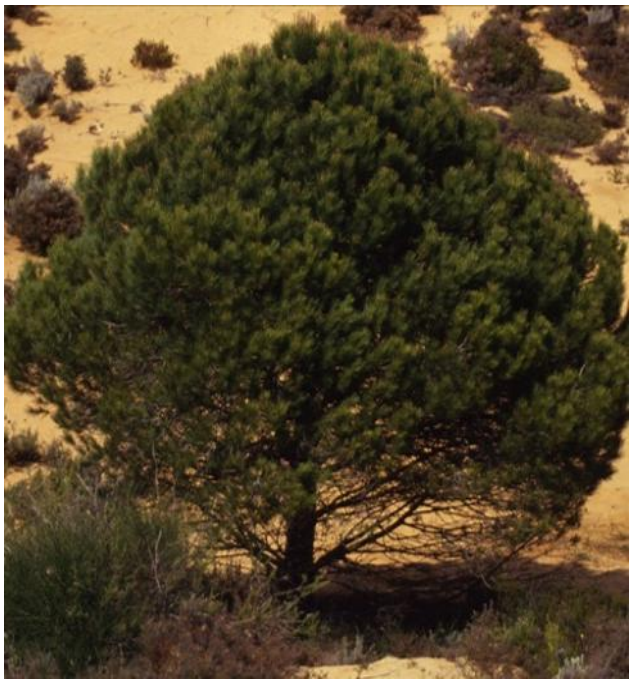
This 'directive' approach inevitably leads to much dissatisfaction, many protests, and a great deal of legal challenge. Perhaps Finland is the best, or worst, example of this outcome: there were around 14,000 cases taken to the courts in protest at the application of Natura 2000 onto private land. Although these were all resolved, it did prolong the timescale and, more significantly, tainted the view of many private landowners towards the Directives and to the role of the EU more generally.

Non resolution of 2 and 3 tier systems in Member States: In some Member States, such as Austria, Germany and Spain, nature conservation is delegated to the provincial or regional levels of government. This lead to tensions between the national government with responsibility for implementing the Directive and the lower tiers of administration which wished to retain their legal independence on matters delegated to them.

(3) Inadequate implementation mechanisms

The best protected areas systems have the following characteristics: financial assessment of the costs of all stages in the process, appropriate financial mechanisms and resource allocation to ensure that the necessary tasks can be undertaken both in the short and longer terms, and the revision of those policies and programmes whose continuation would impact on or hinder the implementation of the protected areas measures (Phillips, 2003; Lockwood et al., 2006). The Natura 2000 system does not perform well when assessed against these standards.

Failure to align all policies and programmes to support*:* In the EU, policies and associated funding instruments for regional development, infrastructure improvement, agriculture, and fisheries have substantial political support compared with policies for nature and biodiversity conservation. More significantly, the resources available to support the implementation of these policies, most especially the Common Agriculture Policy, are very significantly greater than the budgets available for implementing Natura 2000. There have been attempts to transform these policies to make them



Coto Doñana National Park, Spain: large wetland, shrub and sand dune area internationally important for migrating birds and the Imperial Eagle © Michel Gunther / WWF-Canon

more environmentally friendly, for example the Maastricht Treaty, the EC Communication introducing the Biodiversity Strategy, the El Teide and Malahide declarations and the European Parliament Resolutions (for example, on the EU Biodiversity Strategy, 20th April 2012) and the conclusions of relevant Council meetings (for example, 19th December 2011). The Mid-Term Review of the CAP, implemented over the past decade in Member States, is perhaps the most far-reaching step as no support for agriculture is now provided to farmers without their compliance to a strict code of environmental practice. However, the recently agreed revision of the Common Agricultural Policy is arguably a retrogressive step as compliance with nature protection is not changed in a positive direction as the European Commission originally proposed, demonstrating the power of the agricultural lobby in Europe compared with the nature conservation lobby. There have been instances where Member State governments have been threatened with removal of access to certain EC funds unless they improve their performance on the implementation of Natura 2000, for example, Bulgaria and Romania. These approaches are helpful, but there is not a universally agreed approach linking compliance with agreed EU Directives with the provision of funds for programmes and projects which might cause problems.

No specific EU funding line for implementation*:* Funds available for the implementation of Natura 2000 and the funds approved by the European Council and the Parliament are totally inadequate for implementing the provisions of the two Directives. First, Article 8 only refers to priority species and habitats rather than the whole suite listed in the annexes to the Directives and is an ineffective instrument for co-financing the implementation of Natura 2000. More important is the fact that the funds available for implementing Natura 2000 are miniscule when compared with the assessments of resources undertaken a few years ago. This is in complete disregard of the provisions in Article 8 for the co-financing of management measures by the EC in sites containing priority species or habitats. It ignores the amount of co-financing that might be required and does not provide new money but rather relies on existing sources which are defined for different purposes, are not complementary with each other and none are available on a long-term basis. The costs of financing implementation are calculated at €6bn pa but only between 9 and 19 per cent are provided (Kettunen, 2011). Options for improving funding have been identified, but consistently these have not been agreed by the collective decision of Member States through the Council or the elected members through the Parliament. This is a case of determining the project but failing to will the means of its achievement and therefore is bad practice in implementing a regional protected areas mechanism. Also, it is interesting to note that no formal assessment of funding was undertaken until 10 years after the approval of the Habitats Directive.

Spatial units too coarse: Subdividing the EU territory into units to reflect the great diversity of its biogeography could undoubtedly lead to too many units to make a pan-European system manageable. However, the biogeographic regions used in the selection of species and habitats are too coarse grained. For example, the Atlantic Biogeographical Region comprises at least 3 major habitat types and their associated species compositions: arctic/alpine, upland heaths, and lowland grasslands. Although the influence of the temperate maritime climate is evident over much of the sub-region, there are other critical factors, especially altitude, which mean that the biogeographical units on the ground are much more complicated than depicted on the maps. Also, selecting the biogeographical regions was not based on sound science, nor subject to a process of expert consultation.

Inconsistencies in dealing with additional countries: New Member States joining the EU has meant that the biogeographic regions have been added to or extended in a piecemeal way; and reflect a pragmatism not applied to the definition of the original regions. Also, the system has not been able to recognise the impact of new Member States on the allocation of biogeographical

Table 1 Summary of strengths and weaknesses of Natura 2000

Strengths	Weaknesses
Regional, transnational approach	Not all Member States took it as seriously as they should have
Based on biogeographic regions	More rational approach to selection of regions
Common classification of species and habitats	Unsystematic in subdivision of habitats
Site and area focus	Lacks focus on connectivity
Encouragement to restore habitats	Selection of priority habitats unsystematic
Encouragement to re-introduce lost species	Little activity in most Member States
Expert scientific basis	Difficult for non-expert to engage
Top down approach ensures action	Top down approach causes conflict with key stakeholders
eNGOs played positive role in implementation	Opponents feel that eNGOs have too much influence
Natura key EU biodiversity mechanism	Other EU policies in opposition with perverse incentives
Responsibility on Member State to resource	No additional resources provided

regions. In Scotland, for example, many arctic/alpine species are common with the Nordic countries, but it was classed as part of the Atlantic Region originally and no changes were made following the accession of Sweden and Finland to the EU which are assigned to either the Boreal Region or the Alpine Region.

Species and habitats unbalanced*:* Protected areas should ensure that the whole range of species and habitats are represented recognising the variations in size and scale (see Adams, 1996).

The listing of species and habitats in the 1992 Directive displays a very unbalanced approach. Some major habitats are collapsed together and others are sub-divided to an extraordinary degree. A number of examples are taken from the largest sub-region, Atlantic.

Marine and brackish water fjords and rias are characteristic of west coasts of Europe with variations in salinity, depth and species. Yet, the 1992 Directive excludes these unless they are 'large shallow inlets and bays'. On the other hand, the coastal sand dunes of the Atlantic, North Sea and Baltic coasts are subdivided into 17 types based on subtleties in vegetation types. Another example of imbalance is the vagueness of 'sandbanks which are largely covered by sea water all of the time', compared with six different types of scree (talus).

ASSESSMENT

The focus of this review is whether Natura 2000 is a model protected area mechanism for biodiversity conservation. There are two critical questions: has biodiversity conservation improved as a result of the system and what lessons can be learned for use in other parts of the world.

Has Natura been success? The first issue to address is whether the Natura sites are protected areas according to the IUCN definition (Dudley, 2008). In the work undertaken by the IUCN National Committee for the UK *Putting Nature on the Map* (Crofts & Phillips, 2013), the Assessment Panel concluded that Natura sites did pass the IUCN definition test and that they are protected areas.

Overall, the preceding analysis concludes that the basic concept of the two Directives and the way they have been implemented has both strengths and weaknesses. These are summarised in Table 1.

The requirement for all existing, 15 at the start and now 28, Member States to comply is a great strength of the Natura 2000 system. There is now a systematic pan-European approach to the protection of all significant species and habitats which did not previously exist. This exists in perpetuity, except in the unlikely event there is a major political upheaval to remove or dilute all of the EU's environmental directives. No other part of the world has achieved such a focussed and non-discretionary approach. Janez Potočnik, the current European Commissioner for Environment said "I very much doubt that 20 years ago, people imagined that the European Union would one day be home to the largest coordinated international network of protected areas in the world" (European Commission, 2013). Despite this point, the Commission has made it clear that the task of identifying and designating sites is not completed, although it is complete for five Member States: Denmark, Hungary, Ireland, Luxemburg and The Netherlands (European Commission, 2013).

It is difficult to determine from available statistics whether biodiversity conservation has improved.

Table 2: Habitats and species trends in the Europe (%)

Trend	Terrestrial habitats	Terrestrial species	Marine habitats	Marine species
Unfavourable bad	37	22	20	13
Unfavourable inadequate	28	30	30	11
Favourable	17	17	10	2
Unknown	18	31	40	74

Source: Compiled from EEA, 2010, *EU 2010 Biodiversity Baseline*, EEA Technical report No 12/2010 (www.eea.europa. eu/ publications/eu-2010-biodiversity-baseline/?b_ start:int=12&-C=)

Certainly, there were many species and habitats still in an 'unfavourable state' in the 2001-06 monitoring report (bd.eionet.europa.eu/activities/Reporting/Article_17/ Reports_2007/chapter8). More recent results are not yet available, but informal indications are that there are some slight improvements. Table 2 provides an overview of habitat and species trends. It shows a high proportion of unfavourable trends. Add to this the effects of land use practices and infrastructure development on the fragmentation of habitats, it is probably justifiable to state that without the Natura 2000 network the state of biodiversity conservation would have been much worse. Whether the management of protected areas has improved as a result of implementation of Natura 2000 is a mute point. Certainly, the requirement to achieve *favourable conservation status* is over time likely to lead to improvements, but unless sanctions are applied then there is little incentive for Member States to ensure that this happens. Perhaps the increasing availability of common standards of monitoring and means of measuring effectiveness of management, as for example developed by WCPA experts (see Hockings et al., 2006), has had and will continue to have as much effect. Only detailed assessment will be able to ascertain whether this is correct.

Some elements are in need for improvement to improve biodiversity conservation. At a technical level, there is the need to make sure that the linkages between protected areas are a central part of the system and a whole landscape approach is taken rather than a focus on isolated sites and areas. More fundamental is the need to remove the perverse subsidies to farmers through the Common Agricultural Policy as this actively ignores the role of these actors as stewards of the environment and its natural biodiversity, including Natura 2000 sites.

The slow pace of implementation of Natura 2000 has proved to be frustrating for the EC. But the political processes within the European Union have been part of the problem, if not perhaps the major cause for many of the reasons stated in the critique. International experience suggests that lack of engagement of key stakeholders, lack of financial mechanisms and lack of policy coherence will all significantly delay the implementation of a new mechanism. The conclusion, therefore, is that the EU, through the offices of its Commission should have identified and resolved these issues at the outset of the process of implementation and should have provided adequate guidance and advice, rather than leaving many key aspects to be wrestled with in different ways by individual Member States.

As a result of this vacuum, there has been a great deal of variation between Member States in the willingness to implement, the pace of activity and the processes used. The approach to nature protection adopted, fails to link ecologically the protected areas with the surrounding territory, and does not recognise the dynamics of nature and the effects of human activities on nature. In a continent where loss of species and habitats continues and there is fragmentation of the small areas that are left, the Natura 2000 scheme has proved to be a significant benefit. In addition, it is increasingly seen as a tool for encouraging greater public interest in and engagement with nature in Europe's special natural places.

Lessons for elsewhere*:* No doubt if the authorities were devising the Natura 2000 system now it would have looked very different from the one in place for the past 20 years. Nevertheless, there are some crucial aspects which are likely to have remained broadly the same and bear consideration for application elsewhere. First, and foremost, is the ability to implement a scheme across national boundaries through the political will of individual countries acting collectively and which are part of a multi-facetted organisation bound by legal agreement. With similar, but not so legalistic arrangements in other continents and regions, it is worth exploring whether there is political willingness to develop continent- or region-wide schemes. Second, the technical design of the system has some important pointers for application elsewhere, especially the use of a biogeographical framework and the use of a common classification of species and habitats for selecting sites and areas, and the use of specialist, independent technical teams to review and adjudicate on the selection of sites.

Red squirrel (*Sciurus vulgaris*) in Cairngorms National Park, Scotland: species of European Community Interest listed in Annex 4 of the Directive in need of strict protection © Wild Wonders of Europe /Peter Cairns / WWF

There are also lessons from the poor performance in the EU to be learned if others adopt similar transnational approaches. Three are fundamental. First, top-down approaches are negative, result in legitimate opposition from affected parties, especially private owners, and result in longer timescales and high costs through legal challenges through the courts. Second, all policies and financial instruments which have or could have a perverse effect on biodiversity need to be addressed and hopefully resolved, otherwise, however well conceived the biodiversity conservation measures are, they will not be effective. Third, as is well known in some continents, but not in Europe, large scale connectivity measures are needed to cope with species migration and with the effects of climate change on the distribution of species and habitats.

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RESUMEN

Natura 2000 es la primera y la única red regional de espacios protegidos para la conservación de la biodiversidad dentro de la Unión Europea. Si bien durante sus 20 años de existencia ha sido una fuerza positiva para la conservación, tiene ciertas limitaciones. Este documento evalúa algunas de sus fortalezas y debilidades desde la perspectiva de un profesional. La evaluación es positiva en general, por cuanto sin ella la pérdida de biodiversidad probablemente habría sido mayor, y con ella se facilita un planteamiento transnacional único. Los aspectos positivos identificados son el marco biogeográfico, la clasificación paneuropea de especies y hábitats, y la voluntad política para ponerla en práctica. Entre los aspectos negativos cabe destacar la naturaleza estática del enfoque de Natura a las especies y la conservación del hábitat, así como el hecho de que el planteamiento de Natura para la conservación de la biodiversidad está siendo socavado por los subsidios perversos de otros mecanismos de financiación de la UE, siendo especialmente dominantes la Política Agrícola Común y los efectos del desarrollo con respecto a la fragmentación de los hábitats. Además, en la práctica, ha habido omisión en la adopción de medidas más amplias a nivel de paisaje y de conectividad. Se examinan lecciones que podrían ser útiles para otras partes del mundo.

RÉSUMÉ

Natura 2000 constitue la première et la seule approche régionale de la biodiversité des aires protégées au monde. Au cours de ses 20 ans d'existence, elle a été une force positive pour la conservation, mais elle est néanmoins sujette à certaines limites. Ce document évalue quelques unes de ses forces et ses faiblesses du point de vue d'un praticien. Dans l'ensemble, l'évaluation est positive, car sans cette initiative l'appauvrissement de la biodiversité aurait probablement été plus conséquent, sans compter que son approche transnationale est unique. Les aspects positifs identifiés sont donc le cadre biogéographique, la classification paneuropéenne des espèces et des habitats, ainsi que la volonté politique de la mettre en œuvre. Les aspects négatifs sont en revanche son approche statique de la conservation des espèces et de l'habitat, le fait que l'approche Natura de la préservation de la biodiversité est constamment compromise par des subventions aux effets pervers provenant d'autres mécanismes européens de financement, résultant en particulier de la Politique Agricole Commune, et enfin les effets qu'a le développement sur la fragmentation des habitats. En outre, dans la pratique, on a constaté une carence dans la mise en œuvre de mesures plus extensives touchant à l'environnement et à la connectivité. Nous tentons d'en tirer des leçons pour d'autres parties du monde.

PATTERNS AND EXTENT OF THREATS TO THE PROTECTED AREAS OF BANGLADESH: THE NEED FOR A RELOOK AT CONSERVATION STRATEGIES

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ABSTRACT

The protected areas of Bangladesh are subject to a range of threats, making the country's biodiversity conservation programme fragile. Understanding the type, pattern, and extent of these threats is a crucial step towards effective protected area management. This study attempted to assess the relative severity of threats to protected areas and the degree of susceptibility of protected areas to those threats. 102 officials from the 34 protected areas were interviewed electronically. Ten potential threats were identified. The most severe threats were: fund shortages and policy level disorganization; illegal tree cutting; unsustainable forest resource extraction; forestland encroachment; and wildlife poaching and smuggling. The findings indicate that protected areas throughout the entire ecosystem are at risk, and that threats vary geographically. One-third of the protected areas were susceptible to 80 per cent of the threats. Protected areas in the tropical moist evergreen and semi-evergreen forests of hilly regions were highly subject to illegal wood cutting; while those in tropical moist deciduous forests of plain land area were prone to encroachment for settlement and agriculture, and those in mangrove forests of littoral zones were extremely vulnerable to wildlife poaching. Developing rapid strategies to mitigate for these threats, with multi-sectorial coordination and stakeholder involvement, is essential to managing protected areas properly and to reduce the continuing loss of biodiversity in Bangladesh.

KEYWORDS: threat analysis, illegal wood cutting, encroachment, poaching, Bangladesh, protected areas

INTRODUCTION

Halting biodiversity loss is considered a comprehensive global environmental challenge (Brashares et al., 2004; Cardinale et al., 2012; Craigie et al., 2010; Cuthbert, 2010; Krause & Zambonino, 2013). Habitat loss and over -exploitation of wildlife, and other forest resources, are universally acknowledged as the leading causes of biodiversity loss (Baldus, 2008; Brooks et al., 2002), the situation is most severe in the tropical regions (Leuschner et al., 2013). Human population growth, particularly in developing countries, has profound effects on consumption patterns of land and wild resources, and is an indirect driver of biodiversity loss (Kideghesho, 2009; Michel, 2008). The role played by humans, both in Bangladesh and around the globe, in the extinction or reduction of many species of plants and animals is commonly recognized (Grignolio et al., 2011). The fight against biodiversity loss has become a priority for both governments and nature conservation organizations worldwide (Lambooy & Levashova, 2011), and various approaches to tackle the drivers of biodiversity loss have emerged in the past few decades (Vatn et al., 2011).

Bangladesh is a signatory party of the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and thereby, has been undertaking efforts in biodiversity conservation (MoEF, 2014). Declaration of forests, or parts of forests, as protected areas in Bangladesh dates back to 1960s under the provision of the Forest Act 1927 and the later comprehensive legislative instrument, the Bangladesh Wildlife (Preservation) Order 1973 (Chowdhury et al., 2009). Conservation was further articulated in the

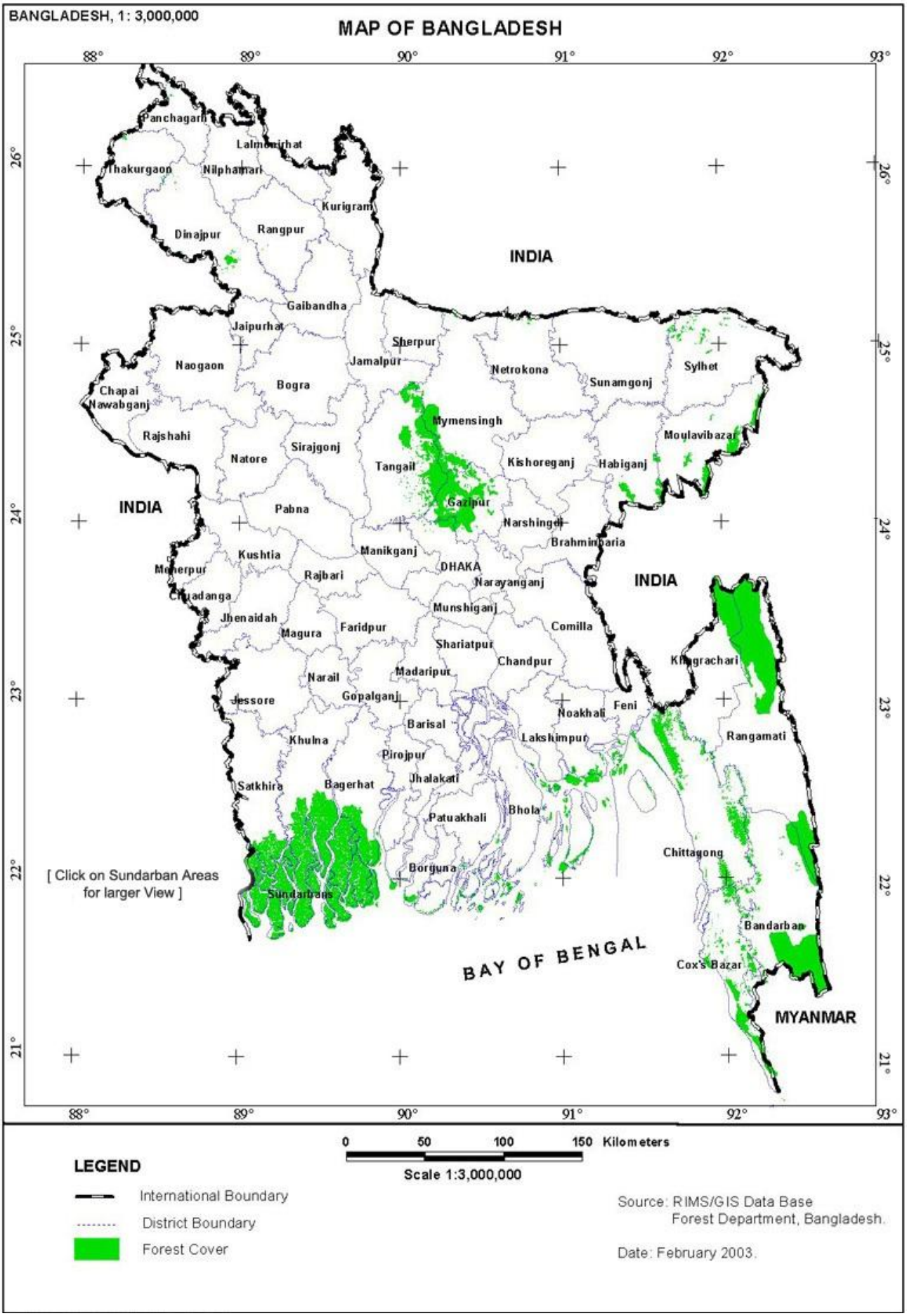
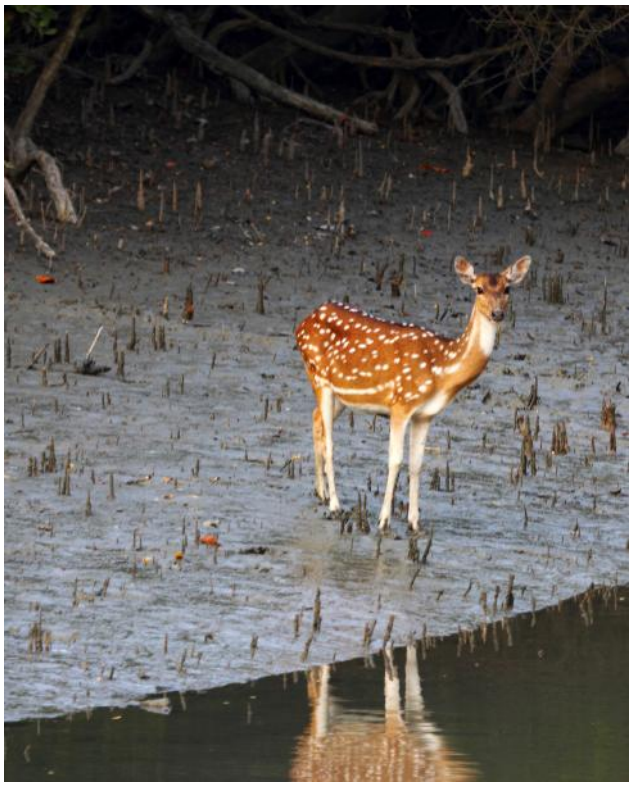


Figure 1. Map of Bangladesh showing the distribution of protected areas (marked green)



Spotted deer (*Axis axis*) in Sundarbans WS © Arunabha Rahman Anjan

Wildlife (Preservation and Protection) Act 2012, in which the approach of co-management was emphasised (BFD, 2013). Despite the challenges associated with protecting forest habitat in such a densely populated country as Bangladesh, where around 85 per cent of the rural population are dependent on forest resources, the government is showing a commitment to biodiversity conservation (Balasinorwala et al., 2008; Chape et al., 2008). Currently there are 34 protected areas in Bangladesh encompassing all forest and ecosystem types in the country (Figure 1). Among those, 17 are national parks (NPs) and 17 are wildlife sanctuaries (WS) (BFD, 2013). In addition, there are a number of eco-parks and safari parks, which are extremely small by comparison to the scheduled protected areas, and are designed to serve 'nature recreation' needs rather than large scale conservation needs (Chowdhury et al., 2009). Historically, protected areas in Bangladesh have been managed using approaches that exclude local people, whose interests have been viewed as incompatible with the conservation of these areas (Sarker & Roskaft, 2011). As noted by Bengtsson et al. (2003), protected areas are subject to both natural and human-induced disturbances at various scales, but it is the intensification of disturbance arising from human activity that is their principal threat (Chape et al., 2005), and can be well expressed by the term 'anthropogenic threats'. Mannigel (2008) argued that if this human-induced threat could be minimized, by active involvement of people in the management process, the protected area system for biodiversity conservation would become effective. Kainer et al. (2009) also considered the involvement of local communities in conservation projects as a key issue for the success of programmes aiming to promote biodiversity protection.

People's participation in forestry activities started formally in Bangladesh in the 1980s with a forestry extension programme on public forestlands (Rana et al., 2007). As an alternative to traditional state forest management, people-oriented forestry has been introduced in Bangladesh to increase the country's forest cover (Muhammed et al., 2008) and community-based forest management using the co-management approach (Borrini-Feyerbund, 1996) was introduced in Bangladesh's protected areas in 2004 (Chowdhury et al., 2011). Sarker & Roskaft (2011) commented that this approach has grown out of attempts to find new solutions for the failure of the so-called 'fences and fines' approach to conservation in the country. As a result there has been a slow but visible change towards co-management in protected areas of Bangladesh (Rashid et al., 2013). However, despite these positive moves there are still a number of multi-dimensional constraints in the system (Chowdhury et al., 2013), which often pose serious threats to conservation efforts (Holmern, 2003).

Understanding the type, pattern and extent of the threats to protected areas is a crucial factor in controlling their magnitude and improving the performance of biodiversity conservation programmes. The parties to the CBD adopted a definition for protected area threat in 2004, in the Programme of Work on Protected Areas (PoWPA), as "any human activity or related process that has a negative impact on key biodiversity features, ecological processes or cultural assets within a protected area" (CBD, 2004). This paper reports the findings of a comprehensive assessment of threats to biodiversity conservation initiatives in the protected areas of Bangladesh.

METHODOLOGY

Information on threats to the protected areas of Bangladesh was collected from field-level protected area managers, who were contacted through an informal letter with the help of the central authority of the country's Forest Department. Managers were asked to list potential threats to the protected areas of Bangladesh, according to their judgments (from their own protected areas and others if they knew them).The results were a variety of statements, many denoting the same kind of threat. By analyzing these 'raw' statements, we summarized the information into a total of ten threats (see table 1). A more in-depth follow-up survey was

Table 1: Threat factors in the protected areas (PAS)

Threat factors identified by PA managers	No. & relative frequency of PAs where threat factors exist	Mean score of the threat factors	Relative severity index of the threat factors
1. Shortage of funds impairing the materialization of the long-term visions and commitments of PA-based biodiversity conservation	34 (100%)	4.70 ± 0.19	0.92
2. Illegal cutting of trees and black market trade of timbers resulting in denudation of forests	30 (88%)	4.10 ± 0.12	0.87
3. Unsustainable and non-scientific harvesting of forest resources by local communities living in and around PAs	28 (82%)	3.84 ± 0.20	0.80
4. Current expansion of real estate business inducing land grabbers to encroach forestlands	10 (29%)	3. 74 ± 0.17	0.78
5. Poaching of selected mammals by smugglers resulting in their decline	21 (62%)	3. 60 ± 0.24	0.72
6. Non-cooperation from local communities for implementation of PA activities that arises from human-wildlife conflicts	18 (53%)	3.20 ± 0.20	0.65
7. Apathetic mindset against eco-tourism that appears hostile to the biodiversity and its habitat	17 (50%)	2.96 ± 0.18	0.63
8. Unnecessary delay in legal procedures regarding land litigation that encourages encroachment	23 (68%)	2.80 ± 0.21	0.56
9. Lack of integration at policy level that hampers the implementation of any new project in Forestry sector	34 (100%)	2.46 ± 0.14	0.42
10. Corruption of the FD authorities resulting in the collaborative deterioration of forests with the ruffians	15 (44%)	1.84 ± 0.22	0.39
Mean		**3.32 ± 0.12**	**0.64 ± 0.09**

conducted for all 34 protected areas, using a brief structured questionnaire. The questionnaire was sent electronically to respondents, and completed over a period of three months from March to May 2013. The respondents were field-level managers and researchers (three from each protected area), such as Assistant Conservators of Forest, Forest Rangers, and Scientific Officers who were considered to be knowledgeable key informants because of their long acquaintance with the protected areas and their surrounding environment. Respondents from each protected area were asked to score each of the ten key threats numerically from 1 as the lowest threat level to 5 as the highest. They were asked to score the threats independently and were only asked to score threats to the protected areas where they have been working officially.

Data analysis: Data was analysed using the methods of Okunlola & Tsujimoto (2009), threat indicators were calculated as follows:

- Protected Area Susceptibility Index (PASI) = The number of threats mentioned for each protected area, divided by 10 (the total number of threats listed), to provide the proportion of threats mentioned for that protected area
- Mean score of each threat factor = Sum of all the scores for that particular threat / Total number of the respondents (102)

- Relative Threat Factor Severity Index (RTFSI) = Mean score for a particular threat / The highest possible score (5)
- Protected Area Relative Threatened Index (PARTI) = Total score of all the threat factors from the respondents of a given protected area / Total responses (30)
- The ranking system based on RTFSI shows the severity of the threats, while the ranking based on both PASI and PARTI shows the vulnerability of protected areas to the identified threat factors. It was assumed that the higher the scores, the more vulnerable the protected area is. A comparison of protected area vulnerability in terms of the forest types they exhibit, and the geographical location they belong to was performed by a non-parametric Kruskal-Wallis test (Zar, 1999).

RESULTS

Protected areas in Bangladesh are prone to a range of threats (Table 1). The threat 'shortage of funds' scored the highest among the ten given threats. Indeed, this threat and 'lack of policy level integration' were reported in all the 34 protected areas, while 'illegal cutting of trees' was reported in 30 sites (88 per cent of the country's total protected areas) followed by 'unsustainable and non -scientific harvesting of forest products' (28 protected areas, 82 per cent of the total). Fourteen protected areas, constituting over 40 per cent of the country's total, were susceptible to eight or more threats. The protected area ranks are shown in Table 2 overleaf, based on the susceptibility index (PASI).

When the relative threatened index (PARTI) is taken into consideration, it was revealed that 10 protected areas (29 per cent of total) had an index of 0.6 and above, and eight (24 per cent of total) had an index of 0.7 and above. Four protected areas (12 per cent of total) had the highest index of 0.8 and above, while only one (3 per cent) had the lowest index (0.38) (Table 2). The protected areas are also ranked based on the relative threatened index (PARTI) and shown in Table 2.

Among the 16 tropical moist evergreen forests in the hilly regions, 14 were found most vulnerable (having both the PASI and PARTI of 0.60 - >0.80). In this category, the most threatened protected areas are Teknaf WS, Chunati WS, and Kaptai NP with the PASI and PARTI of over 0.80. Among the eight protected areas belonging to tropical moist deciduous forests in the plain lands, only two were found most vulnerable (having the PASI of over 0.80 and PARTI of over 0.70). These are Bhawal NP and Modhupur NP. Among the 11 mangrove protected areas in littoral geographical region, six were extremely susceptible and threatened by the identified threat factors (having both the PASI and PARTI of over 0.7). These are Sundarban East, West & South, Chadpai WS, Dhangmari WS, and Nijhum Dweep NP. Of the total protected areas, only six were found with both PASI and PARTI of less than 0.50. These are Ramsagar NP, Nobabgonj NP, Shingra NP, Kadigarh NP, Dudhmukhi WS, and Sonarchar WS.

The Kruskal-Wallis test showed that, for both PASI and PARTI, threat scores were higher in tropical moist evergreen and semi-evergreen forests, followed by mangrove forests and then tropical moist deciduous forests (see Table 3).

DISCUSSION

In Bangladesh's protected areas, many aspects of forest resource utilization have been identified as responsible for their degradation (Chowdhury & Koike, 2010a), posing serious threats to the biological diversity. Of the 10 threats identified in this study, five (illegal tree cutting, harvesting NTFPs, forestland grabbing for real estate business, wildlife poaching, and environmentally non-friendly tourism) were directly or indirectly related to resource utilization.

Because of large human population (1,174 people/km^2), Bangladesh's forests (17.08 per cent of total land area) are under threat from extreme anthropogenic pressure (World Bank, 2011). Encroachment of forestland (3.3 per cent of evergreen hill forests, 31.9 per cent of deciduous plain land forests), for housing and agriculture, is responsible for much of the observed loss of biodiversity (Muhammed et al., 2008; Alam et al., 2008). In this study, encroachment was reported as a threat in almost one-third of all protected areas, and in about 63 per cent of protected areas within tropical moist deciduous forests distributed in plain lands. Among them Modhupur NP is suffered the worst (scoring the PARTI of 0.78), probably because of easy accessibility and its proximity to the country's capital city. These results correspond with the findings of other studies (e.g., Alam et al., 2008; Islam & Sato, 2012; Muhammed et al., 2008). Marcovchik-Nicholis et al. (2008) argued that habitat loss and fragmentation due to urban development may have the most serious consequences to wildlife, because it results in permanent and irreversible changes to the environment, with little chance of restoration and recovery.

Illegal logging is one of the major threats to forests in tropical developing countries, which have long been subjected to rapid deforestation and degradation driven

Table 2. Relative threat index, geographical location, forest type, area and establishment date of protected areas of Bangladesh

Protected Areas		No. of threats exist	PASI (rank)	PARTI (rank)	Geography	Forest Type	Area (ha.)	Date of Establishment
National Parks (NP)	Bhawal NP	8	0.80 (2)	0.74 (4)	Hilly	TMDF	5022.00	May 11, 1982
	Modhupur NP	8	0.80 (2)	0.78 (3)	Plain	TMDF	8436.00	Feb. 24, 1982
	Ramsagar NP	6	0.60 (4)	0.38 (18)	Plain	TMDF	27.75	Apr. 30, 2001
	Himchari NP	6	0.60 (4)	0.54 (13)	Hilly	TMEF	1729.00	Feb. 15, 1980
	Lawachara NP	8	0.80 (2)	0.60 (10)	Hilly	TMEF	1250.00	July 07, 1996
	Kaptai NP	8	0.80 (2)	0.80 (2)	Hilly	TMEF	5464.00	Sept. 09, 1999
	Nijhum Dweep NP	5	0.50 (5)	0.74 (4)	Littoral	MNGF	16352.23	Apr. 08, 2001
	Medha-Kachhapia NP	6	0.60 (4)	0.72 (5)	Hilly	TMEF	395.92	Aug. 08, 2008
	Satchari NP	7	0.70 (3)	0.68 (6)	Hilly	TMEF	242.91	Oct. 15, 2005
	Khadim Nagar NP	7	0.70 (3)	0.64 (8)	Hilly	TMEF	678.80	Apr. 13, 2006
	Baraiyadhala NP	5	0.50 (5)	0.62 (9)	Hilly	TMEF	2933.61	Apr. 06, 2010
	Kuakata NP	5	0.50 (5)	0.52 (14)	Littoral	MNGF	1613.00	Oct. 24, 2010
	Nobabgonj NP	4	0.40 (6)	0.42 (16)	Plain	TMDF	517.61	Oct. 24, 2010
	Shingra NP	4	0.40 (6)	0.48 (15)	Plain	TMDF	305.69	Oct. 24, 2010
	Kadigarh NP	4	0.40 (6)	0.40 (17)	Plain	TMDF	344.13	Oct. 24, 2010
	Altadighi NP	4	0.40 (6)	0.52 (14)	Plain	TMDF	264.12	Dec. 24, 2011
	Birgonj NP	4	0.40 (6)	0.55 (12)	Plain	TMDF	168.56	Dec. 24, 2011
Wildlife Sanctuary (WS)	Rema-Kalenga WS	9	0.90 (1)	0.66 (7)	Hilly	TMEF	1795.54	July 07, 1996
	Char Kukri Mukri WS	6	0.60 (4)	0.58 (11)	Littoral	MNGF	40.00	Dec. 19, 1981
	Sundarban East WS	7	0.70 (3)	0.78 (3)	Littoral	MNGF	31226.94	Apr. 06, 1996
	Sundarban West WS	7	0.70 (3)	0.80 (2)	Littoral	MNGF	71502.10	Apr. 06, 1996
	Sundarban South WS	7	0.70 (3)	0.78 (3)	Littoral	MNGF	36970.45	Apr. 06, 1996
	Pablakhali WS	7	0.70 (3)	0.62 (9)	Hilly	TMEF	42087.00	Sept. 20, 1983
	Chunati WS	8	0.80 (2)	0.80 (2)	Hilly	TMEF	7763.97	Mar. 18, 1986
	Fashiakhali WS	6	0.60 (4)	0.62 (9)	Hilly	TMEF	1302.43	Apr. 11, 2007
	Dudh Pukuria-Dhopachari WS	6	0.60 (4)	0.66 (7)	Hilly	TMEF	4716.57	Apr. 06, 2010
	Hazarikhil WS	7	0.70 (3)	0.62 (9)	Hilly	TMEF	1177.53	Apr. 06, 2010
	Sangu WS	6	0.60 (4)	0.58 (11)	Hilly	TMEF	2331.98	Apr. 06, 2010
	Teknaf WS	8	0.80 (2)	0.82 (1)	Hilly	TMEF	11615.00	Mar. 24, 2010
	Tengragiri WS	5	0.50 (5)	0.62 (9)	Littoral	MNGF	4048.58	Oct. 24, 2010
	Dudhmukhi WS	5	0.50 (5)	0.48 (15)	Littoral	MNGF	170.00	Jan. 29, 2012
	Chadpai WS	5	0.50 (5)	0.78 (3)	Littoral	MNGF	560.00	Jan. 29, 2012
	Dhangmari WS	6	0.60 (4)	0.78 (3)	Littoral	MNGF	340.00	Jan. 29, 2012
	Sonarchar WS	4	0.40 (6)	0.42 (16)	Littoral	MNGF	2016.48	Dec. 24, 2011

TMDF= Tropical Moist Deciduous Forest, TMEF= Tropical Moist Evergreen Forest, MNGF= Mangrove Forest

largely by poverty and complex socio-political settings (Kaimowitz, 2003). In Bangladesh human-induced removal of woody biomass, in the form of timber and fuel wood, is considered the principal cause of forest loss in the protected areas (Chowdhury et al., 2009). While several other studies (e.g., Mazumder et al., 2007; Rashid et al., 2013) claim that the rate of illegal logging in protected areas has diminished following the adoption of a co-management program in Bangladesh, it was still reported as one of the severe threats in this study with a relative severity index (RTFSI) of 0.87. In Bangladesh the increase in timber demand (6 per cent) is much higher than the increase in forest cover (1 per cent) exhibiting a gap between production and demand of

Table 3. The PASI and PARTI values of protected areas based on the forest types and geographical locations

Categories		PASI	K-W test value	p value	PARTI	K-W test value	p value
Forest types	TMDF	0.52 ± 0.04	9.88	p = 0.0059	0.55 ± 0.02	13.78	p = 0.0023
	MNGF	0.65 ± 0.03			0.69 ± 0.03		
	TMEF	0.72 ± 0.03			0.71 ± 0.01		
Geographical locations	Plain	0.48 ± 0.02	17.04	p < 0.001	0.42 ± 0.02	20.01	p < 0.001
	Littoral	0.55 ± 0.02			0.66 ± 0.02		
	Hilly	0.74 ± 0.03			0.72 ± 0.01		

TMDF= Tropical Moist Deciduous Forest, TMEF= Tropical Moist Evergreen Forest, MNGF= Mangrove Forest

timber; thus, an imbalanced demand–supply cycle is making the country's forest resources even more vulnerable (Rahman, 2012).

Another severe threat to Bangladesh's protected areas was the over-exploitation of forest resources (RTFSI 0.80). Since rural households are vulnerable to a wide range of stresses and shocks that affect their livelihoods (Debela et al., 2012), and forest-rich protected areas are the fundamental sources of various livelihood options for the local communities (Chowdhury & Koike, 2010b), over-exploitation is common. This over-exploitation can result in the decline and disappearance of biodiversity, e.g. Odisha *Cycas* in India (Singh & Singh, 2011), populations of black colobus (*Colobus satanas*) in the Congo Basin, spider monkeys (*Ateles* sp.) and woolly monkeys (*Lagothrix* sp.) in the Amazon basin (Kumpel et al., 2010), and the wolf populations of the Pamir region of Kyrgyzstan and Tajikistan (Watanabe et al., 2010). Loss of biological diversity within already established protected areas indicates a distinct institutional/administrative weakness, especially when they have governmental support, legal protection and formal governing organization (Oestreicher et al., 2009).

Local communities living in the forested regions of Bangladesh extract both plant and animal products from the neighbouring forests (Chowdhury et al., 2007; Miah & Chowdhury, 2004), and wildlife is used as a source of protein and income. Hunting wild animals for bush meat is prevalent in the tropical moist evergreen and semi-evergreen forests of hilly protected areas where some indigenous communities inhabit (Chowdhury et al., 2014). Wildlife is often an open access resource, and the cost of its production is often lower than the cost of raising livestock (Fa & Brown, 2009). Poaching of selected mammals for smuggling is prevalent in mangrove protected forests of the littoral zone, mainly the Sundarbans, where the Royal Bengal Tiger (*Panthera tigris tigris*) is the iconic species (Uddin et al., 2013) and subject to poaching because of the high demand for its skin and other body parts in international black markets. Robinson & Bodmer (1999) identified such unsustainable hunting and poaching of wildlife as a major global threat to biodiversity in tropical forests. Uncontrolled hunting may also undermine climate change mitigation efforts, as a reduction in the abundance of seed-dispersing animal species has been shown to, in turn, reduce the density of key carbon-storing tree species (Krause & Zambonino, 2013). Many of the animals of Bangladesh have either become extinct or are at risk of extinction; 40 mammal species, 41 bird species, 58 reptiles and eight amphibians are categorized as vulnerable or above in the IUCN Red List (IUCN, 2000).

Human-wildlife conflict, which is a function of human population increase and encroachment into protected areas, is a major concern in biodiversity conservation programmes. The present study discovered that conflict is prevalent in the protected areas of hill and mangrove forests; and mostly arises from the damage of crops and houses by elephants and attacks on humans by tigers. Human-wildlife conflict in hilly regions arises from specific problems such as crop raiding, destruction of homes, and fear of collecting water and firewood in the evening because of wild elephants (Sarker & Roskaft, 2011). Barlow (2009) estimated a mean of 76 human deaths/year over the last 130 years in the Sundarbans, which is the highest rate within the tiger's current range. Controlling 'problem animals' could be a solution to help

Bamboo extraction by locals in Rema-Kalenga WS © Sharif Ahmed Mukul

reduce the number of human deaths. The hunting of 'problem animals', however, is not currently legally acceptable or in line with conservation objectives to preserve tiger population in Bangladesh. On the contrary, the 2-3 tigers killed each year in and around the Sundarbans due to attacks on human or livestock, plus an unknown number poached, could threaten the long-term viability of the tiger population (which is estimated at about 150 adult females). Controlling 'problem animals' due to human-wildlife conflict is a global issue, and includes conflicts with Amur Tiger (*Panthera tigris altaica*) in the Far East provinces of Russia (Goodrich et al., 2011), wolves in the Pamir regions of Kyrgyzstan and Tajikistan (Izumiyama et al., 2009; Watanabe et al., 2010), lions in Masai region of Kenya and Tanzania (Okello & Hadas, 2000). Tiger conservation in Bangladesh must take into account the local socio-economic conditions of which human-tiger conflict is an important feature (Barlow, 2009). Tigers cause considerable stress to local communities that rely on the forest for their livelihoods. More than 3.5 million people living around the Sundarbans are directly or indirectly dependent on its various ecosystem services (Giri et al., 2007; Uddin et al., 2013). Working in the forest is the only potential source of income for many people living along the forest border, and those killed are normally the main providers of income for a family (Azad et al., 2005; Gurung et al., 2008). Moreover, human-tiger conflict also strains relationships between local communities and the authorities, and may impede management activities in protected areas. In this study the threat of 'non-cooperation from local communities for implementation of protected area activities' scored a severity index of 0.65. Increasing safety measures and compensation amounts would reduce the negative attitudes of local people to the conservation issues.

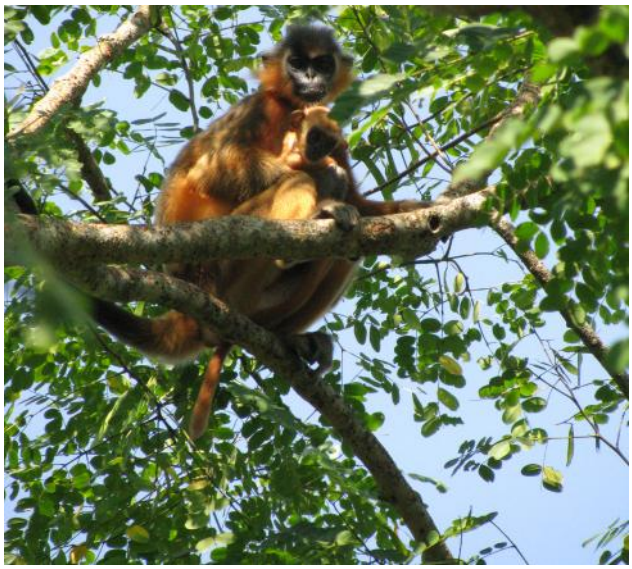
Many studies have shown that measures to reduce the threats to protected areas are more likely to succeed when local communities are socio-economically

empowered and actively involved in the protected area management process (e.g., Bostrom, 2012; Egbuche et al., 2009; Hjortso, 2004; Idrissou et al., 2013; Kothari, 2006; Marshall et al., 2007; Okech, 2010). Although a participatory approach under the 'co-management programme' has been adapted in Bangladesh's protected areas (Chowdhury et al., 2009), significant involvement of the different stakeholders (including local communities), in terms of planning and decision making, still remains largely to be accomplished (Chowdhury et al., 2013; Rashid et al., 2013). Stakeholder participation in the stages of forest planning and decision making is essential to get long-lasting and viable solutions regarding the mitigation of the threats (Bruna-Garcia & Marey-Perez, 2014). Because the nature of conflicts between people and protected areas varies regionally and according to the communities social values and economic status, it is imperative to design participatory protected area programmes to suit local needs (Sarker & Roskaft, 2011). It must be recognized that the state has an important role to play in protected area governance and that these roles will often be more strategic, instrumental and, to a degree, controlling in nature, in order to ensure the fulfillment of obligations to legal institutions such as the CBD and related regional and national policies, as well as related obligations to wider society and future generations (Jones, 2013). At the same time, effective co-management through a 'statutory partnership' between the state and multi-level stakeholders is necessary to overcome significant governance challenges and multi-dimensional threat factors. To achieve success in such programmes, the behaviour of the official organizations should be more pro-people, and the resentment and distrust against the administration by the local communities should, in turn, decline.

Delays in legal procedures for land titling have also increased the threat of illegal encroachment, or 'land-grabbing'. Borras Jr. et al. (2011) estimated 45 million hectares exchanged hands globally in the form of land grabs between 2005 and 2009. In Bangladesh, more than 0.6 million ha of land was scheduled for reservation under the existing Forest Act (Choudhury & Hossain 2011). However, some cases were delayed by the official gazettement process for decades. These delays diluted the Forest Department's claim to the title and provided opportunities to vested interest groups to make counter claims. These groups then acquired land and filed title suits, leading to numerous legal disputes with the Forest Department. The sub-judicial ownership of the land under title suits, and questionable ownership of the land that was due to be gazetted, present serious hurdles in implementation of conservation programmes in Bangladesh. Land-grabbing is a major threat to biodiversity conservation and has resulted in serious conflicts in many regions of the world (Borras Jr. et al., 2011). In Bangladesh, big business (e.g., real estate, shrimp culture etc.) use a wide variety of market and non -market, economic and extra-economic, as well as legal and illegal mechanisms to establish control over lands held by the state forest authority or poor people (Adnan, 2013). Processes leading to forest loss within protected areas are thus different to those that drive habitat loss on other land tenure arrangements that lack such formalized government property rights status (Petursson et al., 2013). Controlling encroachment and associated activities is a difficult endeavour unless there is a strong and effective political commitment from the government.

Lack of integration at policy level was reported to be a threat to biodiversity conservation, hampering the implementation of any new projects in the forestry sector, and within protected areas. During field implementation of forestry programmes, overlapping sectorial policies in some cases lead to contradictions, conflicts and confusion (Muhammed et al., 2008). In addition, many protected areas and other forest units lack management plans (Choudhury & Hossain, 2011). This lack of management planning is not unique to Bangladesh; more than two-thirds of the world's protected areas lack a management plan, and where such plans exist, they very rarely address issues associated with sustainable livelihoods or ecosystem services (Ervin, 2011). In addition to such policy level disorganization, the implementation of conservation programmes is further constrained by institutional corruption. As with many other developing countries, corruption is a common problem for the Forest Department in Bangladesh. TIB (2000) reported incidences of cutting and selling of trees by timber traders and smugglers and killing of animals by poachers with the direct cooperation of forest officials through bribery, embezzlement and misuse of administrative power. Corruption thus seriously impairs the sustainability of forest conservation and protected area implementation in Bangladesh (Choudhury & Hossain, 2011; Isalm & Sato, 2012).

The highest ranked threat in this study was the paucity of funds. All protected areas are facing the acute threat of fund shortage, hampering the sustainability of forest protection and biodiversity conservation. Bangladesh is a developing country and, having extreme resource constraints, its government cannot allocate sufficient funds from the public budget to the forestry sector, because of other priorities. (Mulongoy et al., 2008). In Bangladesh, in the 1970s and 80s, almost 95 per cent of the Forest Department's budget was met by the exchequer. However, in the last two decades this has



Phayre's leaf monkey (*Trachypithecus phayrei*) in Rema-Kalenga WS © Mohammed Abu Sayed Arfin Khan (left); Capped leaf monkey (*Trachypithecus pileatus*) in Modhupur NP © Sharif Ahmed Mukul (right)

completely turned around, and presently over 80 per cent of expenditures is met from donor-funded projects. Therefore, when there is no externally funded project, there is no funding for forestry activities. The flow of development funds is often short term (4 – 5 years) and unreliable and cannot be the basis for a long-term national programme, such as the protected area network of Bangladesh. This funding model is the most serious problem for the forestry sector, frustrating the long-term visions and commitments of biodiversity conservation in the country (Choudhury & Hossain, 2011). Suggested solutions include the creation of a 'Trust Fund' for Bangladesh's protected area network, which could be established by international donors (Baldus, 2008), and given appropriate checks to prevent misuse of funds.

Another potential source of funds for protected area management comes from eco-tourism, for those protected areas with magnificent scenic beauty and biodiversity (EWI, 2009). Since the 1990s, many developing countries rich in biodiversity have been vigorously promoting eco-tourism as a conservation and development tool in their protected areas (He et al., 2008). From a community perspective, eco-tourism can provide benefits (e.g. revenues from lodging, food, guiding and transportation to tourists) that ultimately enhance local support for the conservation of natural resources due to the direct link between biodiversity conservation and local development (Rana et al., 2010; Lambooy & Levashova, 2011; Anup & Parajuli, 2014). The collected revenues from visiting a protected area could support its preservation. However, when inadequately managed, visitors' activities can result in degradation of the landscape, and have negative impacts on wild plants and animals (Kimura, 2011), including impacts on the socio-psychological behaviour of wildlife, as evident from the behaviour of elephants in the Rajiv Gandhi National Park, India resulting from the severe anthropogenic interference (Ramchurjee, 2013). Sometimes, this industry encourages encroachment into forestlands as is the case in Costa Rica where land clearance for the construction of large hotels without any proper spatial planning has become a major problem (Koens et al., 2009). The national parks of Himchari, Lawachara, Kaptai, Satchari, Khadim Nagar, Kuakata and the wildlife sanctuaries of Rema-Kalenga, Sundarbans (East, West and South), Chunati, Sangu, and Teknaf are the protected areas most negatively affected by tourism.

CONCLUSION

With limited land and a large population, Bangladesh is facing a range of anthropogenic threats to its forest resources. Administrative procrastination and corruption encourage unlawful activities, which in turn, affects biodiversity both directly and indirectly. The types and patterns of the threat factors in Bangladesh's protected areas are complex. These findings suggest that existing strategies relating to biodiversity conservation are inadequate. Efforts to reduce the threat factors need to be fully integrated into the forest conservation and development programmes driven both by the government and the donors. Systematic and concerted attention is required to make the recently adoption of co-management programmes successful. Proper and functional partnership between multi-sectorial stakeholders such as the government, forest user groups and local communities, donor agencies, and civil society groups is a pre-requisite for success. The authors hope that the findings of the present study provide useful information for policy makers developing new programmes of biodiversity conservation in Bangladesh.

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RESUMEN

Las áreas protegidas de Bangladesh están expuestas a una serie de amenazas que fragilizan el programa de conservación de la biodiversidad del país. Uno de los pasos cruciales para la gestión eficaz de las áreas protegidas consiste en entender el tipo, modelo y alcance de estas amenazas. El estudio evaluó la gravedad relativa de las amenazas a las áreas protegidas y su grado de susceptibilidad a ellas. Ciento dos funcionarios de las 34 áreas protegidas fueron entrevistados por vía electrónica. Se identificaron diez amenazas potenciales. Las amenazas más graves son: la escasez de fondos y la desorganización existente a nivel de políticas, la tala ilegal de árboles, la extracción no sostenible de recursos forestales, la invasión de bosques y la caza furtiva y el contrabando. Los resultados indican que las áreas protegidas a través de todo el ecosistema se encuentran en riesgo, y que las amenazas varían geográficamente. Una tercera parte de las áreas protegidas están expuestas al 80 por ciento de las amenazas. Las áreas protegidas en los bosques tropicales húmedos de hoja perenne y semiperenne de las regiones montañosas son muy propensas a la tala ilegal de madera, mientras que los bosques caducifolios tropicales húmedos de superficie terrestre llana son propensos a la invasión para el asentamiento y la agricultura, y los bosques de manglar de las zonas litorales son extremadamente vulnerables a la caza furtiva. El desarrollo de estrategias rápidas para mitigar estas amenazas, con la coordinación multisectorial y la participación de los interesados, es esencial para la gestión adecuada de las áreas protegidas y para reducir la pérdida constante de la biodiversidad en Bangladesh.

RÉSUMÉ

Natura 2000 constitue la première et la seule approche régionale de la biodiversité des aires protégées au monde. Au cours de ses 20 ans d'existence, elle a été une force positive pour la conservation, mais elle est néanmoins sujette à certaines limites. Ce document évalue quelques unes de ses forces et ses faiblesses du point de vue d'un praticien. Dans l'ensemble, l'évaluation est positive, car sans cette initiative l'appauvrissement de la biodiversité aurait probablement été plus conséquent, sans compter que son approche transnationale est unique. Les aspects positifs identifiés sont donc le cadre biogéographique, la classification paneuropéenne des espèces et des habitats, ainsi que la volonté politique de la mettre en œuvre. Les aspects négatifs sont en revanche son approche statique de la conservation des espèces et de l'habitat, le fait que l'approche Natura de la préservation de la biodiversité est constamment compromise par des subventions aux effets pervers provenant d'autres mécanismes européens de financement, résultant en particulier de la Politique Agricole Commune, et enfin les effets qu'a le développement sur la fragmentation des habitats. En outre, dans la pratique, on a constaté une carence dans la mise en œuvre de mesures plus extensives touchant à l'environnement et à la connectivité. Nous tentons d'en tirer des leçons pour d'autres parties du monde.

TEMPERATE INDIGENOUS GRASSLAND GAINS IN SOUTH AFRICA: LESSONS BEING LEARNED IN A DEVELOPING COUNTRY

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ABSTRACT

The fragile state of temperate indigenous grasslands globally has galvanised action in the form of the Temperate Grasslands Conservation Initiative of the International Union for Conservation of Nature's World Commission on Protected Areas. However, despite this initiative raising the profile of temperate grassland conservation on the global conservation agenda, one still requires country-based interventions at the hands of local conservation authorities, in collaboration with non-governmental organisations (NGOs), to improve protection levels on the ground. To this end we report on progress made with temperate indigenous grassland conservation in South Africa since 2006, a landmark heralding the birth of biodiversity stewardship in our temperate grassland biome. Since then an additional 124,983 ha of temperate grassland have been brought under formal protection with a further 96,641 ha in the declaration process, most of which should be secured by the end of 2014. We also discuss the driving forces underpinning these gains - namely the National Protected Area Expansion Strategy, the Grasslands Programme of the South African National Biodiversity Institute, provincial biodiversity stewardship units and funding channelled through the Critical Ecosystems Partnership Fund into civil society to augment the state's contribution. Given the clear benefits derived from each intervention, we encourage other relevant countries with temperate indigenous grasslands to develop similar structures in the quest to safeguard representative, viable samples of one of the world's great terrestrial biomes.

KEYWORDS: temperate indigenous grasslands, South Africa, biodiversity stewardship, protected areas

INTRODUCTION

Temperate indigenous grassland conservation has over the years languished behind conservation efforts directed towards the more charismatic tropical grasslands and tree-dominated biomes. For example, Henwood (1998a) and Bertzky et al. (2012) reported that biomes such as savannas, sub-tropical and tropical forests, and mangroves have all been afforded far higher levels of protection than temperate indigenous grasslands. The reason is partly accounted for by the 'tragedy of the commons' example: the once widespread yet highly amenable indigenous grasslands have been largely transformed into production landscapes (Henwood, 1998b; Henwood, 2010). Sadly, congruence with areas of rich mineral and agricultural resources has led to irreversible land-use change at the hands of development and intensive resource use, with far less secured through the more measured and compatible forms of land-use management such as conservation and sustainable resource use. It appears that a tipping point has now been reached whereby temperate grasslands in many parts of the world have been reduced to vestiges of their former ecological state (Henwood, 1998b; Henwood, 2006; Peart, 2008a). The most imperilled and least protected terrestrial biome on the planet (Henwood, 1998b; Mark & McLennan, 2005; Henwood, 2009; Henwood, 2010) requires a Herculean effort to stem further habitat loss and bring representative samples of temperate vegetation and ancillary biodiversity under formal conservation.

An estimated 3.4 per cent to 5.5 per cent of the world's temperate grassland biome is protected (Peart, 2008b; Bertzky et al., 2012). The aim is to double this level of protection (to 10 per cent) by 2014 (TGCI, 2011), a milestone still well below Aichi Biodiversity Target 11, namely 17 per cent protection of all terrestrial ecosystems by 2020, set in 2010 during the 10th Conference of the

Table 1: Countries contributing the most temperate indigenous grassland in southern Africa (ranked from largest to smallest contributor by area) and the breakdown of support for the Biodiversity Stewardship Programme (BSP) and protected area expansion strategies (PAES)

Countries, and provinces in South Africa, with TGB	Area of countries, and provinces in South Africa, with TGB (km^2 and %)	Has a PAES in place?	Has a BSP unit?	Size of BSP unit
Free State (South Africa)	112,348 (31.20)	in progress	yes (2012)	2 (1 manager/ 1 part-time facilitator)
Eastern Cape (South Africa)	67,181 (18.65)	yes (2012)	yes (2012)	1 (1 manager)
Mpumalanga (South Africa)	50,977 (14.15)	yes (2009)	yes (2009)	2 (1 manager; 1 facilitator)
KwaZulu-Natal (South Africa)	44,861 (12.46)	yes (2010)	yes (2006)	5 (1 manager; 4 facilitators)
North West (South Africa)	32,281 (8.96)	yes (2013)	yes (2013)	3 (1 manager; 2 facilitators - vacant)
Lesotho	30,538 (8.48)	no expansion strategy or BSP		
Gauteng (South Africa)	11,697 (3.25)	yes (2011)	yes (2009)	5 (2 managers; 3 facilitators)
Swaziland	4259 (1.18)	no expansion strategy or BSP		
Northern Cape (South Africa)	3724 (1.03)	not applicable (small outlying fragments only; not considered further)		
Limpopo (South Africa)	2157 (0.60)	not applicable (small outlying fragments only; not considered further)		
Western Cape (South Africa)	126 (0.04)	not applicable (extremely small outlying fragments only; not considered further)		
Total (km^2)	**360,149**			

Notes: The size of the BSP unit excludes secretarial support. The South African contribution is ranked by province. TGB: temperate grassland biome

Parties to the Convention on Biological Diversity in Nagoya, Japan (CBD, 2012). Temperate indigenous grassland conservation is slowly gaining momentum thanks largely to the Temperate Grasslands Conservation Initiative (TGCI), launched officially in 2008 at the Joint International Grasslands-Rangelands Congress hosted in Hohhot, China (Peart, 2008b; Henwood, 2009; Henwood, 2010; Mark, 2012). The primary target or focal areas for temperate indigenous grassland conservation are understandably the world's remaining large contiguous and intact tracts of grassland that support landscape-scale processes (Peart, 2008b; TGCI, 2010a), and that once secured will afford the most cost effective returns on expended effort. These grasslands are located in the Patagonian Steppe (Argentina and Chile), Daurian Steppe (Russia, Mongolia and China), Kazakh Steppe (Kazakhstan) and the Northern Great Plains (Canada and USA) (Peart, 2008b; TGCI, 2010a; Mark, 2012). These four mega-regions may potentially contribute millions of hectares and are therefore the most realistic means of achieving the 10 per cent protection target.

Although the TGCI has successfully highlighted the plight of temperate grasslands at a global scale (Peart, 2008a), and placed them on the global conservation agenda (Peart, 2008b; TGCI, 2010b; TGCI, 2012), it is still incumbent upon country-based interventions at the hands of local conservation authorities in collaboration with NGOs, to secure adequate representation of these grasslands on the ground.

TEMPERATE INDIGENOUS GRASSLANDS IN SOUTHERN AFRICA

Notwithstanding the significant extent of transformation, the grassland biome of southern Africa is essentially a semi-contiguous expanse of temperate indigenous grassland with small outlying biome fragments located north and south-west of the biome core. This temperate grassland biome (TGB) comprises the sub-escarpment, escarpment and plateau grasslands and shrublands associated with the Great Escarpment that formed during a period of dramatic continental uplift of the subcontinent during the Pliocene (Mucina & Rutherford,

The Maloti Drakensberg Transfrontier World Heritage Site is Southern Africa's largest temperate indigenous grassland protected area, covering an area of *c.* 250,000 ha. It is due to be expanded by a further 44,500 ha thanks to the pending declaration of the proposed Upper uThukela Nature Reserve © Clinton Carbutt

2006). In South Africa, six provinces, namely Free State, Eastern Cape, Mpumalanga, KwaZulu-Natal, North-West and Gauteng, account for most of South Africa's temperate indigenous grasslands (Table 1). The remaining three provinces contribute only extremely small outlying grassland fragments, particularly Western Cape (Table 1).

The National Biodiversity Assessment 2011, a national assessment of the state of South Africa's biodiversity and ecosystems, has identified the TGB as one of the most threatened and least protected biomes in South Africa (Driver et al., 2012). Only some 2 per cent of the TGB is formally conserved in South Africa (Carbutt et al., 2011), with one of the four grassland bioregions, namely the sub-escarpment grassland bioregion, requiring 'critically important' attention (SANBI & DEAT, 2008). The corollary is that 98 per cent of the TGB is unprotected, and when one factors in that at least 33 per cent is already irreversibly transformed (Carbutt et al., 2011), then 65 per cent of South Africa's temperate indigenous grasslands remain in varying degrees of degradation, fragmentation and semi-intensive to intensive use on private and communal land. The principal transformer of the TGB in South Africa is cultivation (Reyers et al., 2005). Therefore of the total area of *c.* 360,149 km² delineated by Mucina & Rutherford (2006; Table 1), only a much smaller proportion is potentially available to the conservation estate. For this reason the global framework of expansion potential for temperate grassland landscapes has categorized South Africa as a 'moderately modified and fragmented landscape' (UNEP -WCMC, 2008). Expansion opportunities in South Africa at scale are relatively limited, and any gains that may be achieved at the landscape-scale will be the exception.

South Africa is obligated to protect its temperate indigenous grasslands, firstly as a signatory to the Convention on Biological Diversity, and more specifically as a signatory to the Hohhot (Peart, 2008b) and Bariloche (TGCI, 2010a) Temperate Grasslands Declarations (signed June 2008 and February 2010, respectively). To this end we focus on the progress with temperate indigenous grassland conservation in South Africa. The aims of this paper are twofold: (1) document the gains achieved for temperate grassland conservation since the baseline assessment of Carbutt et al. (2011); and (2) share some of the key initiatives that have underpinned these gains.

Although the focus of this study is South Africa, all of the land-locked mountain kingdom of Lesotho, as well as the western highlands of Swaziland, also form part of this TGB (Table 1). An exciting recent development is the inclusion of Sehlabathebe National Park in Lesotho as an extension of the uKhahlamba Drakensberg Park World Heritage Site in South Africa, which is being renamed the Maloti Drakensberg Transfrontier World Heritage Site. This inclusion opens the door to further additions within Lesotho and to an extension of the formally delineated and appropriately managed buffer zone around the uKhahlamba Drakensberg Park World Heritage Site into Lesotho.

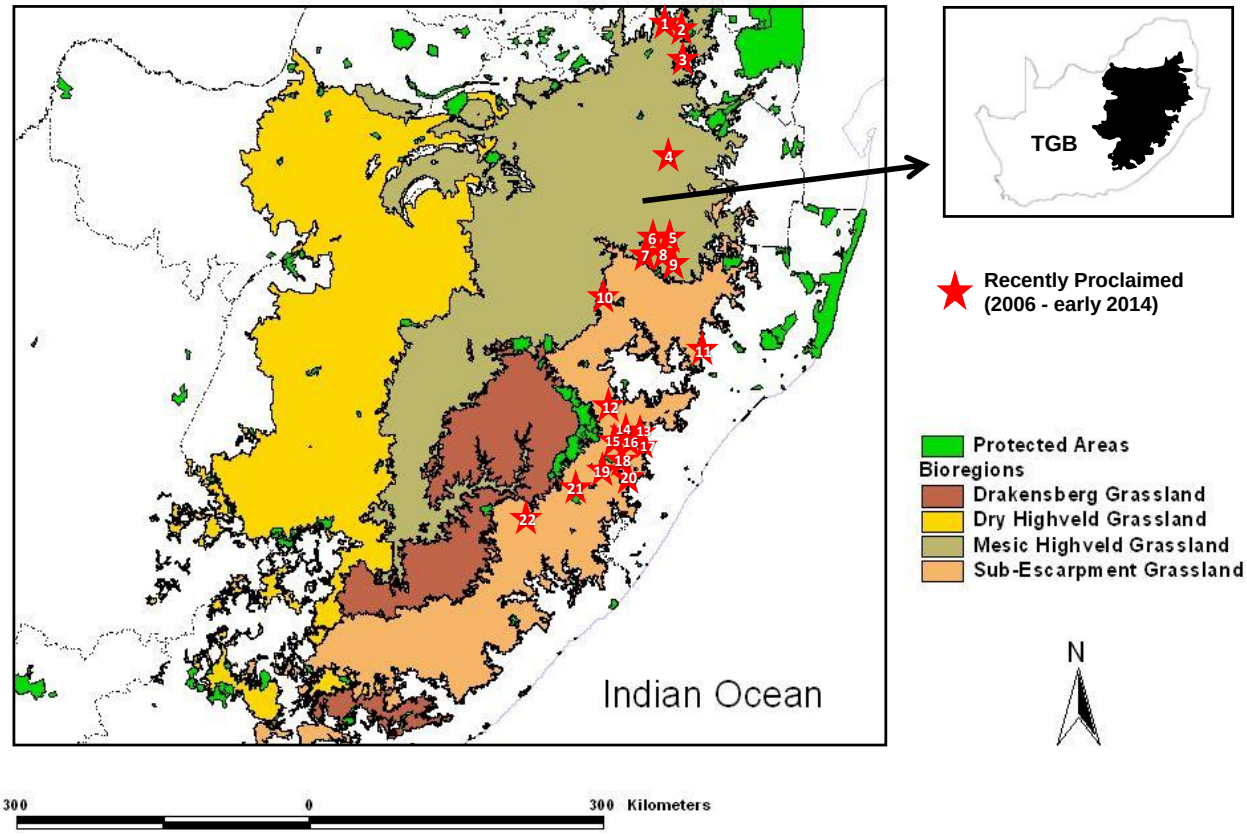

Figure 1: Map of the Temperate Grassland Biome (TGB) in South Africa, Lesotho and Swaziland, showing the four grassland bioregions, and the most recently declared temperate indigenous grassland protected areas (shown as red stars) relative to the protected area network pre-2006 (shown in green). Adapted from Carbutt et al. (2011) using the bioregion delineation of Mucina & Rutherford (2006)

Key to recently declared temperate indigenous grassland protected areas listed from north to south: 1. Kudu Private Nature Reserve; 2. Mndawe Trust Protected Environment; 3. Buffelskloof Private Nature Reserve; 4. Chrissiesmeer Protected Environment; 5. KwaMandlangampisi Protected Environment; 6. KwaMandlangampisi Protected Environment (expansion); 7. Tafelkop Protected Environment; 8. Mabola Protected Environment; 9. Pongola Bush Protected Environment; 10. Ncandu Private Forest and Grassland Reserve; 11. Gelijkwater Misbelt Nature Reserve; 12. Zulu Waters Game Reserve; 13. Mt Gilboa Nature Reserve, and the two properties in close proximity, Dartmoor and Middle Drai (the latter two properties form part of Karkloof Nature Reserve); 14. Blue Crane Nature Reserve; 15. Bill Barnes Crane and Oribi Nature Reserve; 16. Michaelhouse Nature Reserve; 17. Hilton College Nature Reserve; 18. Mount Shannon Protected Environment; 19. Clairmont Nature Reserve; 20. Roselands Nature Reserve; 21. Excelsior Protected Environment; 22. Matatiele Nature Reserve

METHODOLOGY

This study focuses only on the temperate indigenous grasslands of South Africa, since Lesotho and Swaziland do not have any formal programmes dealing with temperate indigenous grassland conservation and reporting. All South African protected areas in the TGB formally declared (proclaimed) since 2006 as either nature reserves or protected environments were identified and documented as the recent gains for temperate grassland conservation. The year 2006 was selected because the baseline assessment of Carbutt et al. (2011), using the revised delineation of South Africa's TGB by Mucina & Rutherford (2006), included the status and extent of the protected area network up to 2005. Coincidentally, the year 2006 was also significant as it marked the beginnings of the Biodiversity Stewardship Programme (BSP) in South Africa's TGB (see results section for further information).

The categories 'nature reserve' and 'protected environment' were selected because they are both formal legal instruments constituted through the National Environmental Management: Protected Areas Act (57 of 2003), and as such offer the highest levels of protection, regardless of whether the land is privately, communally, or state-owned. Two analyses were undertaken in this regard: (1) formal gains based on declarations gazetted between 2006 and early 2014 (the gazetted areas of each protected area were extracted from gazette notices and the areas of each were summed to form a total area

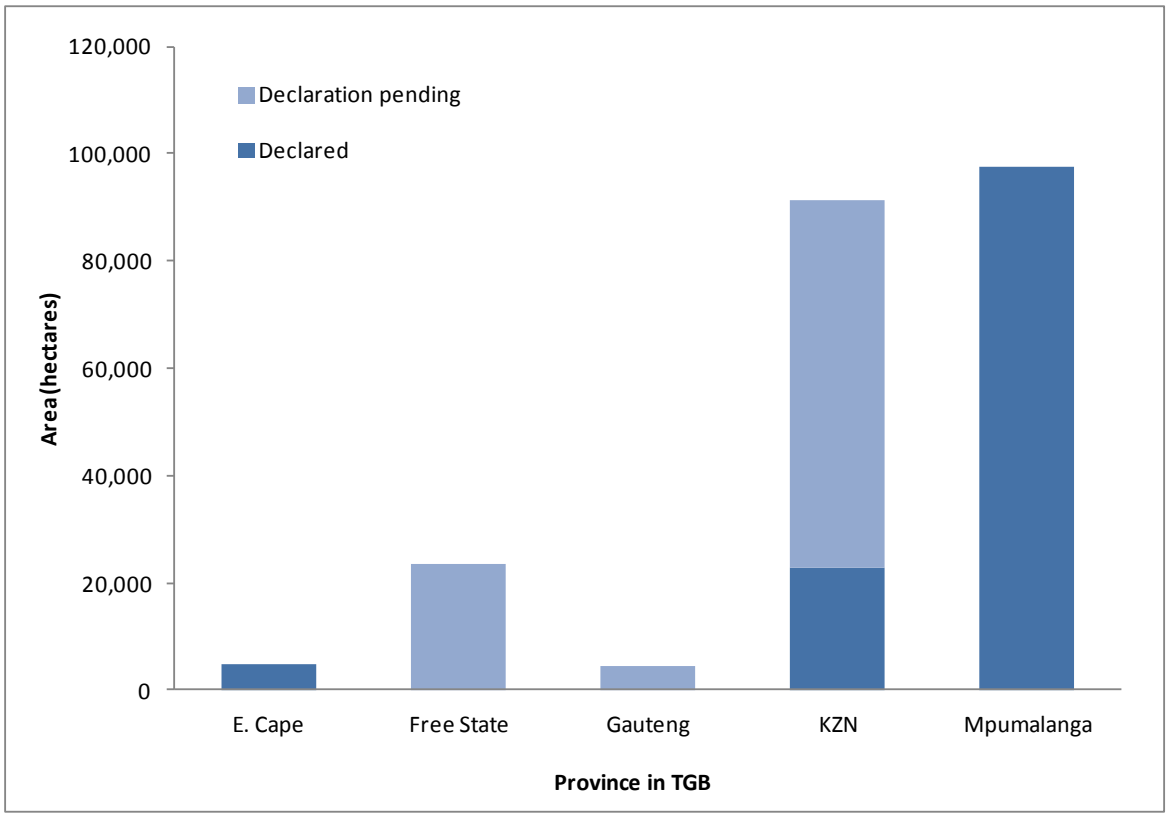

Figure 2: Temperate indigenous grassland gains, and anticipated future gains, in each of the five contributing provinces located in the Temperate Grassland Biome (TGB) of South Africa
Abbreviations: E. Cape, Eastern Cape; KZN, KwaZulu-Natal

representing the overall gain); and (2) pending gains based on properties currently engaged in the declaration process, most of which should be gazetted by the end of 2014.

Finally, we applied four important rules, where applicable. Firstly, in order to prevent over-reporting, the gains reported here should not have been reported elsewhere. An example is Mbona Private Nature Reserve, recently declared under national legislation through the BSP. This protected area was declared previously in 2005 as Mbona Mountain Estate under *provincial* legislation [KwaZulu-Natal Nature Conservation Management Act (Act 9 of 1997)] and has therefore already been reported as a gain. Secondly, by their intrinsic nature, the temperate indigenous grasslands of Africa are sometimes associated with relatively small temperate forest patches where aspect, temperature and hydrology allow (Mucina & Rutherford, 2006), the latter likened to 'islands in a sea of grassland' (Meadows & Linder, 1989; Meadows & Linder, 1993). Therefore some of the temperate grassland gains reported here include relatively small patches of forest. However, the gain contributed by the protected area was considered null and void if the property, located within a broader matrix of temperate grassland, comprised entirely of temperate forest. For this reason two recently declared protected areas, Forest Side Nature Reserve and Weza Protected Environment, were excluded. Thirdly, if the protected area spanned two or more biomes, i.e. the TGB and adjoining biome(s), then only the TGB portion was used for this assessment, noting also rule two above. Fourthly, we had to further interrogate the protected environment declarations since they *may* by definition include areas of transformation (principally through agricultural land use). Using habitat information from the site evaluation forms, we excluded the areas of transformation from the total gazetted area so that we are reporting only on untransformed areas under formal protection. Therefore, the gains reported here for two protected environments are less than their official gazetted area.

THE GAINS

Since 2006, an additional 124,983 ha of temperate indigenous grassland have come under formal protection due to the declaration of 22 new protected areas, and the purchase of two properties which have been incorporated into an existing protected area (Figure 1; Appendix 1). The overall level of protection in the TGB has thereby increased from 2.04 per cent (Carbutt et al., 2011) to 2.38 per cent. Most of the newly declared protected areas are located in Mpumalanga and KwaZulu-Natal (Figure 2), the two provinces with the longest history of biodiversity stewardship in South Africa's TGB (Table 1). It is not

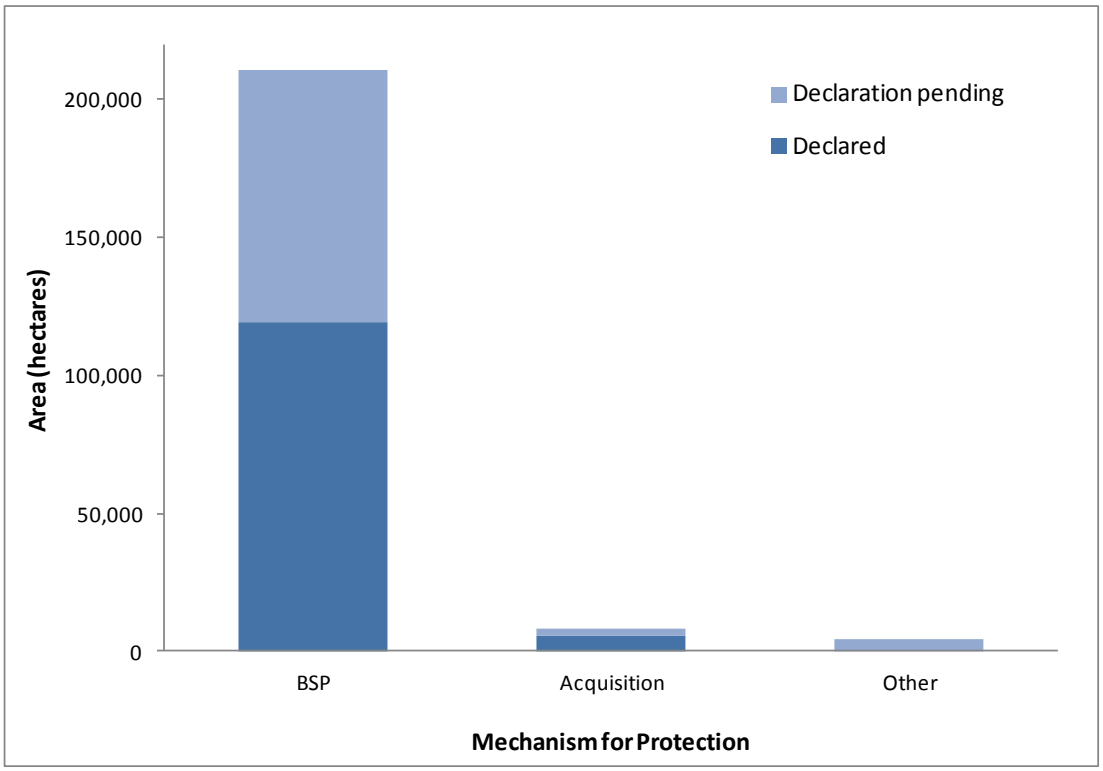

Figure 3: Temperate indigenous grassland gains, and anticipated future gains, by each of the three mechanisms employed in the Temperate Grassland Biome of South Africa

Abbreviation: BSP, Biodiversity Stewardship Programme. 'Other' refers to the programme of re-declaring protected areas under national legislation

surprising that some 95 per cent of the declarations were secured through the BSP on private and communal land (Figure 3). In terms of the grassland bioregions, most of the newly declared protected areas occur within the sub-escarpment grassland and mesic highveld grassland bioregions of the TGB (Figure 1). Most of the recently established protected areas are high water yield areas and therefore have high value in terms of ecological infrastructure (defined here as the natural capital from which ecosystem goods and services are derived).

Included in these gains is the significant landmark of declaring a protected area on land owned by an agroforestry company - Mt Gilboa Nature Reserve, owned by Mondi Limited, is the first such example in the industry. Other agroforestry companies, in their pursuit of environmental consciousness and sustainability, are following suit. More recent examples include the Weza (Merensky Timber Limited) and Excelsior (Mondi Limited) Protected Environments. As mentioned previously, the former does not form a further part of this study as it is entirely naturally forested. Another landmark is the declaration of the first community-owned protected environment in South Africa, namely Mndawe Trust Protected Environment. The largest gain is Chrissiesmeer Protected Environment, a 59,432 ha matrix of privately owned land located in what has been referred to as South Africa's 'lake district', characterised by a high density of lakes and pans. Another large gain, the 23,658 ha KwaMandlangampisi Protected Environment located between Wakkerstroom and Luneberg in southern Mpumalanga, is the first protected environment declared in South Africa and forms part of the Enkangala Grassland Project Area (Dugmore, 2010), an area under heavy pressure from the open-pit coal mining industry (see Figure 1; Appendix 1). Other than ensuring sound rangeland management practices and extending protection to threatened fauna, flora, and temperate indigenous grassland vegetation types such as Paulpietersburg Moist Grassland and Wakkerstroom Montane Grassland, this protected area also secures a critical water catchment area for South Africa. The headwaters of the Pongola and Assegaai Rivers feed into the Heyshope Dam, providing clean water for national power generation, agriculture, as well as potable water for domestic consumption (Dugmore, 2010). The protection and better management of such water catchments can only benefit the water utilities and water governing authorities by ensuring a greater volume of runoff as well as a cleaner supply of water that will extend the life span of impoundments and save significant costs in the long term. This is not a new concept. The similarly-sized Te Papanui Conservation Park in the eastern Otago uplands of New Zealand's South Island, appropriately dubbed a 'Waterlands Park' by the local conservation authority, protects a high water yield area of tall snow tussock grassland that supplies more than 60 per cent of Dunedin City's water (Mark & Dickinson, 2008; Mark, 2012).

The only recent acquisitions in the TGB are the properties 'Portion 2 of the Farm Middle Drai No. 4129' (386 ha), purchased in 2003 for ZAR 320,000, and 'remainder of the Farm Dartmoor No. 5093' (779 ha),

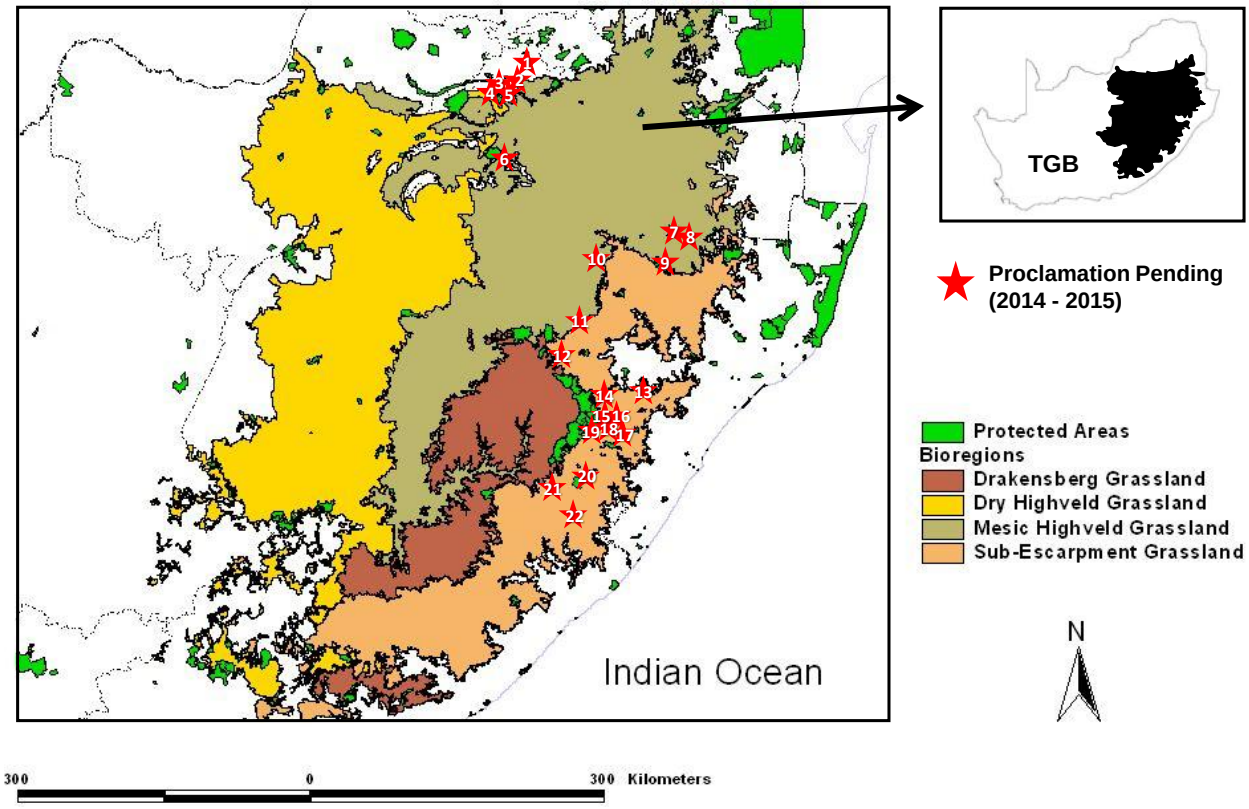

Figure 4: Map of the Temperate Grassland Biome (TGB) in South Africa, Lesotho and Swaziland, showing the four grassland bioregions, and the proposed temperate indigenous grassland protected areas that will be declared in the near future (2014 - 2015) shown as red stars relative to the protected area network pre-2006 (shown in green). Adapted from Carbutt et al. (2011) using the bioregion delineation of Mucina & Rutherford (2006)

Key to proposed temperate indigenous grassland protected areas listed from north to south: 1. Leeuwfontein Nature Reserve; 2. Roodeplaat Nature Reserve; 3. Colbyn Valley Protected Environment; 4. Klapperkop Nature Reserve; 5. Faerie Glen Nature Reserve; 6. Alice Glockner Nature Reserve; 7. Arrarat Nature Reserve; 8. Pongola Bush Protected Environment (expansion); 9. Mabaso Protected Environment; 10. Sneeuwberg Protected Environment; 11. Ingula Nature Reserve; 12. Upper uThukela Nature Reserve; 13. Lake Merthley Nature Reserve; 14. Zulu Waters Game Reserve (expansion); 15. Allendale Nature Reserve; 16. Fort Nottingham Nature Reserve (expansion); 17. Bosch Berg Nature Reserve; 18. Umgeni Vlei Plateau Nature Reserve; 19. Saddle Tree Protected Environment; 20. Umgano Nature Reserve; 21. Beaumont Nature Reserve; 22. Mt Currie Nature Reserve (expansion)

purchased in 2010 for ZAR 3.2 million (ZAR is currently trading at 11.00 to the US$ although was firmer against the US$ at the time). Both properties adjoin, and have thus been incorporated into, the Karkloof Nature Reserve through declaration in 2012. These properties were purchased by Wildlands Conservation Trust and donated to the Board of the local provincial conservation authority, Ezemvelo KwaZulu-Natal Wildlife. Although not a recent acquisition, Matatiele Nature Reserve (4800 ha), located in the north-eastern corner of Eastern Cape, was established as the Matatiele Commonage when the town became a municipality by declaration in 1904 (Matatiele Local Municipality, 2009). It was only declared a nature reserve over 100 years later, in 2007, with the local municipality serving as the management authority. This gain finally has legal standing and is a welcome boost to the protection of sub-escarpment grasslands in the region (see Figure 1; Appendix 1).

A further 96,641 ha, relating to 22 proposed protected areas, are in the declaration process, most of which should be secured by the end of 2014 (Figure 4; Appendix 2). This increased area will boost the overall level of protection in the TGB to 2.65 per cent. Most of the proposed protected areas are located in KwaZulu-Natal and Free State (Figure 2), with 95 per cent of the proposed declarations being secured through the BSP on private and communal land (Figure 3). These future gains are located mostly within the mesic highveld and sub-escarpment grassland bioregions (Figure 4). Future efforts should include the semi-arid grasslands of the dry highveld grassland bioregion. The largest pending gain is the 44,525 ha Upper uThukela Nature Reserve in KwaZulu-Natal (Figure 4; Appendix 2), strategically consolidating the fragmented Maloti Drakensberg Transfrontier World Heritage Site. Another exciting prospect in the declaration process is the Sneeuwberg

The black wildebeest, or white-tailed gnu (*Connochaetes gnou*), is a selective grazer of South Africa's temperate indigenous grasslands © Clinton Carbutt

Protected Environment, a 17,456 ha area (Figure 4; Appendix 2) located in the eastern Free State, a more recent proponent of the BSP (Table 1). This proposed protected area will contribute to the protection of Amersfoort Highveld Clay Grassland, Eastern Free State Sandy Grassland, Low Escarpment Moist Grassland and Eastern Temperate Freshwater Wetlands (*David Hayter, pers comm*). Another milestone in the making is the proposed Ingula Nature Reserve, a 9437 ha trans-provincial protected area spanning Free Sate and KwaZulu-Natal (Figure 4; Appendix 2). The project is funded by the parastatal power-generating utility Eskom, with technical support from the conservation NGO, Wildlands Conservation Trust. This will be the first private nature reserve declared by a national minister (and not by provincial members of the executive council) because it stretches across two provinces (*Kevin McCann, pers comm*). A few of the smaller pending gains, located in impoverished communal areas (e.g. the proposed Umgano Nature Reserve; Plate 1A), are central to progressive conservation projects aimed at generating sustainable livelihoods by integrating biodiversity conservation, ecotourism, and small-scale agriculture.

The approach adopted by Gauteng was to first secure and consolidate its exiting protected area estate (declared historically under provincial legislation and without fulfilling the more rigorous criteria necessitated by national protected area legislation) by re-declaring its protected areas under national legislation. This process involved boundary surveys though a professional land surveyor, improved mapping and public participation (*Terence Venter, pers comm*). It seems that some of Gauteng's original provincial declarations, relating to smaller reserves, were not captured in the national protected areas database, and as a result were not included in the assessment by Carbutt et al. (2011). These have since been captured as pending formal gains in this assessment (Figure 4; Appendix 2). However, a suite of generally larger Gauteng nature reserves that are also in the process of being re-declared under national legislation are not considered further in this study since they have been reported as gains previously (see Carbutt et al., 2011). Examples include Groenkloof, Marievale, Rietvlei Dam, Suikerbosrand and Voortrekker Monument Nature Reserves.

THE DRIVERS

Perhaps as important as the gains themselves, which may seem trivial at a global scale, are the interventions that have been applied and lessons that have been learned, many of which may benefit the global temperate grassland community. Four interventions, all in the past 10 years, have generated unprecedented momentum to temperate indigenous grassland conservation in South Africa. These are detailed below.

1. National Protected Area Expansion Strategy: this Strategy was commissioned by South Africa's national Department of Environment Affairs – known at the time as the Department of Environment Affairs and Tourism – with technical support from the South African National Biodiversity Institute and South African National Parks. In 2007, a project team representing the aforementioned departments provided technical oversight to specialist consultants contracted to draft the strategy in 2008, in close collaboration with other key national government departments, and national and provincial conservation institutions (SANBI & DEAT, 2008), all of whom were overseen by the task team of the Ministerial Technical Committee's Working Group 1 ('Biodiversity and Heritage'). The strategy team further consulted with the 'People and Parks' stakeholders.

The Strategy, endorsed through the co-operative governance structures established by national government (SANBI & DEAT, 2008) and approved by the National Minister of Environmental Affairs for implementation in March 2009, recommends that a further 12 per cent of land in the TGB should be formally protected as part of the 20-year protected area expansion targets for South Africa (SANBI & DEAT, 2008). At a more local level, provincial conservation authorities are in the process of embracing the protected area expansion targets identified nationally for the respective provinces by drafting provincial protected area expansion plans (e.g. Morris & Corcoran, 2009; Carbutt & Escott, 2010; Martindale & de Frey, 2011). Most provinces with temperate indigenous grasslands now have provincial protected area expansion strategies in place to secure this threatened biome (Table 1).

This 20-year strategy has been an invaluable framework for identifying national priorities and setting national and provincial protected area expansion targets. It also aims to secure buy-in from conservation authorities by holding them accountable to discrete targets. A critical challenge in implementing such a strategy is devolving and communicating the provisions, policies, signed agreements, authorizations, and endorsements at the level of national government through provincial and local government structures.

2. Grasslands Programme (Phase 1: 2008 - 2013): the Global Environment Facility (GEF) of the United Nations Development Programme has funded phase 1 (2008 - 2013) of a 20-year focussed thematic programme in South Africa which aims to "secure the biodiversity and associated ecosystem services of the Grassland Biome for the benefit of current and future generations" (SANBI, 2008; Stephens, 2009). The Grasslands Programme, with the South African National Biodiversity Institute as its implementing agency, is a strategic partnership between multiple spheres of government, NGOs, as well as private and academic sectors (Stephens, 2009). Phase 2 is aimed at sustaining the gains achieved in Phase 1 and a sustainability plan to galvanise the outcomes of Phase 1 and ensure overall delivery on the 20-year strategy has been developed in this regard (Ginsburg, 2013; Ginsburg et al., 2013). The Grassland Programme is one of few GEF-funded projects to embrace reflective and consultative planning for sustainability (*Anthea Stephens, pers comm*). The Grasslands Programme has initiated a number of key interventions, many of which are focussed within the following three strategic focus areas:

i. Mainstreaming grassland conservation in production sectors: a key strategy of the Grasslands Programme is mainstreaming grassland conservation objectives in the major production sectors operating in the TGB (being the main drivers of biodiversity loss), primarily the agriculture, agroforestry, urban development, and coal mining sectors (SANBI, 2008; Stephens, 2009; SANBI & DEA, 2013; Ginsburg et al., 2013). This strategy includes interventions to ensure that production sectors incorporate biodiversity objectives into operational plans, policies and decision making, while at the same time addressing institutional and policy level barriers, correcting market failures and improving incentives (SANBI, 2008; Stephens, 2009; SANBI & DEA, 2013; Ginsburg et al., 2013). More on-the -ground interventions include better management and formal protection of unplanted areas (Ginsburg et al., 2013). Some of the engagements with the production sectors have been addressed through the annual Grasslands Partner's Forum, a platform to engage formally with key representatives of each production sector to ensure systemic, long-term interventions. Additionally, a further need has been identified to mainstream grassland conservation not only in production sectors but also with government departments whose authorisations in line with their mandates may have significant (negative) impacts on grassland integrity (e.g. Department of Agriculture - food security; Department of Water Affairs - water security).

ii. Creating an enabling environment: the Grasslands Programme has been very effective at creating an enabling, cohesive working environment for partners and stakeholders, particularly in the areas of policy development, as well as technical and financial support. Examples include assistance with a 'Business Case for Biodiversity Stewardship' to galvanise the implementation of biodiversity stewardship as a critical

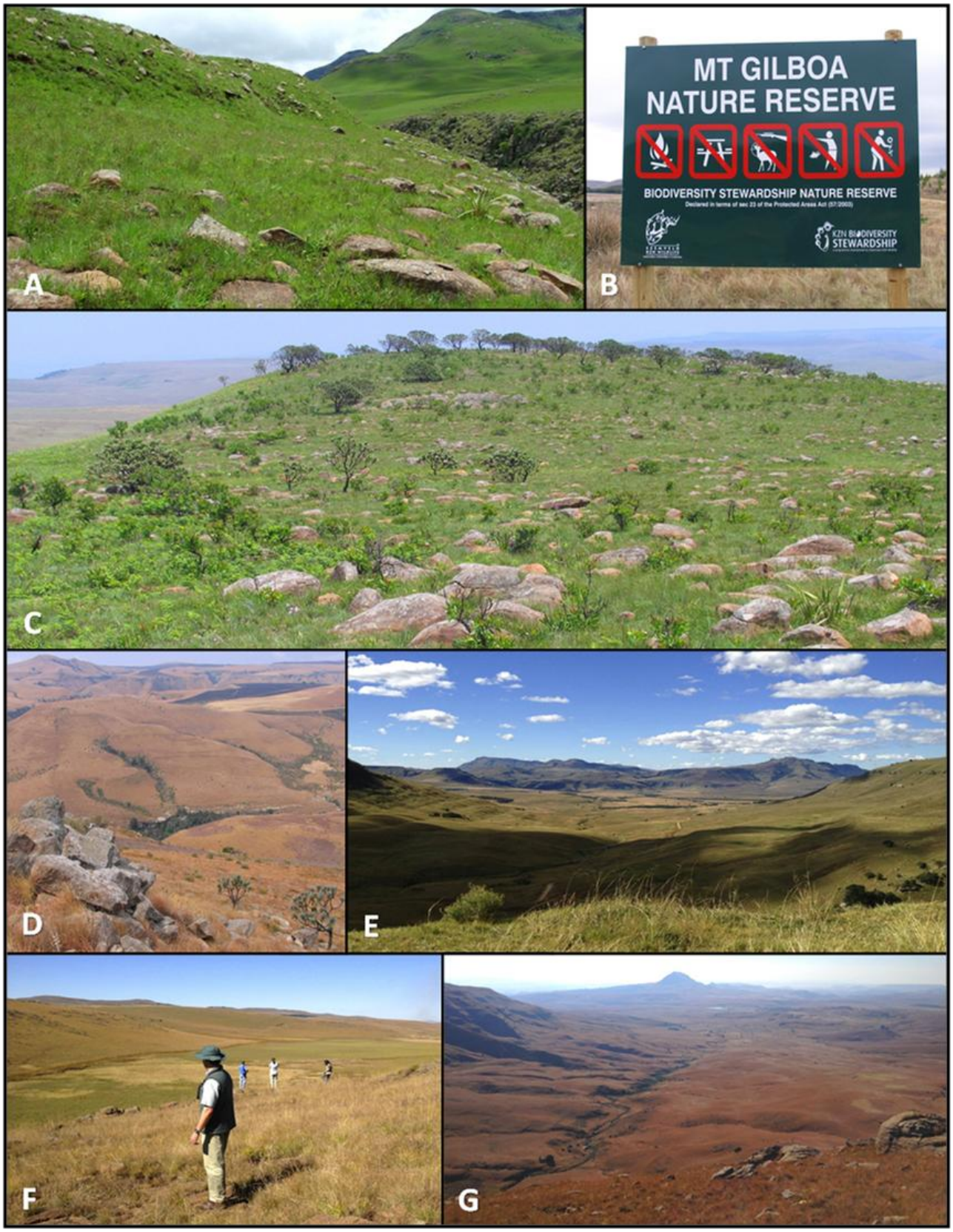

Plate 1: Examples of newly declared, or soon-to-be declared, temperate indigenous grassland protected areas in South Africa. A, the proposed Umgano Nature Reserve, initiated by the Mabandla Community in the remote Ntsikeni region © Clinton Carbutt. This area supports a temperate grassland vegetation type known as Drakensberg Foothill Moist Grassland, on relatively steep and rocky slopes; B. & C. Mt Gilboa Nature Reserve, the first private nature reserve declared within an active agroforestry estate © Clinton Carbutt; D. the greater Ncandu expansion area © Clinton Carbutt; E. Pongola Bush Protected Environment, securing the important headwaters of the Pongola River © Greg Martindale; F. a proposed biodiversity stewardship site in the Underberg region, dominated by a large wetland system supporting the critically endangered wattled crane © Greg Martindale; G. the proposed Allendale Nature Reserve in the foothills of the KwaZulu-Natal Drakensberg © Greg Martindale

mechanism for protected area expansion and rural development (Stephens, 2009), and the piloting of Payment for Ecosystem Services projects and the Wetlands Offsets project (Ginsburg et al., 2013). Other examples of key products enabled through the Programme are the Grassland Ecosystem Guidelines, the Mining and Biodiversity Guideline, the Biodiversity-friendly Red Meat Standard, and the Biodiversity-friendly Grazing and Burning Guidelines for South Africa's Grasslands. The latter product is a timely necessity, given the national debate centred around the influence of grazing on rangeland diversity in South Africa (e.g. O'Connor, 2005; O'Connor et al., 2010; O'Connor et al., 2011).

iii. Shaping policy and political mindsets: according to Tau & Stephens (2012), the term 'biodiversity' is not well understood in the political arena in South Africa and therefore decision making does not often reflect biodiversity priorities. Adding further to this woe is that communication from the biodiversity sector is sometimes contradictory and often confusing, and the link between economic development and biodiversity is not well understood. The result is that biodiversity is commonly seen as being in competition with socio-economic imperatives. Furthermore the 'fear of loss' messages of doom and gloom, inundated with stories of degradation, extinction, species loss and habitat transformation do not resonate with politicians and decision makers who generally want more positive stories (Tau & Stephens, 2012). The Grasslands Programme has worked hard at demystifying the term 'biodiversity' by crafting compelling positive messages (using the 'hope of gain' language) that communicates the value of natural capital and ecological infrastructure to the economy of the country and to rural development (Tau & Stephens, 2012). Key challenges to their 'making the case for biodiversity' sector messaging strategy have centred around: (1) how to frame the case for temperate indigenous grassland conservation within the broader needs of a developmental society in a way that resonates with the government priorities of job creation, rural development, growth and equity; and (2) how to ensure that grassland conservation answers both a rational need and an emotional need (the champions of biodiversity need to demonstrate practically the value of grassland biodiversity if they are to succeed in securing scarce government resources) (Tau & Stephens, 2012; SANBI, 2014). These high-level engagements are long-term interventions aimed at informing and changing political mindsets towards the value of biodiversity to the benefit of not only temperate indigenous grasslands but South Africa's biodiversity at large.

3. Biodiversity Stewardship Programme: despite protected area expansion strategies in South Africa identifying up to 18 options to increase the terrestrial area of the country under formal protection (Carbutt & Escott, 2010), the mechanism of choice most heavily utilized in the country in the past decade is biodiversity stewardship, where the level of contractual agreement is dependent on the biodiversity value of the property and landowner willingness. The BSP has ushered in a whole new era of protected area expansion opportunities not previously considered by, or available to, the private land holder and has contributed to the formal conservation estate in ways never deemed possible in the past (for operational procedures refer to Ezemvelo KwaZulu-Natal Wildlife, 2008). Other mechanisms such as land purchases are becoming increasingly unpalatable to the governing authorities, most likely due to a slowing global economy and shrinking government budgets stretched to accommodate a host of other competing needs including the rhino poaching epidemic. High land prices are also a contributing factor, which for temperate indigenous grassland properties amounts to *c.* ZAR 3000 to ZAR 5000 per hectare (*Robert Turner, professional property valuator, pers comm*).

The BSP was pioneered in the fynbos-dominated Western Cape in 2002, through a two-year partnership project between CapeNature and the Botanical Society of South Africa, funded by the Critical Ecosystems Partnership Fund (CapeNature, 2009). The BSP only reached the TGB four years later when biodiversity stewardship began in KwaZulu-Natal in 2006. The first declarations in the TGB achieved through the BSP were in 2009 (Appendix 1). Most provinces located within the TGB now have BSP units in place (Table 1).

The BSP is well favoured in South Africa because it makes good business sense. A costing exercise by Morris & Corcoran (2009) has shown that the BSP costs a quarter of that needed for land acquisition, even though the model assumed that the BSP will be used 90 per cent of the time, and land acquisition only 10 per cent of the time. However, in response to the more rigorous demands of national protected area legislation, and therefore having to offer a more robust framework for securing the protected area estate, the BSP still carries cost implications, although not to the extent of land purchases. Costs relate to the employment of biodiversity stewardship managers and their teams of facilitators, and the establishment phase involves costs relating to boundary surveys, public participation, and title deed endorsement through a notary prior to gazetting. The maintenance phase too has cost implications, and not only for the landowner. Provincial conservation

South Africa's temperate indigenous grasslands often form part of important water catchment areas, having high value in terms of ecological infrastructure © Clinton Carbutt

authorities have to employ district staff, facilitators and ecologists who all engage with the landowner in the establishment *and* maintenance phases. It is estimated that a single facilitator should be responsible for no more than 15 sites (Olivier, 2012). Therefore, the '*no* ongoing management costs' mindset involving the BSP is unfortunately a misconception. Furthermore, for the BSP to succeed, a 'mating for life' symbiotic commitment between state and landowner has to be in place in perpetuity.

Evident from the results is that 95 per cent of the gains achieved for temperate indigenous grassland conservation are the direct result of the BSP (Figure 3). A significant contribution of the BSP is its role in helping to achieve protected area expansion and biodiversity targets. By securing further habitat such as the endangered Midlands Mistbelt Grassland vegetation type, the BSP has contributed to the protection of the endangered Oribi Antelope (*Ourebia ourebi*), the critically endangered Wattled Crane (*Bugeranus carunculatus*), and the critically endangered Blue Swallow (*Hirundo atrocaerulea*). The gains achieved through the BSP also resonate in terms of formally securing high water yield areas.

Informal contributions through Conservancies, Sites of Conservation Significance and Natural Heritage Sites, none of which are declared formal nature reserves, can now be superseded by a reputable programme that gives private landholders an opportunity to own and manage formal conservation areas on equal standing with state-managed protected areas and thereby contribute to the formal conservation estate both in terms of area under protection and biodiversity target achievement. The BSP also allows better scrutiny of the private offering and imposes a uniformly high standard of protected area management with title deed endorsement. The BSP model also offers a wide range of landowner extension support, including assistance with burning programmes (e.g. pre-burn inspections and advice on burning regimes), invasive alien plant control (including the supply of herbicides) and wetland rehabilitation (Dugmore, 2010). The BSP is well aligned with Natural Resource Management Programmes to harness funding made available in such landcare-orientated initiatives. The BSP is also well favoured because landowners benefit from incentives including tax rebates and rates exemptions. Furthermore, in pursuing the BSP in South Africa, two key serendipitous spin-offs have also been generated:

i. A dynamic and flexible framework to explore new models of protected area expansion and co-management: where possible, BSP sites are often strategically linked to 'anchor tenant' state-managed protected areas to improve connectivity through the creation of biologically meaningful corridors and contiguous linkages, especially important in climate change mitigation and adaptation, enhanced delivery of ecosystem goods and services, and maximization of water yield areas. However, the BSP model allows even further flexibility and innovation in the design and management of the protected area estate, for example the practice of joint declarations between state-managed and private neighbouring protected areas, culminating in co-management agreements. A good example is Fort Nottingham Nature Reserve, a small temperate indigenous grassland reserve in the KwaZulu-Natal Midlands. A process has been initiated whereby this state -managed protected area (130 ha), and the neighbouring private property (1096 ha) earmarked for declaration through the BSP, will be gazetted as a single protected area (1226 ha) represented by a dual management authority (established through a Land Management Association represented by either state-municipal or state-private partners) and managed from a single management plan. Further benefits include simplified management boundaries, enhanced ecological processes, synergistic law enforcement efforts and the production of management plans for state-managed reserves that previously were not in place.

ii. Botanical exploration of previously unexplored or under-explored areas: another dynamic spin-off from the BSP is the new territories that have opened up to botanical exploration by both professionals and amateurs. A number of properties in the TGB were complete botanical unknowns ('black holes'): previously impenetrable and inaccessible to the outside world, either because these properties were unknown or because it was not possible to obtain landowner consent, especially in communal areas, where determining land ownership is often a challenge. With the owners of such properties now volunteering for the BSP, renewed collecting efforts to document a baseline flora as part of the site review and management plan process has resulted in the discovery of new (and presumably rare) plant species such as the milkweed, *Stenostelma* sp. (Apocynaceae), from the proposed Arrarat Nature Reserve (*Isabel Johnson, pers comm*), or range expansions of rare plant species, known from only few sites (Ramdhani & Carbutt, in preparation).

4. Critical Ecosystems Partnership Fund: this Fund, founded in 2000, is a joint initiative of Conservation International (CI), l'Agence Française de Dévelopment, the GEF, the Government of Japan, the John D. and Catherine T. MacArthur Foundation, and the World Bank (CI Southern African Hotspots Programme & SANBI, 2010). The main aim of the Critical Ecosystems Partnership Fund (CEPF) is to enable civil society to participate in, and benefit from, conserving the world's most critical ecosystems, and it therefore funds projects in global biodiversity hotspots. The CEPF has recently invested heavily into the Maputaland-Pondoland-Albany Hotspot, one of South Africa's three global biodiversity hotspots (CI Southern African Hotspots Programme & SANBI, 2010), and the only one located in the summer rainfall region. This hotspot extends to the base of the Drakensberg Alpine Centre and thereby fortunately includes the poorly conserved sub-escarpment grasslands of the TGB (Carbutt et al., 2011).

The funding provided by the CEPF in hotspots is designed to reach civil society in a way that complements previous investments and government priorities, and is committed to enabling NGOs *and* private/communal landowners to help protect vital ecosystems through innovative conservation activities (CI Southern African Hotspots Programme & SANBI, 2010; CEPF, 2012). However, regarding private landowners it is mainly the multiple landowner partnerships such as conservancies that qualify for funding (*Roelie Kloppers, pers comm*). This investment may help to facilitate the formalization of such informal conservation areas through declaration should the landowners be willing and the land be of sufficiently high biodiversity value. It is also important to note that it was funding from the CEPF that enabled the BSP to gain a foothold in South African conservation and contribute as a core member of the strategy.

The project proposals have to fall within the CEPF's five strategic directions for the hotspot, and to benefit conservation in the TGB, the proposals must align with strategic directions 2 and/or 3: ("expand conservation areas and improve land-use in 19 key biodiversity areas" and/or "maintain and restore ecosystem function and integrity in the Highland Grasslands") (CI Southern African Hotspots Programme & SANBI, 2010).

Given that the limitation to formally securing land for conservation is not the lack of site availability or landowner willingness, but rather the limited number of BSP facilitators employed by conservation authorities to broker stewardship contracts, the CEPF has to some degree helped unlock this output bottleneck. Grants have been awarded to the following experienced and reputable NGOs to employ facilitators: WWF-South Africa

South Africa's temperate grasslands are rich in forbs, such as this species of *Brunsvigia* (Amaryllidaceae) © Clinton Carbutt

(Grasslands Programme); BirdLife South Africa; Botanical Society of South Africa, Wildlands Conservation Trust (MPA Hotspot regional implementation team), Endangered Wildlife Trust (Threatened Grassland Species Programme), and the Midlands Conservancies Forum. Given this range of facilitators operating in the country, it is essential to formalise the government-NGO partnerships and ensure consistency in the way that their operations are conducted. To this end, Memorandums of Agreement have been developed between provincial government and its partners and a forum established for all partners to meet on a quarterly basis through a Working Group. We reaffirm that multiple government-NGO enabling partnerships will be key to securing temperate indigenous grasslands in South Africa and in other parts of the world.

CONCLUSION

Temperate indigenous grassland conservation in South Africa has benefitted greatly from four key interventions, namely the National Protected Area Expansion Strategy, the Grasslands Programme of the South African National Biodiversity Institute, the establishment of provincial biodiversity stewardship units (as the key mechanism to formally secure private and communal land to expand the temperate indigenous grassland conservation estate), and CEPF funding channelled into civil society. Given the clear benefits derived from each intervention, relevant countries with temperate indigenous grasslands are encouraged to develop similar structures. South Africa is learning that well-resourced BSP units are fundamental to national and provincial biodiversity conservation strategies and are the single most important intervention to formally secure land for biodiversity conservation, and bring threatened species and habitat under protection. However, the national and provincial governments have not fully comprehended the true value of the BSP, especially given that the alternative, land acquisition, has fallen out of favour. Therefore, government-funded BSP units in South Africa remain under-resourced and under-capacitated.

The success of the BSP will be undermined if private landowners do not comply with the management plan and the state does not employ further district staff and ecologists to service the growing number of sites. To avoid the 'paper park' syndrome, each temperate indigenous grassland protected area should be assessed on an annual basis using best-practice management effectiveness assessments (Carbutt & Goodman, 2013), involving landowner, facilitator, ecologist, district conservation officer and an independent assessor. Such a programme, already well entrenched in state-managed protected areas in South Africa (Britton, 2010; Carbutt & Goodman, 2010) should also become standard practice for sites secured through the BSP.

The gains since 2006 have increased formal protection in South Africa's TGB from 2.04 per cent (Carbutt et al., 2011) to 2.38 per cent, which is still well below acceptable limits. However, given the good systems in place and the large number of sites in the declaration process, the area under formal protection will increase further to at least 2.65 per cent in the foreseeable future. A more realistic picture of transformation in the TGB can only be gleaned from an updated National Land Cover which is still outstanding (the current coverage is based on outdated satellite imagery from 2000).

Making the case for the value of the TGB will require repeated and sustained efforts in order to make headway in the political arena and production sectors in South Africa, so a 'building the case' approach is advocated. Fortunately, the sleeping giant is awakening and perceptions are slowly shifting from an 'unimproved' agricultural-based working landscape mentality towards a more realistic appraisal of a mega-biome harbouring significant biomass, as well as myriad threatened and awe-inspiring biodiversity. Temperate indigenous grassland conservation should receive more attention on the global conservation agenda and every conceivable effort should be made to halt further habitat and species loss in this imperilled global biome.

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Appendix 1: The most recent declarations in the temperate indigenous grassland biome of South Africa. Protected areas are listed by date of declaration. If the protected area is not entirely temperate grassland, or in the case of protected environments that sometimes include areas of transformation, the area of temperate grassland is listed first, followed by the total gazetted area in brackets. BSP, Biodiversity Stewardship Programme

Protected Area (as per gazette notice)	Province	Declaration Level	Month & Year Declared	Gazetted Area (ha)	Management Authority	Mechanism	Reference no. as per Figure 1
Matatiele Nature Reserve	Eastern Cape	Nature Reserve	September 2007	4800	Matatiele Local Municipality	Acquisition (historic)	22
Bill Barnes Crane and Oribi Nature Reserve	KwaZulu-Natal	Nature Reserve	January 2009	450	KwaZulu-Natal Crane Foundation	BSP	15
Dalton Private Reserve (trading as Zulu Waters Game Reserve)	KwaZulu-Natal	Nature Reserve	January 2009	2463	Zulu Waters Trust	BSP	12
Mt Gilboa Nature Reserve	KwaZulu-Natal	Nature Reserve	January 2010	717	Mondi Limited	BSP	13
Roselands Nature Reserve	KwaZulu-Natal	Nature Reserve	July 2010	401	Landowner	BSP	20
Gelijkwater Misbelt Nature Reserve	KwaZulu-Natal	Nature Reserve	February 2011	829	Mondi Limited	BSP	11
Hilton College Nature Reserve	KwaZulu-Natal	Nature Reserve	February 2011	458	Hiltonian Society	BSP	17
Karkloof Nature Reserve (Farm Dartmoor)	KwaZulu-Natal	Nature Reserve	August 2012	779	Ezemvelo KwaZulu-Natal Wildlife	Acquisition	13
Karkloof Nature Reserve (Farm Middle Drai)	KwaZulu-Natal	Nature Reserve	August 2012	386	Ezemvelo KwaZulu-Natal Wildlife	Acquisition	13
KwaMandlangampisi Protected Environment	Mpumalanga	Protected Environment	September 2010	23,658	KwaMandlangampisi Protected Environment Landowners Association	BSP	5
Buffelskloof Private Nature Reserve	Mpumalanga	Nature Reserve	May 2012	150 ha of Lydenburg Montane Grassland (1484)	Buffelskloof Private Nature Reserve Trust	BSP	3

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Appendix 1: Continued....

Protected Area (as per gazette notice)	Province	Declaration Level	Month & Year Declared	Gazetted Area (ha)	Management Authority	Mechanism	Reference no. as per Figure 1
Kudu Private Nature Reserve	Mpumalanga	Nature Reserve	May 2013	400 ha of Steenkampsberg Montane Grassland (transition) (4794)	Kudu Game Ranch Share Block Limited	BSP	1
Blue Crane Nature Reserve	KwaZulu-Natal	Nature Reserve	October 2013	701	Jackson Trust	BSP	14
Clairmont Nature Reserve	KwaZulu-Natal	Nature Reserve	October 2013	1869	Sappi Southern Africa (Pty) Ltd	BSP	19
Excelsior Protected Environment	KwaZulu-Natal	Protected Environment	October 2013	1314 (1967)	Mondi Limited	BSP	21
Michaelhouse Nature Reserve	KwaZulu-Natal	Nature Reserve	October 2013	234	St Michael's Dioscesan College	BSP	16
Mount Shannon Protected Environment	KwaZulu-Natal	Protected Environment	October 2013	1395 (4414)	Mondi Limited	BSP	18
Ncandu Private Forest and Grassland Reserve	KwaZulu-Natal	Nature Reserve	October 2013	1388	Ncandu Reserve Private Landowners Association	BSP	10
Pongola Bush Protected Environment	KwaZulu-Natal	Protected Environment	October 2013	9259	Pongola Bush Protected Environment Landowners Association	BSP	9
Chrissiesmeer Protected Environment	Mpumalanga	Protected Environment	January 2014	59,432	Chrissiesmeer Protected Environment Landowners Association	BSP	4
KwaMandlangampisi Protected Environment (expansion)	Mpumalanga	Protected Environment	January 2014	3094	KwaMandlang-ampisi Protected Environment Landowners Association	BSP	6
Mabola Protected Environment	Mpumalanga	Protected Environment	January 2014	8772	Mabola Protected Environment Landowners Association	BSP	8
Mndawe Trust Protected Environment	Mpumalanga	Protected Environment	January 2014	826	Mndawe Trust	BSP	2
Tafelkop Nature Reserve	Mpumalanga	Nature Reserve	January 2014	1208	Landowner	BSP	7
Total (ha)				124,983			

Appendix 2: Proposed protected areas to be declared as either nature reserves or protected environments in the temperate indigenous grassland biome of South Africa in the near future. We anticipate that the majority of the gazette notices will be published by the end of the 2014 financial year. Protected areas are listed by date of anticipated declaration. BSP, Biodiversity Stewardship Programme

Protected Area	Province	Declaration Level	Declaration (expected)	Area (ha)	Management Authority	Mechanism	Reference no. as per Figure 4
Alice Glockner Nature Reserve	Gauteng	Nature Reserve	Early 2014	168	Gauteng Department of Agriculture and Rural Development (Biodiversity Directorate)	Consolidation and re-declaration under national legislation	6
Colbyn Valley Protected Environment	Gauteng	Protected Environment	Early 2014	49	City of Tshwane	Declaration under national legislation	3
Faerie Glen Nature Reserve	Gauteng	Nature Reserve	Early 2014	128	City of Tshwane	Consolidation and re-declaration under national legislation	5
Leeuwfontein Nature Reserve	Gauteng	Nature Reserve	Early 2014	2338	Gauteng Department of Agriculture and Rural Development (Biodiversity Directorate)	Consolidation and re-declaration under national legislation	1
Sneeuwberg Protected Environment	Free State	Protected Environment	Early 2014	17,456	Sneeuwberg Protected Environment Landowners Association	BSP	10
Klapperkop Nature Reserve	Gauteng	Nature Reserve	Early 2014	180	City of Tshwane	Consolidation and re-declaration under national legislation	4
Roodeplaat Nature Reserve	Gauteng	Nature Reserve	Early 2014	1555	Gauteng Department of Agriculture and Rural Development (Biodiversity Directorate)	Consolidation and re-declaration under national legislation	2
Ingula Nature Reserve (also proposed as a Ramsar site)	Free State/ KwaZulu-Natal	Nature Reserve	Early 2014	9437 (Free State 6118; KwaZulu-Natal 3319)	Eskom	BSP	11
Bosch Berg Nature Reserve	KwaZulu-Natal	Nature Reserve	Mid 2014	352	Landowner	BSP	17
Umgano Nature Reserve	KwaZulu-Natal	Nature Reserve	Mid 2014	1874	Umgano Project Landowners of the Mabandla Community (Umgano Development Company)	BSP	20

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Appendix 2: Continued....

Protected Area	Province	Declaration Level	Declaration (expected)	Area (ha)	Management Authority	Mechanism	Reference no. as per Figure 4
Zulu Waters Game Reserve (expansion)	KwaZulu-Natal	Nature Reserve	Mid 2014	717	Zulu Waters Trust	BSP	14
Allendale Nature Reserve	KwaZulu-Natal	Nature Reserve	Late 2014	1847	Landowner	BSP	15
Beaumont Nature Reserve	KwaZulu-Natal	Nature Reserve	Late 2014	1020	Landowner	BSP	21
Fort Nottingham Nature Reserve (expansion)	KwaZulu-Natal	Nature Reserve	Late 2014	1096	Fort Nottingham Land Owners Association	BSP	16
Lake Merthley Nature Reserve	KwaZulu-Natal	Nature Reserve	Late 2014	438	Umvoti Municipality	BSP	13
Mabaso Protected Environment	KwaZulu-Natal	Protected Environment	Late 2014	± 3000	Mabaso Community	BSP	9
Mt Currie Nature Reserve (expansion)	KwaZulu-Natal	Nature Reserve	Late 2014	± 600	Ezemvelo KwaZulu-Natal Wildlife	Acquisition (donation by Local Municipality)	22
Pongola Bush Protected Environment (expansion)	KwaZulu-Natal	Protected Environment	Late 2014	1922	Pongola Bush Protected Environment Landowners Association	BSP	8
Saddle Tree Protected Environment	KwaZulu-Natal	Protected Environment	Late 2014	615	Landowner	BSP	19
Umgeni Vlei Plateau Nature Reserve	KwaZulu-Natal	Nature Reserve	Late 2014	824	Ivanhoe Farming Company (Pty) Ltd	BSP	18
Upper uThukela Nature Reserve	KwaZulu-Natal	Nature Reserve	Late 2014	44,525	Amazizi and Amangwane Communities	BSP	12
Arrarat Nature Reserve	KwaZulu-Natal	Nature Reserve	2015	6500	Landowner	BSP	7
Total (ha)	**96,641**						

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RESUMEN

El frágil estado de los pastizales templados autóctonos a escala mundial ha motivado acciones tales como la Iniciativa para la conservación de pastizales templados de la Comisión Mundial de Áreas Protegidas de la Unión Internacional para la Conservación de la Naturaleza. Empero, si bien esta iniciativa eleva el perfil de la conservación de los pastizales templados en la agenda mundial de la conservación, aún así se requiere de intervenciones a nivel de país emprendidas por las autoridades locales de conservación, en colaboración con las organizaciones no gubernamentales (ONG), para mejorar los niveles de protección sobre el terreno. A este fin, informamos sobre los avances logrados con respecto a la conservación de los pastizales templados autóctonos en Sudáfrica desde 2006, un hito que marca el nacimiento de la gestión de la biodiversidad en nuestro bioma de pastizales templados. Desde entonces, 124.983 hectáreas adicionales de pastizales templados han sido puestas bajo protección formal con más de 96.641 hectáreas en proceso de declaración, la mayor parte de las cuales deberían estarlo para finales de 2014. También se examinan las fuerzas motrices que sustentan estos logros – a saber, el Programa de Pastizales del Instituto Nacional de Biodiversidad de Sudáfrica, la Estrategia nacional de ampliación de áreas protegidas, las unidades provinciales de gestión de la biodiversidad y el financiamiento canalizado hacia la sociedad civil a través del Fondo de Alianzas para los Ecosistemas Críticos para aumentar el aporte estatal. Dadas las ventajas evidentes derivadas de cada intervención, alentamos a otros países con pastizales templados autóctonos a desarrollar estructuras similares para salvaguardar muestras representativas y viables de uno de los biomas terrestres más importantes del mundo.

RÉSUMÉ

Afin de protéger la nature fragile des prairies tempérées indigènes à l'échelle mondiale, la Commission Mondiale des Aires Protégées de l'UICN à lancé l'Initiative de Conservation des Prairies Tempérées. Cette initiative a mis en exergue l'urgence de la protection de ces prairies sur l'agenda mondial de la conservation, toutefois des interventions de la part des autorités locales de conservation, en collaboration avec les organisations non-gouvernementales (ONG), doivent encore être exigées afin d'améliorer le niveau de protection sur le terrain. A cet égard, nous citons les progrès réalisés depuis 2006 pour la conservation des prairies indigènes tempérées en Afrique du Sud, qui ont ouvert la voie à une réelle gestion de la biodiversité dans le biome des prairies tempérées. En effet depuis lors, 124 983 ha supplémentaires de prairies tempérées ont été mis sous protection officielle, et 96 641 ha sont en cours d'évaluation, la plupart devant être accrédités d'ici la fin 2014. Nous discutons aussi des forces motrices qui sous-tendent ces acquis - à savoir le programme en faveur des prairies de l'Institut National de la Biodiversité en Afrique du Sud, la Stratégie Nationale d'Expansion des Aires Protégées, les associations locales de gestion de la biodiversité, et les fonds qui transitent par le Critical Ecosystems Partnership Fund vers la société civile afin d'accroître la contribution de l'Etat. Compte tenu des avantages tangibles issus de chaque intervention, nous encourageons les autres pays qui possèdent des prairies tempérées indigènes à développer des structures similaires afin de préserver ces parcelles représentatives et viables de l'un des plus impressionnants biomes terrestres.