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Developing capacity for a protected planet

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IUCN PROTECTED AREA DEFINITION, MANAGEMENT CATEGORIES AND GOVERNANCE TYPES

IUCN DEFINES A PROTECTED AREA AS:

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

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

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

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

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

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

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

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

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

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

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

IUCN defines four governance types.

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

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

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

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

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

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

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

PARKS: THE INTERNATIONAL JOURNAL OF PROTECTED AREAS AND CONSERVATION

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WELCOME TO THE NEW *PARKS: THE INTERNATIONAL JOURNAL OF PROTECTED AREAS AND CONSERVATION*

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Welcome to the first issue of the re-launched *PARKS: The International Journal of Protected Areas and Conservation*. From now on *PARKS* will be published at least twice a year as an online, open-access and peer reviewed journal, with occasional 'special issues' focusing on particular topics. The language is currently English, with abstracts in French and Spanish.

We aim for *PARKS* to be a rigorous, challenging publication with high academic credibility and standing. But at the same time the journal is and should remain primarily a resource for people actively involved in establishing and managing protected areas, under any management category or governance type. All papers accepted will include practical management information. We will also work hard to include authors who are involved in management but do not usually find the time to report the results of their research and experience to a wider audience. We welcome submissions from people whose written English is imperfect as long as they have interesting research to report, backed up by firm evidence, and are happy to work with authors to develop papers for the journal.

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 fulfil 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.

Each journal will include an editorial, around ten original peer reviewed papers and from issue 18.2 some non-peer reviewed articles including letters (a right of reply to previous papers) and book reviews.

Peer-reviewed papers will range from reviews and policy analyses, to relevant research, succinctly reported. In the latter category are detailed papers, as in the first issue, but would also like to this expand to include shorter technical notes of up to 1,000 words, reporting on key findings. Prospective authors are invited to check the author's guidelines before submitting (see www.iucn.org/parks); please also write to the editors if you want to check whether something is likely to be of interest.

The journal stems from and is supported by the IUCN World Commission on Protected Areas and peer reviewers are primarily drawn from amongst Commission experts. Please let us know if you would be willing to review draft papers. And please give us feedback on content, style and other issues: the journal will continue to develop in response to the needs of readers. We hope you approve of progress to date.

Sue Stolton and Nigel Dudley are both members of the IUCN World Commission on Protected Areas and work as consultants on protected area issues, covering everything from practical work on field projects through research, assessment and policy advocacy. They are based in the UK.

PARKS is published electronically twice a year by IUCN's World Commission on Protected Areas. For more information see: www.parksjournal.com

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EDITORIAL: WHAT DOES TARGET 11 REALLY MEAN?

Nik Lopoukhine[1] and Braulio Ferreira de Souza Dias[2]

[1] Chair, IUCN World Commission on Protected Areas
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According to the latest statistics from the UNEP World Conservation Monitoring Centre, there are now over 157,000 nationally designated terrestrial and inland water protected areas recorded on the World Database on Protected Areas (WDPA) covering 12.7 per cent of the world's land area outside Antarctica. Approximately 1.6 per cent of the global ocean area is also protected, although the majority of these marine protected areas are concentrated in the coastal zone (0-12 nautical miles), where 7.2 per cent of the total is protected (UNEP-WCMC, 2012). As most protected areas have been established in the last fifty years, this represents perhaps the largest and fastest change in land and water use in the history of the planet.

Protected areas are the basis of most national biodiversity conservation strategies, with growing evidence of their success in conserving biodiversity (Pimm et al, 2001; Butchart et al, 2012). More recently, they have also been recognized as playing a critical role in delivering a range of ecosystem services, cultural benefits and economic values (Stolton and Dudley, 2010). Importantly, the process of protected area creation is still underway: since the tenth Conference of Parties of the Convention on Biological Diversity (CBD) in 2010, countries have committed to a further extension of protected area coverage by 2020, to: "*at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services*".

Such ambitious targets bring their own social, political and economic challenges. The re-launch of *PARKS* journal comes at a critical time in conservation history, and aims to provide a forum for research, debate and assessment about the establishment and management of protected areas, under all relevant management approaches and the full range of governance types.

One of the most urgent issues that must be addressed by the protected area community is the clarification of Target 11 of the so-called 'Aichi targets' agreed at the tenth CBD Conference of Parties (COP), which commits to the increase in protected area coverage referred to above. More precisely, confusion remains about what management approaches are, and are not, to be included within the land and water areas established under the auspices of the target.

In 2008, after exhaustive consultation, IUCN agreed a new definition of a protected area, which made subtle but significant changes to the Union's understanding of the nature of protection defining 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*" (Dudley, 2008). The new definition clarified several issues that had long dogged debate. It stated clearly that nature conservation was the primary role of protected areas as recognized by IUCN. An associated principle emphasised this distinction: "*For IUCN, only those areas where the main objective is conserving nature can be considered protected areas; this can include many areas with other goals as well, at the same level, but in the case of conflict, nature conservation will be the priority*" (Dudley, 2008). The primary objective also adopted the broader concept of 'nature conservation', which now embraces 'geodiversity, landform and broader natural values' (Dudley, 2008) and used less technical language that non-specialists were more likely to understand.

The new IUCN definition is also much more consistent with the CBD definition for a protected area, as a: "*geographically defined area which is designated or regulated and managed to achieve specific conservation objectives*". There is a tacit agreement between the institutions that the two definitions are equivalent.

Both IUCN and the CBD also recognise the six protected area management categories, ranging from strict 'no-go'

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Tasmanian Wilderness, World Heritage Site, Australia © Nigel Dudley

protection to broader, culturally-managed protected landscapes; and four governance types (state, private, shared and indigenous and community management). In effect these provide a single 'universe' in which to define and measure protected areas. Such considerations became even more important with adoption of the CBD's Programme of Work on Protected Areas (PoWPA) in 2004, with clear area-based targets for the international community.

The decision at the tenth COP in Nagoya, Japan in October 2010 added a significant qualifier to the protected areas framework. Target 11 states that the targets refer to: "... *effectively and equitably managed, ecologically representative and well connected systems of protected areas* ***and other effective area-based conservation measures****, and integrated into the wider landscapes and seascapes*" (our emphasis). Concern has been raised that a loose interpretation of the bolded wording could result in inclusion of areas under so many management approaches that the target becomes meaningless. There have long been efforts, for example, to open up the concept of protected areas to embrace a range of management options, such as intensive forestry, farming and mining, which would seriously undermine their biodiversity values. Care is needed if the Aichi targets are not inadvertently to provide a perverse incentive for weakening the same protected area systems that they were aiming to promote.

At the same time, it is clear that biodiversity conservation is not and should not be confined to protected areas and that a significant proportion will remain outside protected areas. Indeed, the importance of connectivity between protected areas (Worboys et al, 2010) and of implementing broader ecosystem approaches to conservation are enshrined within the CBD targets.

In the context of the PoWPA, it is important to make a distinction between areas that are managed primarily for conservation and those managed for other benefits. If achieving Aichi Target 11 is to be determined by the protected areas that governments recognise and report to bodies such as the CBD, some sites that might logically qualify as 'other effective area-based conservation measures' would clearly also fit the IUCN and CBD definitions of a protected area. However such sites are not usually listed in the World Database on Protected Areas (WDPA) or the *UN List of Protected Areas*. This may be because governments only recognise, and report on, state-owned areas or because the owners of such sites do not wish to be recognised officially by the UN process. Examples might be private reserves (owned by private individuals, non-profit or for-profit institutions and corporations) and various forms of indigenous and community conserved areas. Many of these sites *could* be included in the WDPA, if governments open their reporting systems to private and indigenous and community-run protected areas (ICCAs). (Indeed, an increasing number of countries are starting to include non-state protected areas in their official statistics.)

Agreeing to list and report these areas would help many countries in moving towards meeting the Aichi Target 11. Both PoWPA and successive decisions of the CBD COP accord recognition to ICCAs and the PoWPA reporting framework adopted by the COP in decision X/31 provides for reporting on ICCAs.

Rangers and Community Committee, Niumi National Park, The Gambia © Colleen Corrigan

It is critical that a distinction is made between such sites and other 'effective area-based conservation measures' which will *never* be protected areas, for instance because their primary aim is directed towards other objectives, or because they have no long-term security of tenure. Examples might be sustainably-managed commercial forestry; organic farms; de-militarised zones; areas of semi-natural vegetation alongside motorways; extensive pasture grazing; and temporary areas set aside to build fish stocks. These may play an important role in the conservation of biodiversity, but do not have the safeguards inherent in the IUCN definition and associated principles. They may need a better form of recognition than is currently available, but are not protected areas in the sense understood by the CBD and IUCN.

In the context of the CBD's Programme of Work on ***Protected Areas*** (our emphasis), a conceptual division is needed between these two groupings. Effective area-based conservation measures that meet the definition of a protected area but are not currently recognized by the state fit well within Aichi Target 11, while those areas that contribute to conservation aims but could *never be protected areas* unless appropriate measures are taken to ensure nature conservation in such areas which allow them to meet the definition of a protected area. It is encouraging that most governments instinctively seem to be adopting this interpretation.

The fine-tuning of what is, and is not, a protected area will doubtless continue. Given that governments are ultimately responsible for deciding what to report to the WDPA, regional and national nuances in interpretation will remain. IUCN WCPA is currently developing assignment standards to help people better understand the protected area definition and use of the IUCN categories. Clarity in international understanding of the broad principles involved in defining and describing protected areas will help the world to achieve the ambitious targets that governments signed up to in Nagoya.

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ABOUT THE AUTHORS

Nik Lopoukhine has been Chair of the IUCN World Commission on Protected Areas (WCPA) since the IUCN World Conservation Congress in Bangkok, Thailand, in 2005 and will stand down at the 2012 Congress in Jeju, South Korea. Nik started his professional career with the Forest Management Institute and later moved to the Lands Directorate of Environment Canada. In 2001, Nik became the Director General of National Parks in Canada. He was a key supporter and mover of the idea of ecological integrity in the Parks Canada programme, of strengthening science, and coming to grips with the emerging challenge of climate change.

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SAFEGUARDING THE BLUE PLANET: SIX STRATEGIES FOR ACCELERATING OCEAN PROTECTION

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ABSTRACT

The oceans are facing greater pressures now than at any other time in human history. Marine protected areas (MPAs), nested within a wider approach of ecosystem-based management, have consistently emerged as one of the most important tools in halting the oceans' decline and promoting their recovery. The Convention on Biological Diversity (CBD) Aichi Target 11 calls for at least 10 per cent of coastal and marine areas to be conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas by 2020; unfortunately, most of the Parties are not on track to meet this commitment. To contribute to this effort, this paper details six strategies that can accelerate MPA establishment and create resilient MPA management models around the world. These strategies (build public-private partnerships to change how MPAs are designed and financed; strengthen links between MPAs, local communities and livelihood needs; manage MPAs to enhance carbon stocks and address climate change; act on high seas conservation and initiate MPAs immediately; reframe thinking about the benefits of MPAs; and use technology to connect people with the oceans) can help ensure that the oceans are protected, well managed, and provide livelihood benefits for humanity far into the future.

INTRODUCTION

The oceans are facing greater pressure now than at any other time in human history. Coastal development, unsustainable fisheries and aquaculture, shipping, marine pollution, and oil and gas activities are causing documented harm to coastal and offshore ecosystems (Halpern et al., 2008; Waycott et al., 2009; Jernelöv, 2010; Burke et al., 2011). Rising atmospheric carbon concentrations are leading to increased ocean temperatures and alterations in seawater chemistry, with impacts including coral bleaching, sea level rise, and ocean acidification (Harley et al., 2006; Doney et al., 2009). Beyond these well known threats, the oceans face impacts that are still relatively uncertain, including shifts in species distribution and ocean circulation (Toggweiler & Russell, 2008; Cheung et al., 2009). In the context of the 'unknown unknowns' – changes to marine ecosystems resulting from interactions between existing threats and climate change impacts that result from

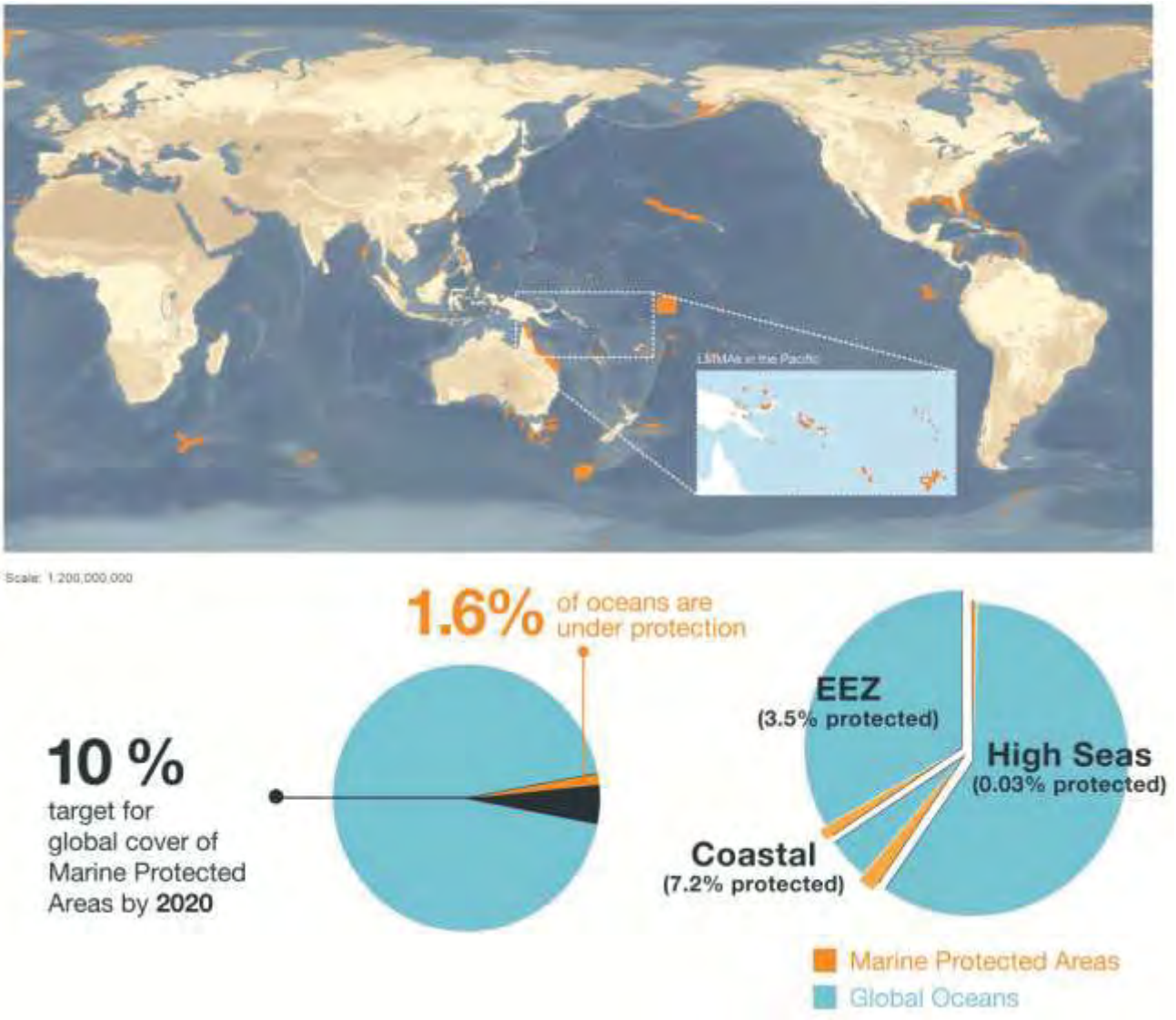

Figure 1: Only 1.6 per cent of global oceans are currently protected, leaving an 8.4 per cent gap to meet the 10 per cent protection target agreed by the Parties to the Convention on Biological Diversity by 2020 (left pie). A much smaller proportion of this consists of 'no-take' marine reserves. MPA protection differs by ocean governance regimes: 7.2 per cent, 3.5 per cent and 0.03 per cent are protected in coastal waters (0-12nm), Exclusive Economic Zones (EEZs; 12-200nm) and High Seas (beyond national jurisdiction) respectively (right pie). Some parts of the world have been successful at scaling up their MPA networks (see zoomed area in the Pacific), often via small coastal MPAs, which can be important for local food security © UNEP-WCMC, WWF-International, and the LMMA Network.

global, rather than local, drivers – it is critical to examine current marine protected area (MPA) establishment and management models, and instigate new approaches that reflect the challenges of the decades to come (McLeod et al., 2009; Driscoll et al., 2011).

For many years, amidst debate over how to reverse the degradation of the oceans, MPA networks have consistently emerged as one of the most important tools for promoting the oceans' health and recovery. MPAs are not the only marine spatial management strategy available to control human impacts, and should ideally be nested within a wider approach of ecosystem-based management. However, the efficacy of MPAs in reducing the decline of marine systems, enabling climate change adaptation, and building social-ecological resilience has been firmly resolved in the scientific literature, and in practice (Gell & Roberts, 2003; Dudley et al., 2010; Selig & Bruno, 2010).

In 2002, global leaders at the World Summit for Sustainable Development adopted a target for the establishment of representative networks of MPAs by 2012. In 2010, parties to the Convention on Biological Diversity (CBD) pushed back the goalposts to 2020. They developed a *Strategic Plan for Biodiversity 2011-2020*, in which Aichi Biodiversity Target 11 calls for at least "*10 per cent of coastal and marine areas ... conserved*

through effectively and equitably managed, ecologically representative and well connected systems of protected areas." MPAs are relevant to other Aichi Targets as well, including Targets 1 (values of biodiversity), 6 (sustainable fisheries), 10 (coral reefs) and 15 (C stocks) (www.cbd.int/sp/targets/). Unfortunately, most of the Parties are not on track to meet this 2020 CBD commitment. Wood et al. (2008) calculated that based on growth rates to 2008, the 10 per cent goal would be met only by 2047. The most recent (2011) World Database on Protected Areas analysis indicated that only 1.6 per cent of global oceans are protected in MPAs (Figure 1). These MPAs protect 7.2 per cent of coastal waters (0-12 nautical miles), 4.0 per cent of marine areas under national jurisdiction (0-200 nautical miles), 3.5 per cent of Exclusive Economic Zones (12-200 nautical miles), and 0.03 per cent of the high seas (beyond 200 nautical miles) (IUCN & UNEP-WCMC, 2011).

IUCN's World Conservation Congress and the CBD's 11th Conference of the Parties in September and October 2012, respectively, are critical opportunities for fostering international collaboration, ensuring effective MPA management, and scaling up MPA establishment efforts for the 21st century. To contribute to this effort, this paper offers six strategies that designers of MPAs and policymakers advocating for their creation can use to accelerate MPA establishment and effectiveness and create resilient MPA management models around the world. Strategies one, two and three are emerging concepts for MPA function and management; strategies four, five and six are innovative policy approaches. A high degree of innovation is essential to close the 'designation gap' between the area of the oceans that is already in well-managed MPAs and the much larger area that needs to be protected. To accommodate the rapid changes the world is undergoing, conservation policies need 'business unusual', with a creative and entrepreneurial spirit, and will require regular review and revision as new challenges and knowledge emerge. These six strategies present inventive and adaptive MPA establishment and management models, and can help ensure that the oceans are protected, well managed, and continue providing livelihood benefits for humanity far into the future.

STRATEGY ONE: BUILD PUBLIC-PRIVATE PARTNERSHIPS TO CHANGE HOW MPAS ARE DESIGNED AND FINANCED

Marine resources are crucial to the activities of private sector stakeholders – including fisheries, transport, mining and tourism companies. These stakeholders possess valuable technical capacity, information management skills and financial assets, and could play a crucial role in creating a business case for the establishment and effective management of MPAs. Businesses are interested in sustainable resource use as a risk management strategy, and increasingly willing to invest in long-term solutions (Michalisin & Stinchfield, 2010). Environmental degradation and change are also matters of strategic risk, and businesses that fail to recognize and proactively engage with these issues are likely to prove uncompetitive (Hoffman, 2005; Porter & Reinhardt, 2007).

Business investment in MPAs could offer valuable opportunities to offset the cumulative impacts of industrial activities. For example, a 'Financial Institution for the Recovery of Marine Ecosystems' (FIRME) has been proposed as a means to invest in fish habitat and biodiversity conservation, thereby catalyzing fisheries' recovery and sustainability (Rangeley & Davies, 2012). This initiative recognizes that MPAs are unlikely to be established in high conservation value locations at the scales they are needed without a variety of investment strategies. The FIRME would work through loans, based on a credible sustainable management plan, and secured against the value of future fish stocks. Loans, repaid with interest once a certain baseline on profitability is reached, would allow the FIRME's original capital to be reinvested into the fishery. WWF is currently partnering with stakeholders interested in helping to create a global FIRME, with Canada's Grand Banks of Newfoundland as the most likely candidate for a pilot.

Scaling up public/private partnerships and business-funded MPAs will increase the quantity of cost-effective MPA management models that mitigate investment risk, develop public and private finance streams, reduce illegal activities, conserve and enhance biodiversity, and encourage wider stakeholder participation and support (Riedmiller, 2003; Teh et al., 2008). California's *Marine Life Protection Act 1999* mandated a review and extension of regional MPAs, but implementation initially failed due to lack of funding and resources. In 2004, a new approach involved extensive stakeholder engagement and private sector finance to reinvigorate successfully the Act's implementation process (Scholz et al., 2011). Similarly, in the Malaysian part of the Coral Triangle, the proposed one million hectare Tun Mustapha Park has been developed through collaboration between local industry associations and community groups engaged with an international alliance of national and local government agencies, research institutions, and non-governmental organizations (WWF-Malaysia, 2012).

A chief in Marou community, North Efate, Vanuatu establishing an MPA using a modern approach (signing a management plan) hybridized with a traditional ceremony (using a pig) © Tevi Obed

STRATEGY TWO: STRENGTHEN LINKS BETWEEN MPAS, LOCAL COMMUNITIES AND LIVELIHOOD NEEDS

The engagement and participation of local communities and stakeholders is recognized as critical to the effective implementation of spatial marine management (Pomeroy & Douvere, 2008; Rodríguez-Martínez, 2008). There needs to be more extensive use of innovative strategies – such as hybridizing conventional conservation approaches with traditional practices, ensuring MPAs are linked to livelihood needs, and developing community advocates for MPAs through participatory research – that deliver bigger and better grassroots support for MPAs.

In the Pacific Islands, the Locally Managed Marine Area (LMMA) network has helped communities to address their livelihood needs through implementation and adaptive management of MPAs and associated management activities. The LMMA approach - which hybridizes conventional conservation approaches and science with traditional ecological knowledge and revived traditional marine management practices, such as the *tabu* in Fiji or *sasisen* in Indonesia - has spread across the region, with word travelling through clan-based and other networks (Hastings et al., 2012). As of 2009, the LMMA approach had expanded to over 500 communities in 15 countries, with 12,000 km^2 under management and 1,000 km^2 in traditionally protected, no-take areas (Govan, 2009).

One of the benefits to the LMMA strategy is that it can be incredibly cost-effective from a management perspective. For example, the Navukavu LMMA in Fiji was estimated to cost supporting institutions only US$760 yearly (Govan, 2009), but research showed that the fisheries, bequest value, and coastal protection provided by the coral reefs and mangroves within this area was worth US$1.795 million per year (O'Garra, 2012). The success of the LMMA approach, while owing much to regional tenure systems, demonstrates that local communities can be cost-effective stewards of marine resources, provided that they feel involved and that their livelihood needs are accounted for.

Developing advocates for MPAs from local communities can greatly increase public support for MPA establishment. Environmental non-governmental organizations and public-sector organizations can assist with this capacity-building process by involving community members in MPA research. Near the town of Caravelas in the Bahia state of Brazil, Conservation International-Brazil nurtured dozens of young community advocates by actively involving local secondary-school students in ongoing MPA research and analysis. This participatory research programme, called 'Open Your Eyes to Science', gave students an appreciation of the social-ecological system of the Abrolhos Bank and encouraged them to talk about the benefits of marine protection with their friends and family. This discourse ultimately helped to build

Students work with experienced marine researchers to make discoveries about the Abrolhos Bank in the state of Bahia, Brazil. Open Your Eyes to Science was supported by the State University of Maringá (UEM), Conservation International Brazil, the Brazilian Ministry of Science and Technology, and Bahia state organizations. Getting community members involved in MPA research has the potential to increase enthusiasm for MPA establishment © CI-Brazil

community support for the creation of the *Cassurubá* Marine Extractive Reserve in 2009 (Hastings, 2011).

STRATEGY THREE: MANAGE MPAS TO ENHANCE CARBON STOCKS AND ADDRESS CLIMATE CHANGE

The oceans work to absorb carbon dioxide and shape the weather – without them, the world would already be experiencing runaway climate change. The oceans remove almost a third of the carbon dioxide released into the atmosphere yearly, and regulate local climate. Carbon sinks in coastal ecosystems such as mangroves, seagrass meadows, kelp forests, and salt marshes – called 'blue carbon' – account for as much as 71 per cent of all organic carbon captured in the oceans, and provide other benefits including provision of habitat, production of food, regulation of disease vectors, nutrient cycling, and the stabilization and protection of coastal areas (Harborne et al., 2006; Laffoley & Grimsditch, 2009; Nellemann et al., 2009; Donato et al., 2011). Ongoing research continues to highlight the extent to which the carbon and ecosystem service values of blue carbon resources have been underestimated (Eyre & Maher, 2011; Fourqurean et al., 2012).

Management focused on maintaining and rehabilitating intact ecosystems can be a cost-effective strategy to achieve positive emissions mitigation and climate adaptation outcomes (Murray et al., 2011). MPAs protect coastal carbon sinks, which can be lost very quickly when these habitats are damaged by human activities (Laffoley & Grimsditch, 2009). By reducing stresses on habitats and promoting recovery, MPAs can increase resilience to climate change impacts and sustain benefits to people. They may be selected, designed and managed specifically to address both ecological and social resilience in the face of environmental change (West & Salm, 2003; McLeod et al., 2009; Lawler, 2009).

Coastal sinks, such as mangroves, can assist with carbon removal and help mitigate climate change. Here, a mangrove wetland reforestation project in West Java, Indonesia © Sebastian Thomas

Recognition of the mitigation and adaptation values of MPAs can also help harness climate finance. For example, conservation and rehabilitation of blue carbon resources are suitable as Nationally Appropriate Mitigation Actions (NAMAs), which are the responsibility of all developing countries that are signatories to the United Nations Framework Convention on Climate Change (UNFCCC, 2011). Blue carbon offset projects can be attractive to private investors due to sustainability benefits (Venter et al., 2009), and there is increasing evidence to support the recognition of blue carbon resources as integral to the global carbon accounting system (Mcleod et al., 2011), and calls for a dedicated international blue carbon policy and finance instrument (Herr et al., 2012). MPAs are one way that blue carbon resources can be conserved and rehabilitated, and novel forms of both public and private finance are potentially available. Although a dedicated international blue carbon fund is yet to be established, the United Nations (through key agencies) is working towards this goal in conjunction with the World Bank and other partners. Creating a blue carbon fund and market is the first specific proposal of the UN's '*Blueprint for Ocean and Coastal Sustainability*', presented in June 2012 at the Rio+20 Conference on Sustainable Development (UNCSD, 2012; IOC/UNESCO et al., 2011). While the outcome document of the UNCSD has been criticised as lacking firm commitments (e.g. Climate Connections, 2012), the language on 'Oceans and seas' is relatively strong (UNCSD, 2012: p27), with parties committing to pollution and debris reduction as well as enhancing fish stocks and supporting biodiversity, and calling for initiatives that address ocean acidification and the impacts of climate change on marine and coastal ecosystems. The document recognises the social, economic and environmental benefits of coral reef and mangrove ecosystems, and calls for international cooperation to support this, paving the way for financial instruments such as a dedicated blue carbon fund (UNCSD, 2012).

Anemone Reef, Phuket, Thailand © Dawnelle Froehler 2006

STRATEGY FOUR: ACT ON HIGH SEAS CONSERVATION AND INITIATE MPAS IMMEDIATELY

High seas and seabed areas beyond national jurisdiction are critical components of the global ocean ecosystem. Spanning nearly two thirds of the world's oceans, they are both under-protected and essential to reaching the CBD 10 per cent target. Regional conservation organizations already exist with the authority to designate high seas MPAs. The Oslo/Paris Commission in the Northeast Atlantic, the Commission for the Conservation of Antarctic Living Marine Resources in the Southern Ocean and the Barcelona Convention in the Mediterranean have established eight high seas MPAs (Reeve et al., 2012). Financial assistance, scientific support and public pressure could accelerate progress by these and other regional bodies towards wider MPA networks.

However, these regional agreements are only binding on members (Druel, 2011). To establish a common, global mandate for precaution, protection and ecosystem-based management, many governments are now calling for a global agreement for the conservation and sustainable use of marine biodiversity beyond national jurisdiction (Gjerde & Rulska-Domino, 2012). Such an agreement – created under the Law of the Sea Convention – would provide a platform for a truly global MPA network, as well as ensure the effective and equitable management of the global ocean commons beyond national boundaries. Political commitment to such an agreement by governments could accelerate progress towards the 2020 MPA target.

While working towards the global agreement, governments, scientists, NGOs and industry leaders can act now to initiate *ad hoc* alliances to pursue protective measures on the high seas. The Pacific Oceanscape Framework is one example where Pacific regional leaders have agreed upon an ambitious goal of MPA networks that includes high seas areas (see forumsec.org for more information). The Sargasso Sea Alliance (sargassoalliance.org), led by the Bermuda government, is paving the way for protection in the western north Atlantic. Similar initiatives to establish high seas MPAs are needed to address the huge gap in ocean management.

Priority areas for protection and collaboration can be derived from work underway within the CBD regarding areas of ecological or biological significance (EBSAs) based on scientific criteria adopted by CBD COP10 in 2010 (Gjerde & Rulska-Domino, 2012). Since 2010, the CBD in conjunction with governments and regional organizations has been convening workshops to describe areas that meet the scientific criteria. So far, regional workshops have been held in the North-East Atlantic, the Western South Pacific, the Wider Caribbean and Western Mid-Atlantic and the Southern Indian Ocean. Additional workshops are planned for the Eastern Tropical and Temperate Pacific, the North Pacific and the South East Atlantic, and elsewhere. Reports from the initial workshops and a similar Mediterranean process were reviewed by the CBD's scientific advisory body (SBSTTA) in May 2012, and have been submitted for endorsement to CBD COP11.

As in the Pacific and the Sargasso Sea, states may work through regional organizations or informal alliances to pursue measures through the relevant sectoral bodies, e.g., for fishing, shipping, or seabed mining, to enhance an area's conservation and management. They can even agree amongst themselves to designate the area as an MPA, and adopt other measures consistent with international law such as environmental impact assessments.

The development of apps such as this one on Marine World Heritage sites demonstrate the ability to go beyond desktop systems and put ocean exploration literally in the hands of the user © Andy Jeffrey

STRATEGY FIVE: REFRAME THINKING ABOUT THE BENEFITS OF MPAS

Political and public debate about MPAs often centres upon their perceived economic and societal costs, as opposed to their myriad economic, cultural, and environmental benefits (Mascia et al., 2010; Smith et al., 2010). For example, public discussions over the Great Barrier Reef Marine Park (GBRMP) have often focused upon immediate direct costs, whereas in fact the economic returns from rezoned MPA networks within the GBRMP have been estimated at approximately 130 times greater than the costs of management (McCook et al., 2010). MPAs can contribute not only by generating alternative revenue streams, but can also be designed to enhance fisheries' productivity (Gaines et al., 2010; Harrison et al., 2012). There is an immediate need to 'reframe' thinking about MPAs to pursue proactively more balanced appraisals of their benefits relative to costs, while also being conscious and transparent about trade-offs that are often involved between biodiversity conservation and livelihoods. At the very least, such information will lead to better informed political and public debate; at best, it will allow win-win solutions to emerge and be recognized, and grow a larger and better informed constituency of support for MPA establishment and management.

Research in the Pacific has already shown that in addition to economic and conservation benefits, MPAs can deliver development, cultural and governance benefits, including improved children's health, reduction in internal conflicts, and better community organization (Leischer et al., 2007; Govan, 2009; Pascal, 2011). Reframing thinking could be done by undertaking additional case studies detailing the relative and distributional benefits and costs of MPAs at different scales (Fox et al., 2012). Case studies should evaluate benefits with the MPAs' primary purposes in mind (evaluating fisheries benefits when that MPA has been designed in part for fisheries, for instance), acknowledge additional benefits (such as coastal stabilization or nutrient cycling), include explicit consideration of the likely long-term costs of *not* having an MPA, and analyze – or at least acknowledge – the indirect and non-financial benefits of MPA protection. Indeed, several international initiatives, including The Economics of Ecosystems and Biodiversity (TEEB, www.teebweb.org) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES, www.ipbes.net/), are highlighting the global economic benefits of biodiversity and the growing costs of biodiversity loss and ecosystem degradation.

STRATEGY SIX: USE TECHNOLOGY TO CONNECT PEOPLE WITH THE OCEANS

The power of social media to create change is clear. The 'Arab Spring' in the Middle East and North Africa was propelled by these communication tools, helping activists share ideas and coordinate action (Soper & Demirkan, 2012). Ocean protection has yet to mainstream such opportunities, but early examples demonstrate its utility: in the Bahamas, a social media "crowdfunding" campaign raised almost US$500,000 for MPA management (Davis et al., 2012), and by early 2012, Google Earth™, with its a new perspective on the oceans, surpassed one billion downloads. Mainstreaming social media for ocean conservation can enable greater sharing of scientific findings, create new opportunities for MPA

The rescue of a pygmy killer whale at Tanjung Aru, Sabah, Malaysia was greatly assisted by social media © Scubazoo, 2012

funding, and increase public mobilization, engagement, and ownership. Strategies include showing locations of MPAs on mobile apps, sharing news of MPA successes or challenges via Twitter™, raising funds for MPA management through crowdfunding apps, or expanding use of YouTube™ for dissemination of informative and riveting talks on MPA issues.

Social media also represent the extraordinary power of immediacy, the ability to connect people instantly with critical events. For example, in January 2012 a pygmy killer whale was stranded on a beach in Kota Kinabalu, Sabah, Malaysia. As a result of text messaging, Twitter™ and Facebook™, there were more than 100 volunteers on site to assist within two hours of the first incident report. With expert leadership, these volunteers worked around the clock for 36 hours to support the animal and return it to a safe location (Fong & Vanar, 2012).

Social media can be strategically deployed to empower policymakers, managers, scientists, and environmental advocates to increase awareness and create personal connections to the oceans. Just as Facebook™ targets advertising toward different demographics, there is an opportunity to connect communities with their local marine environments, to build global constituencies of interest or concern and to direct specific, high-impact messages to the right people. Information technologies can promote wider recognition not only of threats and impacts (acidification and bleaching, for instance) and unique events (such as dolphin sightings or whale strandings) but also of the oceans' significant climatic role and the value of MPAs in biodiversity conservation, and climate change mitigation and adaptation. Powerful messages and personal engagement are crucial to building understanding and support.

CONCLUSION

MPAs are vital tools for long-term sustainable management of the oceans. The design and operation of MPAs in the 21st century must be reconsidered, as the oceans are facing new and greater threats than ever before. This paper has explored six strategies that offer innovative approaches to the design, management, implementation and marketing of MPAs.

The oceans are in serious decline, and we must increase the number and area of MPAs, reform management approaches, and increase the effectiveness of the MPAs already in place. 'Business unusual' is needed to fill the designation gap, and the strategies presented here are key components of this necessary innovation. Action is needed now, for the sake of the oceans' health and humanity's future.

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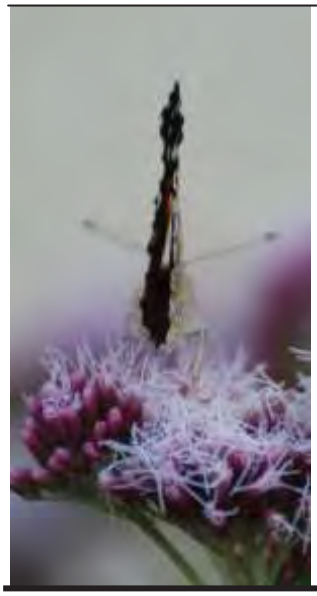
RESUMEN

Nunca antes se habían enfrentado los océanos a tantas presiones. Las áreas marinas protegidas (AMP), dentro de un enfoque más amplio de la gestión basada en los ecosistemas, han surgido como una de las herramientas más importantes para la gestión sostenible, o incluso la recuperación, de los océanos. La Meta 11 de Aichi del Convenio sobre la Diversidad Biológica (CDB) hace un llamado para que para el año 2020 el 10 por ciento de las zonas marinas y costeras se conserven por medio de sistemas de áreas protegidas gestionados de manera eficaz y equitativa, y ecológicamente representativos, pero desafortunadamente, la mayoría de las Partes no está en camino de cumplir con este compromiso. Este documento pretende apoyar este esfuerzo reseñando seis estrategias que podrían acelerar el establecimiento de AMP y crear modelos para la gestión de AMP resilientes en todo el mundo. Estas estrategias (establecer alianzas público-privadas para cambiar la forma en que las AMP son diseñadas y financiadas; fortalecer los vínculos entre las AMP, las comunidades locales y sus necesidades; gestionar las AMP para hacer frente al cambio climático e incrementar las reservas de carbono; implementar la conservación en alta mar mediante AMP; replantear el discurso sobre los beneficios de las AMP; y utilizar la tecnología para conectar a la gente con los océanos) pueden mejorar la protección y gestión de los océanos, y deparar beneficios futuros para la humanidad.

RÉSUMÉ

Depuis l'apparition de l'homme sur terre, les océans n'ont jamais subi de pressions aussi fortes. Les aires marines protégées, prise dans un contexte plus large de gestion écosystémique, se sont toujours présentées comme l'un des instruments les plus efficaces pour lutter contre la dégradation des océans et promouvoir leur régénération. Selon l'Objectif d'Aichi n° 11 de la Convention sur la diversité biologique, au moins 10% des espaces marins et côtiers devront être conservés d'ici à 2020, au moyen de réseaux écologiquement représentatifs et bien reliés d'aires protégées. Malheureusement cet objectif sera loin d'être atteint par la plupart des États Parties. Pour contribuer à cet effort, six stratégies sont ici détaillées, afin d'accélérer l'établissement d'aires marines protégées et de créer des modèles de gestion résilients. Ces stratégies (établir des partenariats de type public-privé pour changer le mode de création et de gestion des aires marines protégées ; renforcer les liens entre les besoins des aires marines protégées et ceux des communautés locales et leurs moyens de subsistance ; gérer les aires marines protégées de façon à accroître les stocks de carbone et à répondre aux effets du réchauffement climatique ; favoriser la conservation de la haute mer et y établir des aires marines protégées sans plus attendre ; recadrer et repenser les bénéfices liés aux aires marines protégées ; faire usage de la technologie pour connecter les gens et l'océan) peuvent contribuer à une meilleure protection et gestion des océans en vue de subvenir durablement aux besoins de l'humanité.



MEETING AICHI TARGET 11: WHAT DOES SUCCESS LOOK LIKE FOR PROTECTED AREA SYSTEMS?

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ABSTRACT

The Convention on Biological Diversity Strategic Plan for Biodiversity 2011-2020 was adopted at the 10th Conference of the Parties in Nagoya, Japan. The plan outlines 20 Aichi Targets to achieve global biodiversity conservation. A fundamental global approach to biodiversity conservation is the use of protected areas. Arguably all 20 Aichi Targets have implications for the establishment and management of protected areas, but only Target 11 addresses them directly. This paper carries out a clause by clause analysis of Target 11 and makes recommendations to countries on interpreting each clause in order to best achieve biodiversity conservation using protected areas. Despite containing only 61 words, Target 11 is surprisingly dense. It applies to both marine and terrestrial ecosystems, and sets goals for spatial planning (representiveness, ecological connectivity and areas of importance for biodiversity); protected areas management (including management effectiveness and social equity); and criteria about what counts toward being a protected area under Target 11. We argue for a holistic interpretation of Target 11 as a way for the global community to use protected areas to change the current unacceptable trends in global biodiversity loss.

INTRODUCTION

Biological diversity underpins ecosystem functioning and the provision of ecosystem services essential for human survival and well-being. It provides food security, clean air and water; it contributes to local livelihoods, human health, and economic development, and thus is essential for the achievement of the Millennium Development Goals, including poverty reduction. Accordingly the 10th Conference of the Parties (COP) to the Convention on Biological Diversity (CBD), in Nagoya, Japan, adopted the Strategic Plan for Biodiversity 2011-2020.

This Plan is comprised of a shared vision, a mission, strategic goals and 20 ambitious, yet achievable, targets, collectively known as the Aichi Targets (www.cbd.int/sp/targets/). At first reading, the Targets are straightforward and require little policy elaboration. Closer examination however reveals that they are complex parts of a whole, and require considerable interpretation if countries are to be able to move ahead in a consistent and fair manner and achieve the Targets.

Arguably all 20 Aichi Targets have implications for the establishment and management of protected areas, but only Target 11 addresses them directly. Protected areas are a tried and tested approach to nature conservation. For centuries they have been created and managed by local communities, indigenous peoples, governments and private organizations. They remain one of the most diverse and adaptable management and institutional tools for achieving conservation. Their effectiveness can be measured, evaluated and enhanced. In addition to conserving nature, protected areas are critical for a range of other benefits, including providing ecological services, reducing the impacts of disasters such as flooding, and storing carbon (Dudley et al., 2010, World Bank, 2010).

Aichi Target 11, which falls under Goal C of the Strategic Plan for Biodiversity, '*Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity*' reads: "*By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal*

Galápagos Islands World Heritage Site © Sue Stolton

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 seascapes."

The target addresses multiple facets of protected areas including increased coverage, connectivity, management, governance and equity. In this paper, we review Aichi Target 11 in order to suggest concrete policy guidance for governments and others attempting to implement the CBD's revised programme. We provide a clause by clause analysis of Target 11, suggesting the most appropriate interpretation based on an integration of 1) wider policy issues relating to the world's protected area system; 2) biological requirements for the persistence of species and ecosystems within protected areas systems; 3) a close understanding of the intent of the Target as drafted at the COP 10. After the discussion of each clause we provide a recommendation to parties of the CBD for interpretation and measurement of that clause.

The modifying clauses of Target 11 fall into three groupings. The first and largest grouping is essentially spatial, and includes the questions of how much area should be protected, the interpretation of ecological representiveness, where protected area should be placed, and how well they are connected and integrated by the surrounding landscape. The second group of modifying clauses focuses on how protected areas should be managed, including management effectiveness and questions of social equity. The third type of modifying clause is explicitly about what counts toward being a protected area under Target 11, which explicitly refers to 'protected areas and *other effective means*'.

CLAUSE 1: 'AT LEAST 17 PER CENT OF TERRESTRIAL AND INLAND WATER, AND 10 PER CENT OF COASTAL AND MARINE AREAS'

The World Database on Protected Areas (WDPA) tracks the coverage of the world's protected areas. Since 1950, there has been a sustained growth in protected areas with currently over 160,000 recognized protected areas conserving 13 per cent of terrestrial areas and 1.6 per cent of marine ecosystems (Bertzky et al., 2012).

Although 1.6 per cent of the global ocean area is protected, marine protection is concentrated in the near-coastal areas (0-12 nautical miles), where 7.2 per cent of the total area is protected. If we consider the total marine area under national jurisdiction, here defined as stretching from the shoreline out to the outer limit of the 200 nautical mile Exclusive Economic Zone, this figure decreases to 4 per cent (Bertzky et al., 2012).

While the global protected area network continues to grow, it should be acknowledged that some existing protected areas have been reduced in size, had their status altered, or ceased to exist (degazetted). A recent pilot study of this phenomenon (Mascia & Pailler, 2011), also known as protected area downgrading, downsizing, and degazettement (PADDD), found at least 89 historic instances of PADDD in 27 countries since 1900, and that PADDD is a current policy issue in at least a dozen countries. Such downgrading, downsizing or degazettement is generally to allow greater access for exploitation of natural resources.

So even with the simplest interpretation of Target 11, the world is currently below the overall target of conserving 17 per cent of terrestrial ecosystems and 10 per cent of marine ecosystems. Adding the other spatial elements mentioned in Target 11 of 'representativeness', 'connectedness', and 'areas of significance for biodiversity' adds additional complexity in achieving the coverage goals.

It must be kept in mind that Target 11 calls for 'at least' 17 per cent of lands and inland waters, and 10 per cent of coastal waters and that these are interim targets, designed to be achieved by 2020. There is nothing in these percentages, or Target 11 itself, that speaks to the more essential question of what level of protected areas would be required to achieve broader conservation goals. The real policy question is what amount of protection is necessary and sufficient to ensure that biodiversity is conserved, ecosystems have integrity, and provide necessary services for people. So, the scientific question is still outstanding as to what should be the ultimate percentage of protected area on land, freshwater and marine areas, since the Target 11 numbers were negotiated in an international convention and not developed through peer reviewed science.

RECOMMENDATION ON PERCENTAGE COVERAGE OF TARGETS

The percentage targets for global coverage should not be interpreted simply on the basis of a given percentage of protected areas in each country. The objective of Target 11 requires that protected area planning include additional spatial considerations of representativeness, connectedness, and areas of importance to biodiversity and ecosystem services (see discussion of other Clauses below).

Parties to the CBD should be aware that the percentage goals in Target 11 are negotiated, interim targets on a global scale, and are not scientifically defined endpoints.

CLAUSE 2: 'ECOLOGICALLY REPRESENTATIVE'

Target 11 requires the global protected area network to be ecologically representative without providing guidance on how 'representativeness' is to be determined. From an ecological perspective, it is reasonable to consider what is the most appropriate scale to assess representativeness: ecoregion, biome or realm.

In a significant global effort, Olson et al. (2001) defined a global set of ecoregions, on land, freshwater and in coastal marine areas. A total of 1055 ecoregions have been defined globally, 823 of which are terrestrial (which includes fresh water), and 232 are coastal marine. Deep sea marine ecoregions have not been defined. Terrestrial ecoregions are large areas with characteristic combinations of habitats, species, soils and landforms (Olson et al., 2001). At present only one-third of the 823 terrestrial ecoregions would meet the Aichi target of conserving 17 per cent (Bertzky et al., 2012). More alarmingly, 10 per cent of terrestrial ecoregions still have less than 1 per cent of their area protected, indicating significant gaps in the protection of large areas with distinctive biodiversity. Coastal marine ecoregions are large areas with characteristic combinations of species that are clearly distinct from adjacent areas (Spalding et al., 2007). By 2010, only 30 of the 232 coastal marine ecoregions met the 10 per cent protection target, while 137 (59 per cent) had less than 1 per cent of their area protected (Bertzky et al., 2012). Although some 13 per cent of marine ecoregions now meet the 10 per cent target, it will take considerable effort to reach required levels of representativeness of protection by 2020.

Coastal dune systems at Ynyshir Nature Reserve, Wales © Nigel Dudley

Ecoregions reflect the distributions of fauna and flora across the entire planet, and they in turn are nested within more coarse classifications of biogeographic realms and biomes (Dasmann, 1973, 1974; Udvardy, 1975). Biomes are defined as the world's major ecological communities (e.g. temperate grasslands, savannah and shrublands), classified according to the predominant vegetation and climate. Biogeographic realms are the large continental geographies of the world with

generalized climate patterns (e.g. Afrotropic). Only the Neotropic Realm has 17 per cent or more of its area protected (Bertzky et al., 2012). For biomes, the highest levels of protection are found in montane grasslands and shrublands, all exceeding 17 per cent. The lowest levels are in boreal forests, Mediterranean ecosystems and temperate grasslands and shrublands, which are all below 10 per cent.

Biological diversity, however measured, is best associated with an ecoregion classification, rather than biomes or realms (Olson et al., 2001). Biomes and realms are classification systems that reflect large scale patterns of climate and geography, but do not reflect species level diversity. Ecoregions cover relatively large areas of land or water, and contain characteristic, geographically distinct assemblages of natural communities and species. The biodiversity of flora, fauna and ecosystems that characterise an ecoregion tends to be distinct from that of other ecoregions. The 1055 terrestrial and coastal marine global ecoregions are well defined, cover all land, freshwater and coastal marine ecosystems and are at a scale relevant to countries and a scale relevant to conservation and representativeness. Because the system is nested, the use of ecoregions will also allow reporting to be done at the biome or realm level if so required.

RECOMMENDATION ON REPRESENTATIVENESS

Countries should use terrestrial, freshwater and marine ecoregions as the basis for determining the spatial element of representiveness in Target 11. The strongest scientific interpretation would be to read the clause as protect "*17 per cent of each terrestrial ecoregion and 10 per cent of each coastal marine ecoregion as protected areas by 2020*."

CLAUSE 3: 'ESPECIALLY AREAS OF PARTICULAR IMPORTANCE FOR BIODIVERSITY AND ECOSYSTEM SERVICES'

In addition to representativeness, Target 11 commits countries to establish protected areas in areas that are of 'particular importance for biodiversity and ecosystem services.' There have been various efforts to identify those areas, based on different scales, taxa and criteria. The most well-established examples are Important Bird Areas (BirdLife International, 2004) and Alliance for Zero Extinction sites (Ricketts et al., 2005). But important biodiversity areas have also been identified for freshwater biodiversity, plants and non-bird vertebrates, such as Important Plant Areas (www.plantlife.org.uk/wild_plants/important_plant_areas/) and Prime Butterfly Areas. While the conservation importance of many of these areas has long been known, global datasets that would allow global reporting have only recently become available for Important Bird Areas and Alliance for Zero Extinction sites. Datasets for other types of terrestrial sites and marine areas (Ecologically and Biologically Significant Areas) are still being developed.

A recent analysis of levels of protection for known sites of particular significance for species conservation showed that, as of 2008, only 22 per cent of the world's 588 Alliance for Zero Extinction sites was fully protected (in terms of protected area coverage), while 51 per cent remained entirely unprotected (Butchart et al., 2012). Each of these sites is critical for the survival of one or more highly threatened species. Similarly, only 28 per cent of the world's 10,993 Important Bird Areas were completely covered by existing protected areas in 2008, while 49 per cent were not protected at all. These sites are important for the conservation of the world's birds but also have other ecological values.

There is a pressing need for a global system to identify areas of particular importance for biodiversity as part of sound conservation planning. The IUCN World Commission of Protected Areas (WCPA) and Species Survival Commission (SSC) have established a joint Task Force on Biodiversity and Protected Areas (www.iucn.org/about/union/commissions/wcpa/wcpa_what/wcpa_science/biodiversity_and_protected_areas/) which is leading an initiative to consolidate a global approach for all taxa and sites to identify areas of significance for the persistence of biological diversity.

Biodiversity should be considered at the ecosystem, species and genetic level. Virtually all of the global efforts have been focused on species. The ecosystem level has also been considered in most approaches, either explicitly or implicitly by considering ecosystems as part of delineating areas for species conservation. Genetic considerations are included in some species-based approaches, although it is fair to say that there are still significant gaps in considerations of genetic diversity.

Identification of sites of particular importance for ecosystem services poses a different challenge and one that has not been well addressed by the conservation community. Ecosystem services are a subset of ecological processes that are viewed as benefits that people obtain from ecosystems. These include provisioning services such as food, water, timber, and fibre; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational,

A mangrove restoration project undertaken by the local community association at Joal-Faljouth National Park in Senegal
© Colleen Corrigan

aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling (Millennium Ecosystem Assessment, 2005). The links between biodiversity and ecological processes remain an area of active research. It is increasingly clear that the conservation of biological diversity is necessary to preserve ecological services (see Cardinale et al., 2012). At the current time there is no agreed methodology for identifying areas that are of particular importance for providing ecosystem services, because ecosystem services are user-defined and site-specific. Nonetheless, it is possible to identify areas that are *likely* to be important for ecosystem services including wetlands, montane grasslands, and cloud forest ecosystems as provisioners of clean water; coastal mangroves as nursery grounds for valuable sea life and diminishing the impact of storms; areas of natural vegetation that are providing soil stabilisation in erosion-prone areas and some forests, peat lands and grasslands as significant carbon stores and sinks (Ten Brink, 2011).

Well-managed protected areas can provide some services to people without impacting the primary nature conservation value of the protected area. This is either because the benefits are a side-effect of conservation, such as clean water, soil stabilisation and coastal protection, or because natural resources within a protected area are abundant enough to allow spillover and sustainable off-take, as can be the case with fish in marine protected areas (Dudley et al., 2011). It is likely that protected areas of sufficient size and location can reduce the vulnerability of local human communities to the impacts of climate change, including shortages of food, potable water and traditional medicines or increases of certain disease vectors (Dudley et al., 2010, World Bank, 2010).

However it is clear that merely identifying areas and proclaiming them as of importance will not result in their effective conservation. Linking them to a country's conservation priorities and global commitments is a vital step towards such effective conservation. Target 11 offers

RECOMMENDATION ON SITES OF PARTICULAR IMPORTANCE

While global databases and standards are still under development to determine sites of particular biodiversity significance and ecosystem services, there are already some well-developed data sets, especially for species conservation. Countries should use the best available data on sites of biodiversity significance and ecosystem services, and incorporate them into their planning for identifying new protected areas or expanding existing ones. When additional information is available, it should be reviewed for potential incorporation into the protected areas system.

Boreal forests in Canada © Sue Stolton

countries an opportunity to review their understanding of areas of biodiversity significance and ensure that they are well-managed.

CLAUSE 4: 'WELL CONNECTED SYSTEMS OF PROTECTED AREAS AND INTEGRATED INTO THE WIDER LANDSCAPE AND SEASCAPES'

Many protected area systems are composed of individual protected areas that are too small and not effectively ecologically connected to conserve biodiversity over the long term. When protected areas exist as islands in a fragmented landscape, their species populations have very low rates of emigration and immigration and higher probabilities of local extinctions (Diamond, 1975; Newmark, 1995). These known shortcomings were addressed in Aichi Target 11, when countries committed to developing '*well connected systems of protected areas*'.

In the last 40 years, major advances in the understanding and application of ecological theory have been applied to protected areas' design and management. It is increasingly accepted that protected areas must be part of connected networks, with conservation cores and effective connectivity (Lindenmayer & Fischer, 2006; Worboys et al., 2010) in order to maintain genetic diversity, viable populations, and adaptive animal behaviour. The term 'connectivity conservation' is widely used to capture this emerging scientific consensus. Building on this consensus the IUCN World Commission on Protected Areas (IUCN WCPA) has stated that the maintenance and restoration of ecosystem integrity requires landscape-scale conservation. This can be achieved through systems of core protected areas that are functionally linked and buffered in ways that maintain ecosystem processes and allow species to survive and move, thus ensuring that populations are viable and that ecosystems are able to adapt to land transformation and climate change.

Any global understanding of connectivity between protected areas must rely on the existence of structural connectivity that incorporates the following principles:

- Connectivity results when two or more protected areas are functionally connected, so that there is a gain in the potential habitat and potential movement of individual animals between protected areas. Connectivity thus results in increased population viability, including gene flow between sub-populations and a greater area of target ecosystems.
- Connectivity is a function of distance between protected areas so that the closer two units are to each other the greater the possibility of connection.
- In addition to separation distance, connectivity is a function of the difficulty or resistance in moving across that distance, termed 'ecological resistance'.
- Achieving ecological connectivity requires informed working with owners, rights-holders and managers of lands between protected areas to ensure that land management practices are compatible with the species moving across those lands.

An initial index of connectivity between terrestrial protected areas was calculated and mapped in the upcoming *Protected Planet Report* (Bertzky et al., 2012). The large protected areas and intactness of several geographical regions stand out. For example, on land, the Amazon Basin, Alaska, sections of boreal Canada, Western United States, Australia and Europe are well protected and well connected. Europe has focused on ecological networks as a means to preserve biodiversity, with 42 Ecological Network initiatives across Europe (Boitani et al., 2007).

Connectivity is a major conservation challenge for the world's nations with 40 per cent of the world's ecoregions having only relatively low or fair levels of protected area connectivity. Thirty-five per cent of the ecoregions have very low connectivity or no protected areas, indicating areas of the planet where significant conservation is required (Bertzky et al., 2012). Coastal marine ecoregions require different approaches to calculating connectivity and have not yet been assessed.

Connectivity conservation represents a new dimension in social relations associated with conservation (Worboys et al., 2010). Connectivity by definition means that there will be multiple stakeholders and rights holders with different views and interests who need to be brought into one type of governance system for a shared vision and equitable distribution of costs and benefits. To achieve

this, responsible agencies need to develop multi-centric governance structures that are able to deliver level-specific (local, regional, national, international) outcomes. To be successful, connectivity organisations need to pursue just distributions of benefits and costs and have well-defined upward and downward accountabilities (Worboys et al., 2010).

The IUCN Theme on Indigenous Peoples, Local Communities, Equity and Protected Areas (TILCEPA) has emphasised how Indigenous Peoples' and Community Conserved Territories and Areas (ICCAs) create opportunities for improved biological and ecological connectivity in landscapes and seascapes. While protected areas are the cornerstones for any national conservation strategy, they need to be integrated into the broader landscape through land management practices and planning at different scales. ICCAs provide one opportunity to harmonise the goals of valuing cultural diversity and sustaining biological diversity.

RECOMMENDATION ON CONNECTEDNESS

Countries need to move into the next phase of protected area and conservation planning by incorporating connectivity between protected areas at both regional and national scales, including transboundary conservation areas. This will require development of sufficiently large ecological cores, whenever possible and necessary, establishing new protected areas to serve as conservation cores, and also ensuring appropriate management of the working landscapes between protected areas to ensure functional connectivity.

Connectivity conservation requires new skills and approaches to bring in stakeholders and rights holders into new and equitable governance structures, founded in diverse tenure systems, where shared values and rules may need to be developed as the process of connectivity evolves.

CLAUSE 5: 'EFFECTIVELY AND EQUITABLY MANAGED'

How well protected areas maintain biodiversity and deliver ecosystem services depends, amongst other things, on how effectively they are managed, how they are integrated with surrounding development contexts and whether they are supported by local communities. The Target 11 wording to include 'effective and equitable management' of protected areas is based on an understanding that a large percentage of the world's protected areas were 'paper parks', or protected areas with very weak management (Hockings et al., 2006). In many of the world's protected areas, the key stakeholders include local communities and indigenous peoples, who may hold valuable traditional ecological knowledge and rely on the protected area for resources and a range of ecological services. Effective and equitable management means that protected areas management includes the need and rights of stakeholders as a fundamental part of management.

Effective management needs to be based on the conservation targets for a given area, and be able to adapt to changing circumstances. Effective management may mean low levels of intervention, for example in large wilderness areas, or require intensive interventions to restore species and ecosystem processes. Effective management will usually involve a wide range of stakeholders, including government agencies, non-government organizations, private entities, indigenous peoples and local communities. One way or another, implementing effective management for a protected area is fundamental for effective conservation.

IUCN has developed a system of protected area management categories that helps classify protected areas based on their primary management objectives and recognizes the importance of all categories for biodiversity conservation (Dudley, 2008). The system is based on a gradient of management and governance regimes from strictly protected areas (category I) with very limited access by human communities to protected landscapes which can include human settlements and cultural management (category V and VI). The system also recognises a range of governance and management authorities, from government agencies to NGOs and indigenous peoples and co-management arrangements. The categories have long been used by the United Nations and governments for protected area planning and reporting. IUCN has also developed a management effectiveness framework for protected areas which allow a detailed evaluation and tracking of how effectively a protected area is managed (Hockings et al., 2006).

The need for effectively and equitably managed protected areas is highlighted in the CBD's Programme of Work on Protected Areas (PoWPA) first agreed in 2004. Goal 1.4 of the PoWPA calls for all terrestrial protected areas to have effective management by 2010 and marine areas by 2012, and stresses the importance of adequate management plans to guide effective management. Goal 4.2 called on CBD Parties to assess at least 30 per cent of their protected areas by 2010; this target was revised upwards to 60 per cent of protected areas by 2015 by

Carrying out an assessment of management effectiveness in Serengeti National Park © Nigel Dudley

COP10 decision X31. A wide range of assessment systems already exist, designed for different situations and at varying levels of detail; most follow the broad framework on management effectiveness assessment laid out by IUCN WCPA (Hockings et al., 2006).

The PoWPA also calls on parties to promote equity and benefit-sharing (Goal 2.1) and to enhance and secure involvement of indigenous and local communities and other relevant stakeholders (Goal 2.2). Because the aim of management is usually effectiveness (of conservation measures), equity is customarily associated with the equally important issue of governance. Management typically focuses on the processes internal to the protected area (the 'what'), and governance (the 'who' and 'how') provides the platform for different interested parties to come together to find a shared vision, work with the costs and benefits issues, and locate the protected area within the greater socio-cultural and economic context.

The specific language of Target 11 which has pushed efficacy and equity into a single phrase relating to management may well be a quirk of multiparty text negotiations. We argue that effectiveness and equity are both different and essential elements of protected area management, and as such, should be treated separately.

The Protected Areas Management Effectiveness (PAME) study by the University of Queensland and the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) has shown that management cannot be effective without addressing governance and social policy issues. IUCN's 2010 workshop on PAME and Social Assessment of Protected Areas concluded that there is a significant correlation between good overall protected areas management effectiveness, effective public participation and social policy processes. Three of the top seven most significant correlated indicators for successfully managing protected areas are related to community participation and benefits (IUCN-TILCEPA, 2010)

Leverington et al's (2010) global study of management effectiveness, based on data from 4,151 assessments, found that only 24 per cent of sampled protected areas have sound management. Moreover 40 per cent of protected areas were found to have major deficiencies in management or be inadequately managed. The weakest aspects of management were the adequacy and reliability of funding, facilities and equipment, staff shortages, and the lack of appropriate benefit sharing programmes for local communities.

Management effectiveness assessments need to be repeated regularly so that changes can be tracked over time, and corrective measures implemented as needed. Only a limited number of such repeat assessments were available for the 2010 global study but they showed an encouraging trend: management effectiveness had

improved over time in 207 (76 per cent) of the 272 protected areas with repeat assessments.

The Aichi Target stresses 'effectively *and equitably* managed' (our emphasis). Most assessment systems to date have focused primarily on management effectiveness. IUCN has two ongoing projects that aim to address this imbalance: methodologies for assessing good governance in protected areas (Borrini-Feyerabend et al, in press) and Social Assessment of Protected Areas (Schreckenberg et al, 2010) to assess the social costs and benefits of protection. Consolidating, expanding, and improving the global protected area system will require much greater engagement of multiple partners, from communities to NGOs, government agencies and the private sector but will bring benefits for both biodiversity and social equity. Already there is good evidence that reserves established and managed by indigenous peoples within their territories are often better protected than other national protected areas as well as surrounding ecosystems (Nelson & Chomitz, 2011).

RECOMMENDATION ON 'EFFECTIVELY AND EQUITABLY MANAGED'

Countries should complete management effectiveness studies using the well-established procedures endorsed by IUCN for all their protected areas to strengthen management by 2020. Assessments should cover both the conservation and social outcomes of protected area management. Policies and procedures for the good governance of protected areas should be developed at both national and site level. Experiences of management and governance should be documented and reported through the CBD PoWPA mechanism, with attention to setting baselines and measuring progress with implementation. We endorse the existing commitment under the PoWPA that 60 per cent of protected areas will have conducted and implemented management effectiveness evaluations by 2020.

CLAUSE 6: 'AND OTHER EFFECTIVE AREA-BASED CONSERVATION MEASURES'

Conservationists agree that while protected areas are the cornerstones of biodiversity conservation they are not the only tools for maintaining species and ecosystems. Some alternatives are area-based, while others employ non area-based approaches, such as trade restrictions or harvest regulations. Furthermore, area-based management is not necessarily restricted to gazetted protected areas. Interpreting these wider approaches to what are often called 'other conservation areas' in the context of Target 11 raises the key question of identifying, classifying and acknowledging the role of areas that contribute significantly to biodiversity conservation, but which are not protected areas as defined by IUCN.

A precise interpretation of 'other conserved areas' is needed to avoid 'opening up' Target 11 to such a wide range of management approaches that it becomes meaningless. To interpret Target 11, we argue that 'other effective area-based conservation' should refer *only* to those sites that meet the intent of the IUCN definition of a protected area (see below), but are not currently listed on the World Database on Protected Areas (WDPA). Such areas include some private protected areas, company reserves and indigenous and community conserved areas. Many of these sites *could* eventually appear in the WDPA, if governments wished to open their reporting systems to non-government protected areas, and the mentioned groups would want to include their sites into this frame. Indeed some governments (e.g. Australia and South Africa) already recognise community-managed and indigenous reserves as formal protected areas. Some 'other conserved areas' are likely to remain outside of the WDPA but still meet the intention of being protected areas. For example, the custodians of some ICCAs and sacred natural sites may have good reasons for not wanting to appear on an international database, because it could draw increased attention to sites that retain value in part because of their isolation.

The IUCN definition for a protected area is as follows (Dudley, 2008): "*A protected area is 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 key clause of the IUCN definition is that protected areas are for the long term conservation of nature. In this context nature always refers to biodiversity, at genetic, species and ecosystem level, and often also can refer to geodiversity, landform and broader natural values (Dudley, 2008). For our purposes 'nature', defined as biodiversity, comes first. The protected area definition used by the CBD, defined in Article 2 of the Convention, is similar in intent and scope and we treat both definitions as being essentially equivalent: "*The term 'protected area' is as a geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives*".

There is no doubt that many production areas, and even urban areas, have important conservation benefits for biodiversity. However they do not meet the intent of being protected areas as defined by the IUCN and the

Community conservancies in Namibia are proving effective conservation approaches © Nigel Dudley

CBD. Whereas Target 11 was developed specifically for protected areas, we argue that areas meeting Target 11 as 'other effective means' should have clear nature conservation objectives, be clearly demarcated, and managed by a competent authority. By meeting these criteria, they meet the intent of being protected areas.

The 'other effective area-based conservation' language has in part been shaped by the acceptance of the State Parties to the CBD of new language brought into the PoPWA that recognises ICCAs. Though some ICCAs are formal protected areas under national legislative frameworks (for example Indigenous Protected Areas in Australia or the Namibian Community Conservancy system), others are unrecognised under current legislation. These areas include community stewardship of sites such as sacred forest groves, monastic conserved wild areas, and particular species that are protected under cultural taboo systems. For example, the Pacific Region has shown leadership in exploring how traditionally governed coastal, marine or reef territories can be integrated into a national strategic plan of Marine Protected Areas (Vierros et al., 2010). Other examples of sacred natural sites that fit 'other effective area based conservation measures' are Mount Athos and the Chaldiki Peninsula in Greece which is home to a series of remote Orthodox monastic communities who effectively conserve wilderness and biodiversity in this territory (on Sacred Natural Sites see Verschuuren et al., 2010).

There is increasing discussion about the need to identify and develop conservation criteria for a wider range of areas that contribute to conservation, including production landscapes and seascapes. These areas are critically important for wider conservation planning, connectivity and landscape approaches. Examples of such sites might be sustainably managed forests, watershed protection areas, production lands under conservation stewardship arrangements, military areas, and demilitarized zones, fishing reserves, organic farms and low intensity pastureland. Such lands will be increasingly important for ecosystem-based adaptation to climate change, especially ensuring ecological connectivity. We recognise the value of these places, but

RECOMMENDATION ON 'OTHER CONSERVED AREAS'

Countries, in meeting Target 11, should only consider 'other conserved areas' as those lands and waters that are either formal protected areas or that meet the intent of being protected areas. 'Other conserved areas' should meet the intent of the criteria for the agreed definition of protected areas in order to contribute to achieving Aichi Target 11. Specifically 'other conserved areas' should have biodiversity objectives, they should be managed by a competent authority for the long-term, assuring that conservation is the first priority.

Well managed production landscapes and seascapes have biodiversity value and are important for conservation and ecological connectivity, but do not fit under Target 11.

argue that they were not intended to meet the intention of Target 11.

MOVING FORWARD: PUTTING THE CLAUSES TOGETHER FOR EFFECTIVE CONSERVATION

The above discussion illustrates the complexity of Target 11. Protected area planning and management is a complex field requiring countries to consider spatial planning, ecological connectivity, and integration with surrounding landscapes, as well as effective management and a range of social issues around equity. Target 11 is remarkably dense in its construction and implication. It contains all the necessary elements for success, but countries need to consider all the elements as a whole to be successful. For many countries the pieces of this protected area puzzle are broken or do not exist. The pieces will have to be built or repaired in order to construct the whole.

Some countries have already protected 17 per cent or more of their land area but many ecoregions and habitats are still very poorly represented within the global protected area network. Ensuring representativeness will require much greater expansion of protected areas in some countries than in others in order to capture unique ecological regions. Indeed achieving Target 11 may well require full protection of all remaining natural habitats of certain poorly-represented types within some countries either through protected areas or other appropriate conservation action that ensures permanent protection, or through regional and transnational cooperation. Even these actions may be insufficient for some ecoregions where much habitat has been lost to agriculture or other land conversion and ensuring better representation will require a greater focus on restoration where this is possible (Keenleyside et al., 2012).

Ensuring representativity will not be achieved through equal contributions from all countries; it will require greater efforts from some countries than others. If those countries are going to have to substantially increase their protected area coverage and shoulder a greater burden to meet the global targets, then additional resources will be required. Meeting the Aichi Targets would seem to add extra weight to the need to ensure that innovative finance mechanisms are made available for protected area establishment and management. How to meet these challenges will be a matter of debate at COP11 in Hyderabad where financial resources will be discussed.

There are a range of international organizations and NGOs that are helping with the challenge of meeting Target 11. The CBD calls for the development of PoWPA Action Plans, as well as revised National Biodiversity Strategies and Action Plans (NBSAPs). PoWPA Action Plans should be integrated with revised NBSAPs, providing a mechanism where the pieces of Target 11 can be put together into a whole, with significant involvement from a range of stakeholders

Tracking progress towards the achievement of Target 11 is a critical first step. UNEP-WCMC, in partnership with the IUCN and others, is tracking progress, and will report findings in the first *Protected Planet Report* to be released at the IUCN World Conservation Congress in September 2012. Recognizing that ecological outcomes are the most vital measure of success, IUCN has sponsored a joint Task Force between the World Commission on Protected Areas and the Species Survival Commission to understand better how the world's protected area systems are conserving biodiversity, and to establish global criteria for areas of biodiversity significance. This involves bringing together various approaches developed to identify areas of importance for birds (BirdLife International's Important Bird Areas), plants (Plantlife International's Important Plant Areas), freshwater species, Alliance for Zero Extinction sites and Prime Butterfly Areas, amongst others. It also embraces an approach whereby IUCN, through its facilitation of the Global Ocean Biodiversity Initiative, is helping governments to identify marine areas of ecological or biological significance (EBSAs) beyond national jurisdiction, the most underrepresented realm.

IUCN is working through its expert networks to support the CBD and national governments to develop the institutional and individual capacity to manage the complexity of protected area system and site management. A flagship initiative is to develop capacity in Africa, the Caribbean and Pacific countries through BIOPAMA, an EU-funded intervention that will respond to priority information and capacity needs, to provide good practice guidance and to support implementation towards Target 11.

Finally we suggest that an initiative is required to develop criteria for lands and waters that contribute to biodiversity conservation but do not meet the full criteria as protected areas. Such lands will be increasingly important for ecosystem-based adaptation to climate change, ensuring ecological connectivity and providing ecosystem services.

We provide this clause by clause analysis of Target 11 as a precursor to a larger, more formal discussion of the Aichi Targets that will take place within countries and within the CBD. The success of the Aichi Targets depends on a

clear and careful understanding of their meaning in order to achieve successful implementation.

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RESUMEN

El Plan Estratégico para la Diversidad Biológica 2011-2020 fue adoptado en la 10ª Conferencia de las Partes en Nagoya, Japón. El plan establece 20 Metas de Aichi para lograr la conservación global de la biodiversidad. Un enfoque global fundamental para la conservación de la biodiversidad es la utilización de las áreas protegidas. Podría decirse que las 20 Metas de Aichi tienen implicaciones para el establecimiento y la gestión de áreas protegidas, pero solo la Meta 11 las aborda directamente. Este documento examina todas las cláusulas de la Meta 11 y hace recomendaciones a los países sobre la interpretación de cada una de ellas con vistas a lograr la conservación de la biodiversidad mediante la utilización de las áreas protegidas. Aunque solo contiene 61 palabras, la Meta 11 es sorprendentemente densa. Se aplica tanto a los ecosistemas marinos como terrestres, y establece metas para la planificación espacial (representatividad, conectividad ecológica y áreas de importancia para la biodiversidad); gestión de áreas protegidas (incluyendo eficacia de la gestión y equidad social); y criterios acerca de lo que para efectos de la Meta 11 cuenta para ser un área protegida. Abogamos por una interpretación holística de la Meta 11 como vía para que la comunidad internacional utilice las áreas protegidas para cambiar las actuales e inaceptables tendencias con respecto a la pérdida global de biodiversidad.

RÉSUMÉ

Le Plan stratégique pour la biodiversité 2011-2010 de la Convention sur la diversité biologique a été adopté à la 10ème réunion de la Conférence des Parties à Nagoya, au Japon. Il établit 20 Objectifs d'Aichi pour conserver mondialement la diversité biologique. À cet égard, l'utilisation des aires protégées constitue une approche fondamentale à l'échelle mondiale. De fait, les 20 Objectifs d'Aichi ont des conséquences pour la création et la gestion des aires protégées, mais seul l'Objectif 11 les

aborde directement. Ce document analyse donc l'Objectif 11 clause par clause, et fait des recommandations aux pays sur l'interprétation de chaque clause afin de conserver au mieux la diversité biologique en utilisant les aires protégées. Malgré ses 61 mots, l'Objectif 11 est, de façon assez surprenante, très dense. Il s'applique en effet aux écosystèmes terrestres et marins, et établit des objectifs pour la planification spatiale (représentativité, connectivité écologique et zones d'importance pour la biodiversité) ; la gestion des aires protégées (notamment l'efficacité de la gestion et l'équité sociale) ; et les critères de désignation d'une aire protégée dans le cadre de l'Objectif 11. Nous soutenons une interprétation globale de l'Objectif 11 dans l'optique que la communauté mondiale utilise les aires protégées pour lutter contre la dégradation actuelle inacceptable de la diversité biologique mondiale.

RECENT PROGRESS WITH THE CONSERVATION AND PROTECTION OF TEMPERATE INDIGENOUS GRASSLANDS IN NEW ZEALAND

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ABSTRACT

Progress with conservation of New Zealand's temperate indigenous grasslands, and particularly the rangelands of the South Island rain-shadow region, is described from the first modest reserve in the late 1960s. Early debates centred on serious degradation of many rangeland areas under the pastoral farming practices of periodic burning and associated sheep grazing, but later involved the need for baseline research areas and the protection of indigenous biodiversity and ecosystems. A Government-initiated tenure review process since the mid-1990s is described, whereby farmers volunteer to relinquish the more vulnerable, usually higher elevation and biodiverse, areas of their lease-hold properties in return for free-hold arrangements for the more productive areas. Reviews are ongoing. To date, 82 completed reviews of the 303 properties has resulted in 49 per cent of their 441,188 hectares being formally protected, and an additional 125,792 hectares from five properties purchased by the Government, being designated as conservation land. The current conservation status of the country's four major indigenous grassland types, totaling 15.4 per cent protected, is described in relation to the grassland types and their altitudinal distribution in relation to their baseline areas at the time of European settlement in the early 1840s.

INTRODUCTION

Temperate indigenous grasslands are one of the world's great biomes but are also the most altered, most threatened, and least protected of the earth's major terrestrial biomes (Henwood, 2010). Occupying approximately 8 per cent of the world's terrestrial surface (Figure 1 overleaf), just 5 per cent of this biome is currently within the global system of formally protected areas. Although this has increased from only 0.69 per cent in 2008, it remains the least-protected, major terrestrial biome as reported in the 1993 UN List of Protected Areas (IUCN – WCPA), a fact which led to the creation of IUCN WCPA's Grasslands Protected Areas Task Force (now Specialist Group) in 1996 (IUCN, 1994; Henwood, 1998). Following a decade of slow but steady progress to achieve a reported level of 5 per cent by 2007 (UNEP-WCMC, 2008), the Specialist Group launched the Temperate Grasslands Conservation Initiative (TGCI) in 2008, specifically to address this shortfall in the level of protection for this biome and, as well, to encourage the sustainable use of all temperate indigenous grasslands whether in protected areas or not. The TGCI promotes the many values of these grasslands: cultural, social, economic, environmental and ecological, placing particular emphasis on the valuable and varied ecosystem services they provide.

In preparation for a workshop during the World Parks Congress in Durban, South Africa in 2003, an informal TGCI undertook a global assessment of the status and conservation potential of the world's temperate indigenous grasslands (Henwood, 2004). This work was updated for the launch of the TGCI in 2008 in Hohhot, China and has formed the foundation for the ongoing pursuit of higher levels of protection for this biome (Peart, 2008a; 2008b). This assessment identified four temperate indigenous grassland regions in the world where the potential still exists to conserve extensive grasslands on a landscape scale: the Patagonian steppe, the Kazakh steppe, the Daurian steppe and North America's Northern Great Plains. In addition, the assessment recognized the many other temperate grassland regions that, while not necessarily offering potential at the landscape scale, still possess high conservation values worthy of protection. These included the indigenous grasslands of New Zealand.

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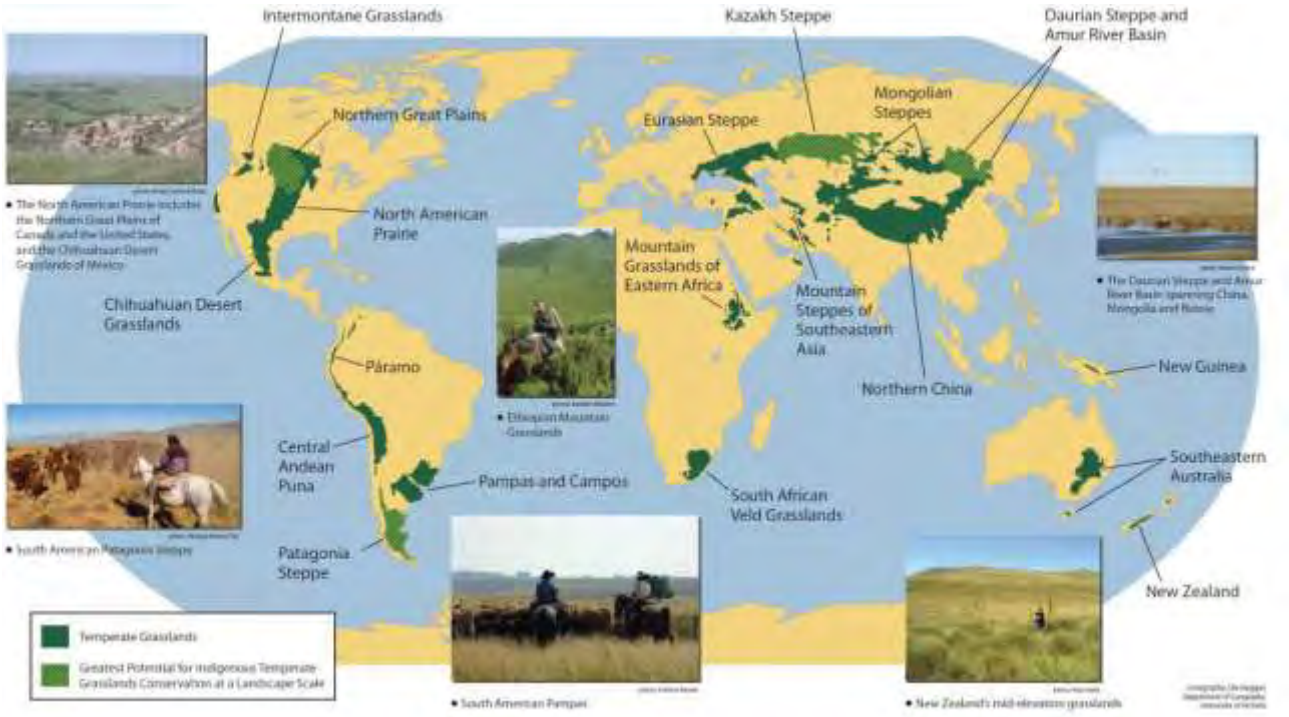

Figure 1. Map of the World's temperate indigenous grasslands; Temperate Grasslands Conservation Initiative (TGCI). Reprinted from TGCI Newsletter No 6, November 2011.

Apart from the low-alpine snow tussock grasslands above the treeline, indigenous grasslands in New Zealand were extensive in the South Island rain-shadow region to the east of the Southern Alps at the time of European settlement in the 1840s (Mark, 1993). In this rain-shadow region, the eastern lower-altitude areas were soon mostly developed for agriculture while the extensive, interior, more mountainous regions, with a semi-continental climate, were largely retained under Government ownership and leased in relatively large units for extensive sheep grazing, with pastoral farming. These extensively grazed indigenous grasslands are generally referred to, here and elsewhere, as rangeland. Subjected to periodic burning and a new phenomenon, mammalian grazing, land degradation was soon recognized as a serious threat to the sustainable management of these grasslands. This issue has been addressed in various ways, mostly with limited success, up to the present (Mark, 1994). The more remote indigenous tussock grasslands, along and west of the Southern Alps and on the North Island volcanic and other high mountains, were largely protected as conservation lands but were subjected to grazing, often severe, by a range of feral animals, mostly red deer (*Cervus elaphus*), introduced for recreational hunting (Mark, 1993; Mark & Dickinson, 1997).

Having initiated the protection of indigenous tussock grasslands within the New Zealand rangelands in the mid 1960s, for both baseline research and their heritage values, in 2003 the author was requested by the TGCI to make an assessment of the conservation status of New Zealand's indigenous grasslands. This was undertaken with the assistance of several colleagues and two Government departments. The Ministry of Agriculture made available their recently compiled Land Cover Data Base 1, while the Department of Conservation provided the records and maps of the country's formally protected areas.

METHODOLOGY

Using a baseline of 1840, the time of European settlement in New Zealand, four colleagues assisted with assessment of the areal extent throughout New Zealand of the five major types of indigenous grassland: lowland sward grassland, montane-subalpine short tussock (*Festuca novae-zelandiae*) grassland, montane-subalpine tall snow tussock (*Chionochloa rigida*) grassland, montane-subalpine tall red/copper (*C. rubra*) tussock grassland and low-alpine tall snow tussock (C. spp.) grassland (Mark, 1993; Mark & Dickinson, 1997), as well as high-alpine (non-grassland) communities and permanent ice and snow of the nival zone.

The role of pre-European Maori settlers from about the mid-13th century in extending the grasslands through burning, particularly in the South Island rain-shadow region east of the Southern Alps, was accepted as part of the baseline since the species involved were indigenous. Moreover, the situation in New Zealand differed from

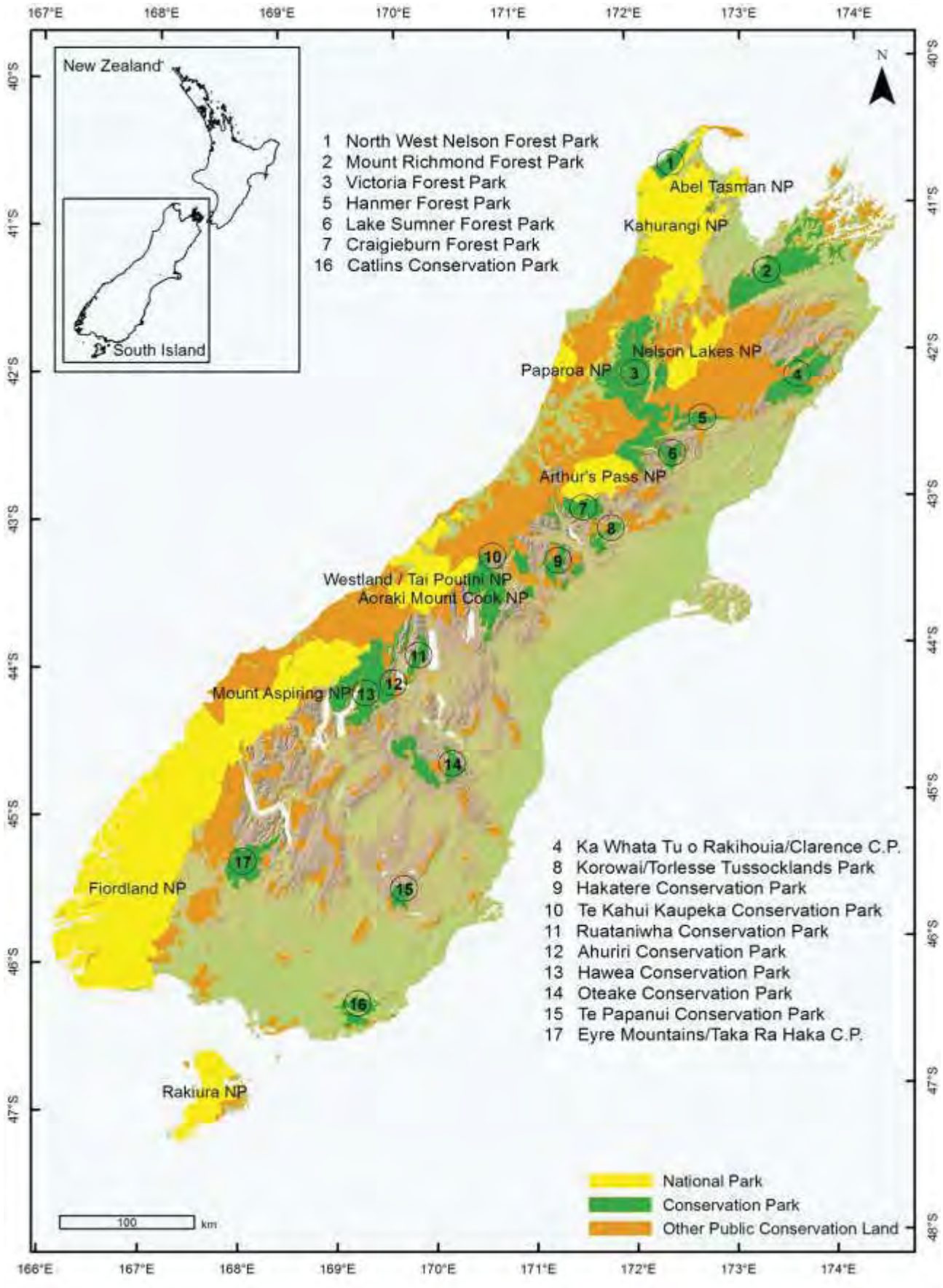

Figure 2. Map of New Zealand's South Island, showing the ten tussockland conservation parks in the rain-shadow region of the Southern Alps (key in lower right), as well as the seven largely forested parks (key in upper left), the eight national parks (named) and other conservation lands. Map supplied by the Department of Conservation.

View south-east across the crest of the Hawkdun Range, 1600-1870 m, northern Central Otago on greywacke parent material, showing low-alpine slim snow tussock (*Chionochloa macra*) grassland in good condition (foreground), eroding grassland beyond (mid-distance) and high-alpine fellfield and snowbanks on the highest slopes (distant) © Alan Mark, January, 2007

other countries only in the recent nature of its human occupation. The methods used are described in detail in Mark and McLennan (2005). The 1:50,000 scale paper maps we produced were digitized and the boundaries computed with ArcGIS, using elevation data obtained from the New Zealand topographic database. The 'tussock' category included in the Land Cover Data Base Version One (LCDB 1), derived from 1996-7 satellite imagery, was extracted to a separate ArcGIS layer, which was used to 'clip' to a copy of the baseline layer, to provide the current extent of the five major grassland types.

Both the baseline and current cover maps were analyzed on the basis of a map of biogeographically-based ecological regions (ERs), of which 60 of the 79 ERs for the three main islands were presumed to have contained indigenous grassland at the time of European settlement. The ecological region data were also grouped into four major geographic regions on the basis of the general pattern of land use and indigenous grassland exploitation. The North Island (114,740 km^2) was treated as one unit of 19 ecological regions because of the relatively small extent of indigenous grasslands. The South Island (151,120 km^2), however, was split three ways: the extensive rangelands in the central rain-shadow region, east of the Southern Alps (19 ERs) which occupies about 10 per cent of the country's land area, the western generally wet mountainous region (10 ERs) which had been largely protected as national parks and other conservation lands, and the eastern lowlands and lower hills which had been mostly developed for agriculture, plus Stewart Island (12 ERs) (see Figure 2).

The South Island rangelands had long caused concern because of the serious degradation under the pastoral farming practices of periodic burning, which the indigenous grasslands clearly tolerated, and associated sheep grazing. These grasslands showed an obvious intolerance to mammalian, mostly sheep, grazing, particularly in the post-fire recovery period. This was attributed to such grazing, combined with burning, being a new phenomenon in a land without indigenous terrestrial mammals, apart from two species of bat (Mark, 1993; 1994). The need for baseline research areas and protection of the indigenous biodiversity and ecosystems was also promoted (Mark, 1985) and, following later research, also the value of upland tall snow tussock grasslands, for maximizing water production (Mark & Dickinson, 2008).

Table 1. Assumed baseline (1840) extent of the four major indigenous tussock grassland types in New Zealand at 1840 (the fifth, sward grassland was minor, ~2%, and is not included here), based on each of the 60 mainland ecological regions (out of the 79 total ERs) (T), which are assumed to have contained indigenous grassland (G) at the time of European settlement in 1840. These have been grouped into four major geographic regions. The percentage of each type remaining in 2002 (%R), and the percentages of the latter which were formally protected in September 2002 (%P '02) and in December 2007 (%P '07), are also shown.

Geographic Region	Km²	ERs (G/T)	GRASSLAND TYPE: Low-alpine tall snow tussock				Montane-subalpine tall snow tussock			
			Area (ha)	%R	%P '02	%P '07	Area (ha)	%R	%P '02	%P '07
North Island total	57,141	19/38	4,292	100	82	82	32,598	100	72	73
South Island western non-rangeland total	57,925	10/10	391,127	100	95	96	278,219	100	94	95
South Island eastern non-rangeland total	28,502	12/12	443	100	64	64	11,717	29	49	49
South Island rangeland total	66,499	19/19	697,352	96	27	40	1,197,842	81	12	21
TOTAL	**210,068**	**60/79**	**1,093,214**	**98**	**52**	**61**	**1,520,376**	**84**	**31**	**39**

Geographic Region	GRASSLAND TYPE: Montane-subalpine tall red/copper tussock				Montane-subalpine short tussock			
	Area (ha)	%R	%P '02	%P '07	Area (ha)	%R	%P '02	%P '07
North Island total	231,446	45	27	27	419,177	1	65	65
South Island western non-rangeland total	60,673	19	88	93	7,253	100	7	7
South Island eastern non-rangeland total	696,672	1	18	24	1,210,354	4	1	2
South Island rangeland total	883,066	28	8	15	1,950,338	42	3	5
TOTAL	**1,871,856**	**20**	**16**	**21**	**3,587,121**	**25**	**3**	**5**

Separate summaries were derived for each of the four major regions, with the rangeland region being of particular interest since, up until the late 1960s, no areas had been formally protected. The indigenous grasslands of this region had been entirely allocated to extensive pastoral farming as rangeland.

RESULTS

Apart from the first reserve, a modest 660 ha area protected in 1969, which involved a relinquished leasehold property plus contributions from two neighbouring farmers, there was considerable farmer and political opposition to the formal protection of rangeland. This was despite the need for baseline research areas to assess the cause(s) of widespread degradation, which had been of general concern to the Government as land owners and the overseeing regional authorities, as well as the farmers, for many decades (Mark, 1993; 1994). Support, however, gradually came from several quarters, notably the Government's Ombudsman, who was prevailed upon to investigate a bid by nine grassland ecologists for a 1000 ha baseline research area, which had been rejected by the Lands Department. This rejection followed an environmental impact assessment that had recognized the conservation values and research potential of the Nardoo catchment which the Ombudsman's report recognized (Mark, 1982). This report had recommended that: "*the area should be retained as a reserve for a limited period ... and subject to review in 15 years time.*" It also stated that: "*persuasive arguments have been advanced for designating ... a scientific reserve. The proposal has received a great deal of support from scientists of all the relevant disciplines. .... I am aware that tussock grasslands are seriously under-represented in the reserves system.*" (Mark, 1982).

The situation subsequently improved, particularly through a tenure review process initiated by the Government in the mid 1990s, as a means of addressing

Montane short tussock (*Festuca novae-zelandiae*) grassland at the ~1000 ha Tekapo Scientific Reserve, Mackenzie Basin, inland South Canterbury. This reserve, on an extensive fluvio-glacial outwash plain, has had sheep removed and rabbits controlled for 20 years and is showing clear signs of restoration. October, 2011 © Alan Mark, January, 2007

environmental degradation of the rangelands, as well as saving on its costs of administering the 303 rangeland leases (which exceeded its income from the rentals). Initiated by a lessee farmer, the tenure review process involves a renegotiation of the lease to separate the more productive, usually highly modified, lower altitude areas from the more vulnerable, usually less modified, higher elevation lands. These latter areas usually had significant inherent (landscape, indigenous biodiversity, soil and water conservation, recreational, etc.) values. These lands would revert to full Crown (i.e. Government) control and management (by the Department of Conservation), while the more productive lands could be made free-hold. In addition to tenure review, the Government also purchased the lease-hold interests of five high country rangeland properties, amounting to 125,792 ha, to be managed for their conservation values.

The situation as at Sept. 2002 was analyzed (for the Durban TGCI workshop) and indicated that some 12.3 per cent of the original country-wide indigenous grassland baseline (1840) area was formally protected but only 9.1 per cent of the rangeland portion (Mark and McLennan, 2005; see Table 1). Within the rangelands, the four major grassland types varied considerably (the fifth type, sward grassland, not a rangeland type, had been minor, ~2 per cent overall), both in the proportion still remaining and also in the degree of protection. For the low-alpine tall snow tussock grassland, some 96 per cent of the baseline area remained, inevitably modified to varying degrees through 150 years of pastoralism, and 27 per cent of this remaining area was formally protected in 2002. By contrast, only 42 per cent of the montane-subalpine short tussock grassland (see picture above) remained, inevitably modified, but only 3 per cent of this remaining area was formally protected at this time. Of the other two grassland types, the montane-subalpine tall snow tussock type (see photos above), with 12 per cent of the baseline area protected, had fared better than the tall red/copper tussock type, which occupies more gentle slopes, often able to be cultivated (8 per cent). The same pattern prevailed for the country as a whole (Mark & McLennan, 2005; see Table 1).

The situation was updated to December, 2007 for presentation at the TGCI Hohhot workshop (Mark et al., 2009), by which time the formally protected area of indigenous grasslands had increased from 12.3 to 15.4 per cent of the original baseline area of 82,436 km^2. This increase was essentially the result of continuing tenure review of the South Island rangelands. Here protection involved mostly the higher altitude types: low-alpine tall

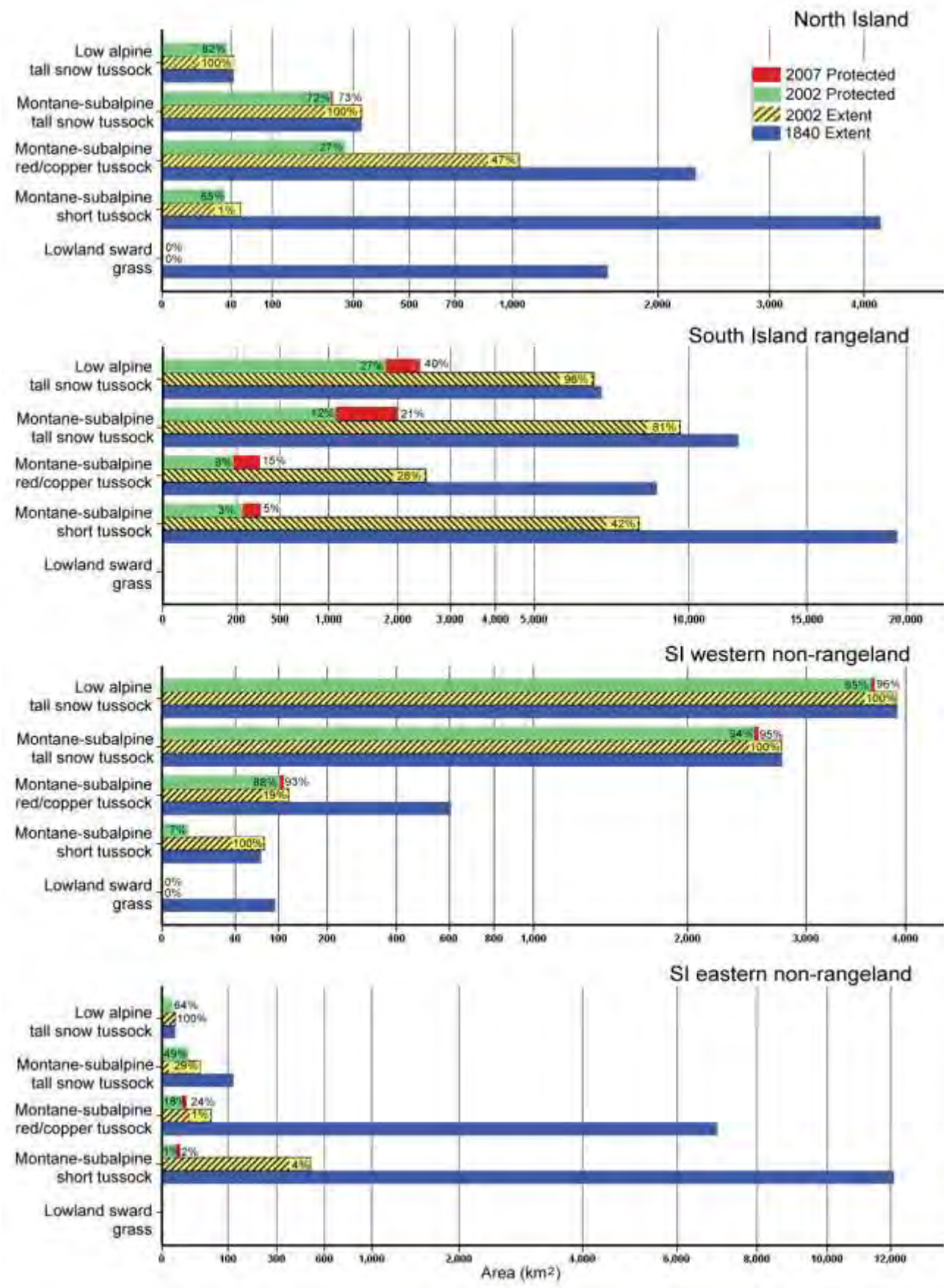

Figure 3: Areal extent of the five major indigenous grassland types in each of the four main geographic regions of New Zealand, with values for the baseline (1840), and current (2007) extents, as well as that formally protected in Sept. 2002 and Dec. 2007. Reprinted, with permission, from Mark, et al., 2009.

Above: ***Montane-subalpine tall snow tussock (*****Chionochloa rigida*****) grassland in Te Papanui Conservation Park, or 'Waterlands Park' in relation to its importance for high water yields recorded nearby, on rolling uplands of the Lammerlaw Range, eastern Otago uplands at 800-1000 m © Gilbert van Reenen.***

Left: ***Montane-subalpine tall snow tussock (*****C. rigida*****) grassland and an extensive wetland, Teviot Swamp, at 800-1000 m, on gentle western slopes of the Lammerlaw Range, eastern Otago uplands, on schist parent material. Part of Beaumont Pastoral Lease, this property is currently going through the tenure review process. February, 2010 © Alan Mark.***

snow tussock grassland increased by 13 per cent to 40 per cent, the montane-subalpine tall snow tussock grassland by 9 per cent to 21 per cent of the baseline value, and the montane-subalpine tall red/copper tussock grassland by 7 per cent to 15 per cent, while the lowest elevation, short tussock grassland increased by only 2 per cent to 5 per cent (Table 1; Figure 3). This latter grassland type continues to be poorly represented and moreover, is currently undergoing rapid land use transformation.

The tenure review process is still on-going and, as at April, 2012, reviews have been completed on 83 of the 303 properties, five have been purchased by the Government, 42 were in various stages of the formal process, while applications had been made for another 68, and 105 were not in the review process. Of the 83 completed reviews, totaling 441,188 hectares, 51 per cent of the land has been taken out under free-hold agreement while the remaining 49 per cent, including the five Government-purchased properties, has reverted to full Government ownership and control, and are managed by the Department of Conservation. This is close to the 50 per cent value indicated by the Government when the special legislation, the Crown Pastoral Land Act, 1998, was being debated in the mid 1990s.

Rangeland areas that have now been formally protected are designated as conservation areas while, beginning in 2000, the larger areas, exceeding 20,000 ha, have been designated conservation parks, of which there are currently ten, amounting to 581,032 hectares (Figure 2; Table 2). These extend from northern to southern South Island and all contain a range of upland ecosystems, representative of much of their ecological region, while some, such as Ahuriri and Hakatere Conservation Parks, have important altitudinal corridors and sequences of ecosystems, and are more adequately representative of their ecological region (Figure 4).

Some additional conservation parks have been identified in conservation strategy documents for the four eastern South Island conservancy regions, which hopefully will be implemented with the completion of future tenure

Figure 4. Eastern slopes of the Old Man Range, Central Otago on schist substrate, showing the altitudinal sequence of vegetation, mostly grassland types and the estimated long-term mean annual precipitation and air temperature vales based on a short-term (6-yr) study in relation to the long-term record for the nearby town of Alexandra (141 m) on the valley floor.

reviews. Thus, over the last 50 years, the indigenous grasslands of the South Island rain-shadow region have greatly increased their proportion of New Zealand's total conservation lands which now cover some 34 per cent of the country's area.

VALUING THE ECOSYSTEM SERVICES OF UPLAND INDIGENOUS TALL TUSSOCK GRASSLANDS

Protected areas are becoming increasingly valued the world over, for their often irreplaceable role in providing a range of ecological goods and services, essential to the well-being of both ecosystems and humans. With this considerable expansion of protected areas in the indigenous grasslands of New Zealand, there has not only been an increased protection of native plants (Mark & Adams, 1995) and animals: birds, lizards and invertebrates (Mark et al., in press), but also an assurance of continuation of the important ecosystem services they provide in soil conservation, and particularly in maximizing the production of clean fresh water, as well as retention of their cultural, recreational and ecotourism values.

Several studies, using both paired catchments and non-weighing lysimeters, in and adjacent to the Te Papanui Conservation Park on the eastern Otago uplands, have shown that good condition, tall tussock grassland can maximise water yield relative to any alternative vegetation cover types, and even bare soil (Mark & Dickinson, 2008). These authors describe a long-term, mid-altitude (460-670 m), paired-catchment hydrological study which revealed increasingly reduced water yields over time, from an afforested catchment compared with an adjacent catchment of indigenous tall snow tussock (*Chionochloa rigida*) grassland. The reduction in water yielded annually, from the 310 ha catchment afforested in exotic *Pinus radiata*, reached 41 per cent after 22 years, relative to that from the adjacent indigenous grassland catchment. Moreover, water yield reached 80 per cent of the measured annual precipitation (and up to 86 per cent over the snow-free six months) from an upland fog-prone site in the same region, reflecting both the conservative water use by the tussock cover and the ability of its metre-long, fine foliage to intercept considerable amounts of water from the not-infrequent passing fog (Holdsworth & Mark, 1990; Mark & Dickinson, 2008). The 20,590 ha Te Papanui Conservation Park on this eastern Otago upland, is referred to as "The Waterlands Park" by the Department of Conservation, in recognition of its recorded value for high water production. This area provides more than 60 per cent of the water for Dunedin City's 120,000 population.

In addition to water production, research has also shown that intact indigenous grasslands have great potential for

Table 2. Area and date of establishment of ten conservation parks from the rangeland region of the South Island of New Zealand.

Conservation park	Area (ha)	Established
Korowai/Torlesse	20,328	2000
Te Papanui	20,590	2003
Eyre Mts/Taka Ra Haka	65,160	2003
Ahuriri	46,655	2004
Hakatere	39,138	2006
Clarence	88,066	2008
Ruataniwha	37,220	2008
Te Kahui Kaupeka	93,800	2009
Hawea	105,260	2009
Oteake	64,815	2010
TOTAL	**581,032**	

the sequestration of large amounts of carbon, perhaps almost as important as forests (Minahi et al., 1993; FAO, 2010). With most carbon stored in the soil rather than in the surface vegetation, this ability to store carbon is highly dependent on these grasslands remaining intact. The conversion of grasslands to other land uses, especially agriculture and also forestry, leads to release of much of this carbon. Conversely, indigenous grassland management practices, designed to maximize the sequestration of carbon, can actually increase productivity and enhance resilience (FAO, 2010).

Globally, land use change accounts for almost 20 per cent of greenhouse gas emissions and, with about 55 per cent of temperate indigenous grasslands already developed, their formal protection, coupled with sustainable use in non-protected areas and the restoration of degraded grasslands, would make a significant contribution to mitigating the effects of climate change (White et al., 2000; World Watch Institute, 2009). Protection of temperate indigenous grasslands lags far behind that of the world's other major biomes and, while many challenges remain to improving this situation, the recent progress made in New Zealand is a strong testament to what can be achieved and hopefully replicated in other parts of the world.

ACKNOWLEDGEMENTS

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Alan has been a member of the Temperate Grasslands Conservation Initiative since its inception in 2003. He has published some 190 peer-reviewed papers and also a popular book, '*New Zealand Alpine Plants*', with botanical artist Nancy Adams which is currently being revised, with the inclusion of the alpine fauna.

Alan has been a strong advocate for conservation of New Zealand's indigenous ecosystems and involved with several conservation organisations. His contributions to conservation and sustainable resource management have been recognised with various awards and honours, including a Fellowship of the Royal Society of New Zealand, the Society's Hutton Medal and Fleming Environmental Award, as well as a CBE (1989) and KNZM (2009), for contributions to scientifically-based conservation in New Zealand.

RESUMEN

El avance con respecto a la conservación de los pastizales templados de Nueva Zelanda, y en particular los pastizales de la sombra pluvial de la región al sur de la isla, se reseña desde la primera y modesta reserva de finales de 1960. Los primeros debates se centraron en la severa degradación de muchos pastizales sometidos a las prácticas agrícolas de quema periódica y el pastoreo de ovejas asociado a ellas, pero luego incluyeron la necesidad de áreas para la investigación de base y la protección de la biodiversidad y los ecosistemas autóctonos. Se detalla un proceso de análisis en materia de tenencia iniciado por el Gobierno desde mediados de la década de 1990, mediante el cual los agricultores renuncian voluntariamente a las zonas más vulnerables (que suelen ser las de mayor elevación y con mayor biodiversidad) de sus tierras bajo arrendamiento a cambio de acuerdos de plena propiedad para las tierras más productivas. Los análisis están en curso de realización. A la fecha, el análisis de 82 de las 303 propiedades ha mostrado que el 49 por ciento de sus 441.188 hectáreas está protegido formalmente, y otras 125.792 hectáreas de cinco propiedades adquiridas por el Gobierno están siendo destinadas a la conservación. El estado de conservación actual de los cuatro tipos más importantes de pastizales autóctonos del país, con un total de un 15,4 por ciento protegido, se describe en relación con los tipos de pastizales y su distribución altitudinal con respecto a sus áreas de referencia en el momento de la colonización europea en la década de 1840.

RÉSUMÉ

Les progrès réalisés dans la conservation des pâturages natifs tempérés de Nouvelle-Zélande, et notamment les pâturages de la région de pluviométrie du sud de l'île, sont décrits à partir de l'exemple de la première réserve, de taille modeste, créée à la fin des années 1960. Les premiers débats

tournaient autour de la grave dégradation de nombreuses zones de pâturages du fait des pratiques d'agriculture pastorale de l'époque (brûlage périodique et pâturage par les moutons). Par la suite, les acteurs ont senti le besoin d'établir des zones de recherche de référence et de protéger la diversité biologique et les écosystèmes natifs. Enfin, notons le processus d'évaluation du régime foncier initié par le gouvernement depuis le milieu des années 1990, où les agriculteurs se sont portés volontaires pour céder les zones les plus vulnérables (en général les plus élevées, et là où la diversité biologique est la plus riche) de leurs propriétés louées à bail, en échange d'accords de pleine propriété pour leurs zones les plus productives. Des études sont en cours. À l'heure actuelle et grâce à la conclusion de 82 études portant sur 303 propriétés, 49% des 441 188 hectares ont pu être officiellement protégés, et 125 792 hectares supplémentaires originaires de cinq propriétés ont été achetés par le gouvernement et désignés terres de conservation. Le statut de conservation actuel des quatre principaux types de pâturages natifs du pays, dont 15,4% sont protégés, est décrit en fonction du type de pâturage et de leur répartition en altitude, et par rapport à leurs zones de référence au moment de l'installation des européens, au début des années 1840.

THE EFFECTS OF PROTECTED AREA AND VETERINARY FENCING ON WILDLIFE CONSERVATION IN SOUTHERN AFRICA

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ABSTRACT

The use of park and veterinary fences to separate wildlife, people and livestock is increasingly threatening greater fragmentation of African rangelands. However, the curtailment and eradication of wildlife borne animal diseases has necessitated the use of fencing as a blunt instrument. The dilemma inherent in the removal of fences to make way for large contiguous transfrontier conservation areas is that wildlife reservoir disease vectors may spread and cause hardship to rural communities and harm national livestock exports. New and creative thinking is required to balance these opposite outcomes so an era that will encourage the sustainable development of African rangelands can be ushered in.

INTRODUCTION

The conservation of protected areas and large mammals in Africa is inextricably linked in terms of ecological dependency and historical necessity (Craigie et al., 2010). The migration of large mammalian herbivores in the savannahs of east and southern Africa either delimit the boundaries of ecosystems that are in need of protection or simultaneously underline the hazards that exist for these populations if the migration range is partially or wholly unprotected. An added concern is the role of fencing which frequently aids and abets the fragmentation of the landscapes that surround protected areas and furthermore can result in impassable barriers to the dispersal of highly mobile species (Ferguson & Hanks, 2010).

Human-wildlife conflict (HWC) is increasing in those places where the boundaries have hardened between wild and domestic use of rangelands. A less publicised form of HWC is the transmission of endemic and emerging animal diseases that filter across the human-wildlife interface. Fencing is seen as one method of reducing this by directly halting host/ pathogen traffic, but inevitably protected areas will then be seen as reservoirs of economically important diseases that risk a spill-over into economically struggling communities (Bengis, 2005). However, the expansion of conservation paradigms into the realm of sustainable natural resource utilisation and a move away from the 'fines and fences' approach (Brockington, 2002), has blurred the boundaries of protected areas by benefitting both human social development and conservation. Transfrontier Conservation Areas (TFCAs), which are growing in acceptance and extent in southern Africa, have the potential to turn conflict into consensus by advocating a mixed (wildlife and agriculture) economy where conservation areas and people are not seen to be mutually incompatible.

Threats to rangelands (natural or semi-natural) come from three primary sources. Habitat conversion for arable production is the most irreversible and inevitably leads to steep declines in wildlife. Habitat degradation due to overstocking of livestock can increase bush encroachment and lower carrying capacities of wildlife and livestock, but this can be reversed by sustained management and by allowing wildlife to decrease woody growth (Augustine & McNaughton, 2004). Habitat fragmentation dissects the landscape into smaller parcels of land that may or may not be interspersed with degraded or converted habitat. Fencing can play a role in all three of these modes of rangeland manipulation, but is especially effective at fragmenting large tracts of lands into compartments for disease control purposes.

Whilst large migratory mammals are the most obvious casualties of rangeland conversion and fragmentation, these species are also threatened when they leave a protected area to utilise external resources. Controlled killing of 'fence escapees' and the payment of compensation to neighbouring communities for the loss of human lives, crops and livestock are generally not well

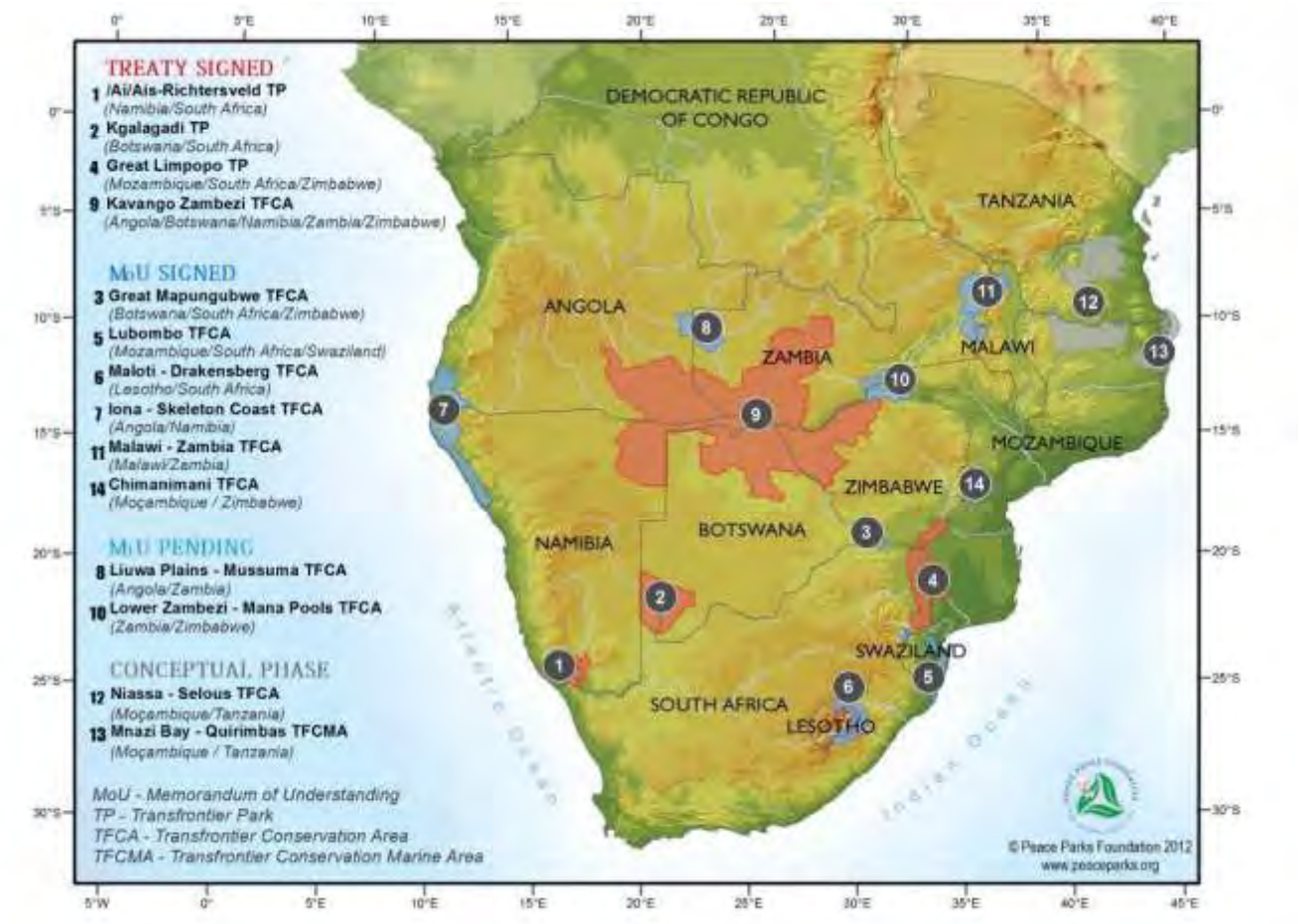

Figure 1: TFCAs identified in the SADC Region (Courtesy of Peace Parks Foundation)

or rigorously documented. Animals escaping through fences can lead to a cascade of HWC and disease-related events, which places renewed pressure on the control of the movement of these animals either lethally or by enhancing the efficacy of the barrier. An additional threat to wildlife comes from snaring, often using fence wire meant to protect these species. The same fences can also initiate profound ecological and biodiversity changes due in part to excluding certain guilds of species and by hastening the change in land use activities by the creation of hard edges (McGahey, 2010).

Fencing if correctly maintained can of course have short-term positive benefits for conservation, such as giving protection to highly endangered or 'expensive to replace' species such as black rhino, and reducing the incidents of HWC.

FENCING EXTENT AND DISEASE TRANSMISSION IN TWO TFCAS

The veterinary fences erected since the 1950s in southern Africa are present in order to protect domestic stock from disease, but it is only relatively recently that there has been recognition of a fundamental association between disease epidemiology and environmental variables (Hess *et al.*, 2002). The fact that pathogenic transmission events can cross a barrier such as a fence illustrates that changes to landscape structure and function (e.g., by imposing fencing) may affect the dynamic behaviour of the disease (and host) in question (Reisen, 2010). At the southern African wildlife/livestock disease interface, wildlife fences seem set to remain a part of the landscape, with their presence during the development of TFCAs increasingly coming into question. Two major TFCAs in southern Africa, namely the Great Limpopo (GLTFCA) and the Kavango-Zambezi (KAZA TFCA), epitomise the areas of concern.

Veterinary cordon fencing varies in structure and purpose, and it is surprisingly difficult to get accurate data on the total length of fences in these two TFCAs and even more so in the sub-region as a whole. The fencing can encompass foot-and-mouth disease (FMD) 'red-line', or tsetse fly control fences, with both being designed to stop the crossing of livestock or wild herbivores. In addition there are national border fences, cattle-ranch stock fences, road and rail fences, private game/ conservancy and other agricultural fencing such as those erected by sugar cane companies that border Kruger National Park (KNP) and protected area fencing, all of

Carmine bee eater* (Merops nubicoides) *using a fence at Kruger National Park to hunt © Ken Ferguson

which were placed to block the movement of large mammals and which inevitably fragment landscapes. Some of these types of fences are dilapidated and their status as effective barriers is largely unknown.

Our estimate of 5,500 km of fencing in and around the KAZA TFCA is tentative and based on several sources (Albertson, 1998; TCC, 2006; Williamson, 2002; Martin, 2005). This could increase significantly if unconfirmed proposals to erect border/veterinary fencing (Angola-Namibia (300km), Botswana-Zimbabwe (re-erect 550km) and Angola-Zambia (1,000km)) go ahead, but this should be countered by recent discussions on the possible removal of the Caprivi border fence between Botswana and Namibia. The GLTFCA is easier to calculate. KNP's boundary is 1,050 km. It used to be entirely fenced, but small sections have been removed (Alexander & Ferguson, 2010). Further fencing in the northern part of the GLTFCA (e.g., Gonarezhou National Park) is largely moribund except for small sections of private conservancy fencing, giving a total of no more than 1,000km of fencing in and around the GLTFCA.

In addition to a veterinary function, fences in and around conservation areas have several other important roles, such as excluding large herbivores from areas of sensitive biodiversity, isolating disease-free breeding herds of buffalo (*Syncercus caffer*), securing tourist rest camps and staff quarters, securing the boundaries of the protected area and preventing the flow of animals and humans to and from the external matrix (Joubert, 2007). None of the major parks in the KAZA TFCA are completely fenced, in marked contrast to the Etosha National Park in Namibia, which lies outside of the TFCA, and which is entirely fenced (MET, 2007). The prevalent fences in the KAZA TFCA serve a veterinary function, either FMD long-term structures or as medium to short-term 'emergency' fences that can be erected relatively quickly to contain a fast spreading disease like Contagious Bovine Pleuropneumonia (CBPP). Added to this are fences that have been primarily constructed to serve as border fences (e.g., Caprivi border fence between Botswana and Namibia) or to have a mixed purpose (the controversial Zimbabwe/Botswana border fence) to prevent disease, livestock and human transmigrants from crossing a border.

THE ECONOMICS OF PARTITION BY THE USE OF FENCING

The delineation of rangeland, promulgated by fencing policies, into 'biodiversity friendly' versus 'human and livestock' dominated landscapes has significant economic implications. The associated fencing creates not only a physical barrier but a fiscal one as well, with fences being expensive to build and maintain, and with all fences having unintended and at times costly environmental impacts. Ultimately, the spatial distribution and spatial choices made by large mammal species (wild or domestic/and their owners) that utilise rangeland provides the basis for all economic incentives, which will be directly linked to environmental resource gradients created by soil fertility and rainfall. It is primarily along these gradients that fencing serves to reinforce the social, economic and political hegemony of agricultural practices. Environmental gradients, especially rainfall, therefore delimit the most economically viable rangeland areas by virtue of the creation of spatial-temporal heterogeneity (maintained by large herbivores) in key and contested landscapes. As human population density and intensification of the efficiency of natural resource extraction increases in higher rainfall areas (e.g., conversion to arable crops), so less efficient and more traditional forms of range land use are pushed into the lower rainfall and nutrient margins, where the conflict between wildlife and social development (and in some cases, traditional pastoralism) is likely to become more intense (Olff & Hopcraft, 2008; Ogutu et al., 2010).

The role and impacts of fencing are best separated by making the primary distinction between their veterinary functions and other uses, such as protecting a protected area or preventing HWC around rural settlements. Fences can be multi-purpose (e.g., KNP's western boundary fence is both a 'red-line' veterinary fence and a park boundary) or serve a single purpose. Therefore, the economic, ecological and epidemiological factors related to fencing are dependent on the purpose of the fence, its efficiency and critically its political backing and

New fencing damaged by elephants at Kruger National Park © Ken Ferguson

motivations. An additional factor is the difference between the use of fencing by the state and by private entities. The development or wildlife commercialism in South Africa is influenced by the use of fencing to control 'externalities' (such as laws requiring fencing, control of disease in a private area, etc.). In Zimbabwe such externalities "*avoided the financial and ecological disadvantages of fences with a rather elegant common property solution*" (Child, 2009; referring to game conservancies and community-based conservation). However, the downside to private fencing is the potential to fragment land into smaller parcels whereby over-stocking and rangeland degradation may occur.

Wildlife fencing is expensive to purchase and maintain by either individuals or the state. Private sector fencing is concerned with protecting investments such as introduced game or rare species (or protecting staff and guests from crime). In the case of state owned veterinary control fences, the costs of the fencing are directly linked to the financial returns from the livestock to be safeguarded from disease. Thus the economic impacts of fencing can be scaled from the macroeconomic (e.g., external beef subsidies received by Botswana) to the microeconomic such as the health effects of a serious disease outbreak on livestock and their owners from rural families, due to the failure of fencing.

MACROECONOMIC IMPACTS OF FENCING

At the macroeconomic scale, climate change in relation to the livestock industry in semi or arid rangelands takes pre-eminence. For example, the anticipated eastward movement of the Kalahari desert, due to increasing regional temperatures and El Nino effects, may 'cut across' fence lines and alter the dynamics of water, grazing availability and stocking densities (Africa Geographic, 2007), all of which will magnify the restrictive role of fences. Such changes may then interact with the need for equity and justice for natural resource-dependent societies (Thomas & Twyman, 2005). Kock *et al.*, (2010) note that the socially mediated changes (increasing privatization and fragmentation) in southern Africa rangelands over the past century have led to new disease transmission pathways and we can surmise that climate change will further concentrate populations of humans, livestock and wildlife, resulting in new disease transmission pathways.

Livestock produces livelihoods for 1.3 billion people worldwide and makes productive use of some 33 per cent of the world's arable land. Eighty eight per cent of Kenya's landmass is populated by 4.5 million people with approximately nine million head of livestock. Most of Kenya's protected areas fall within this 'catchment' area and some 70 per cent or more of the wild large mammals

Lioness caught on camera trap leaving the KNP western fence to feed on livestock, it was killed the next night by local people using the poison carbofuradan, the parks' first recorded case, her young cubs were never again located © Ken Ferguson

live seasonally outside of the parks (Norton-Griffiths and Said, 2010). At this huge interface between state controlled conservation and a rapidly changing tribal or private system, conflict comes in many guises, all of which emphasize the nature of the competition for resources between people (and inter-group competition) and the remaining traditional wildlife and pastoral areas. In 21st Century Kenya, fences are providing a way of privatizing and fragmenting the landscape (Kioko *et al.*, 2008) which historically parallels the role of fencing in the way that the 'American Wild West' was 'tamed' (Fleischner, 2010). Indeed Victurine and Curtin (2010) note that the 'wild west' is still being 'tamed' and fragmented by a new wave of fencing, erected for the sale of cattle ranches to urbanites, who wish to parcel them up still further into 'ranchettes'. The costs of the reorganization of land tenure in Africa, through the sub-division of land, in terms of reduced ecosystem goods and services is exemplified by the fact that at least 50 per cent of large mammal populations in these arid and semi-arid Kenyan rangelands which lie outside protected areas have declined in the last few decades (Norton-Griffiths and Said, 2010).

The economic role of veterinary fencing in southern Africa is distorted by another type of barrier – trade. Africa produces a mere 2 per cent of global livestock exports (G. Thomson, pers. comm.) due to the combined effects of under capacity, trade protectionism and the fear of diseases spreading to the exporting nations. The 'failure' of South African FMD fences in the year 2000 led to a ban on beef imports from Egypt that lasted 10 years (long after the outbreak was brought under control and months after an unrelated outbreak in Egypt; SABC News, 19 March 2010) and Europe is still fearful of a repeat of its 2001 FMD outbreak. Various agreements are in place to give Africa preferential livestock trading status, but these apply only if the rules governing the safe export of these products are adhered to. The financial loss incurred by an FMD outbreak in the source country is dwarfed by the potential loss to an uncontrolled outbreak in an importing country. For example, during the UK's 2001 FMD outbreak, losses to the agricultural and support industries and to the outdoor leisure industry amounted to US$12.2 billion (Kitching et al., 2005). Fencing has consequently been heavily subsidized by the European Union and new disease control fences have recently been proposed, such as a 1,000km fence between Angola and Zambia (AHEAD-GLTFCA, 2008). More research is needed on the macroeconomic connections between fencing, foreign subsidies and sustainable livestock development in general.

Buoyed by these and other foreign subsidies, the commercial ranching systems that demand 'red-line' zonation in Ngamiland, Botswana have become a key focus area for the 'weighting' of different land use options and the impacts of fencing (Barnes et al., 2003; Scott Wilson, 2000). Barnes et al., (2001; 2003) have examined in detail the relationship between continued expansion of the livestock sector (and fencing infrastructure) and its competition for land and resources with wildlife. In Botswana traditional livestock keeping occupies 60 per cent of the land surface and

commercial ranches 6 per cent. Surprisingly, the export figures are shared equally between the two systems, with government seeking to bolster the export earnings of the communal farmers. This expansion into largely undeveloped communal lands of Ngamiland by commercial livestock was preceded by massive fencing investment and without any prior knowledge of the impacts that various land use options would have on biodiversity. Barnes et al. (2003) concluded that in northern Botswana 'capital-intensive commercial livestock ranching is economically inefficient' and that wildlife production systems or low (capital) input systems would provide for better sustained wealth accretion. Child (2009) unambiguously states that *"it is financially and ecologically hazardous to ranch cattle where annual rainfall is less than 750mm per annum, as it cannot meet the twin objectives of being profitable and sustainable"* and further that *"Botswana missed an opportunity to support a substantial industry with the abundant wildlife it had only 60 years ago."* Part of this missed opportunity relates to the role of fencing in de-populating wildlife areas, and in a comparative economic assessment this role cannot be easily disentangled from the profitability of the entire land use option. However, when the external 'beef' subsidies are removed from the calculation we find that economic returns can be negative.

In the absence of subsidies and for a similar profit to accrue Barnes et al. (2001) found that in Ngamiland calving rates would have to increase by 90 per cent, beef prices by 60 per cent or capital costs would need to be reduced by 60 per cent. Investing in new large scale commercial ranches is beset by prohibitively high capital costs of which fencing is but one of these costs. Positioning commercial farms near wildlife areas or veterinary fences obviously increases the risk of herd contamination and predation (Hemson et al., 2009) and this in turn will influence land prices which could deter the expansion of ranches. Barnes et al., (2003) take a 'common-sense' approach to the sub-division of land-use practices, noting that "*wildlife-based tourism in high quality wildlife areas...should get priority where these conditions exist*", and that 'where the economic values (of wildlife) exceed those of livestock' a spectrum of land-use planning should be envisaged. In this sense one could argue that the fencing network in Botswana could be reconfigured to take into account some basic cost-benefit sums i.e., ecological economics must become part of the cost-benefit analysis of fencing. Spinage (1992) relates the decline of the wildebeest (*Connochaetes taurinus*) in the central Kalahari to the impacts of fencing, which begs the question of how to place a monetary figures on the numbers of animals lost and even how is it possible to calculate the loss of migrations associated with this species – which may affect tourists 'willingness to pay' for the experience of visiting such areas.

Currently 'travel and tourism' in Botswana account for 16 per cent of non-mining GDP, and is forecast to grow on average by 7.3 per cent per annum for the next ten years, far outcompeting the majority of other African countries. The ethos for the tourist plan for Botswana is 'high-yield and minimal impact' (WTCC, 2007). For this market to grow as is predicted the natural capital assets must be protected and the issue of fencing and fragmentation addressed as a priority concern. The compromise solution would be to integrate wildlife and livestock production so that each form of use can bolster the other in times of meagre income from any one source. For example a drop in tourism due to a global recession could be compensated for by a temporary increase in livestock production). Kreuter and Workman (1997) examined a mixed ranching scheme in Zimbabwe and concluded that with regards to fencing, less investment was required in wildlife than cattle enterprises (11 to 20 per cent respectively of the cost of asset structures), a saving due to the removal of internal conservancy fencing. They also concluded that the combination of cattle and wildlife production could spread the risks that were associated with each separately. However, such mixed ranching schemes have rarely been successful largely due to the epidemiological problems of a merged interface and the cultural biases in favour of livestock production (Kock et al., 2010).

MICROECONOMIC IMPACTS OF FENCING

The development of 'coarse' and 'fine' scale economic indicators of fence efficiency needs to be developed. For example a fine scale indicator would be to measure the rate of permeability per km of fencing by different species (Ferguson et al., 2012) and relate this to the economic, epidemiological or environmental importance of the disease concerned or the impact of carrier species on the integrity of the fence and HWC impacts. Thus in terms of FMD, buffalo are a high disease risk species and elephants do not represent such a risk but they do break fences more often therefore potentially allowing buffalo to escape through a fence. The scaling of disease risk in relation to fence permeability would be more suited to risk probability modelling exercises. The number of disease outbreaks per unit time would give a coarse level of cost efficiency of the fence as a barrier, a figure which would have to be compared with the total amount of months of disease 'clean-up' costs due to a 'leaky' fence

Elephant bull inspecting the new 'I' beam fence, Kruger National Park © Ken Ferguson

versus the cost of the fence in terms of construction and maintenance. Ultimately, such a holistic economic approach should have the double benefit of discerning whether a fence upgrade is required or whether the fence itself is a financial burden with little efficiency. This fencing cost to benefit ratio should form part of the overall economic and financial estimation of using rangeland for livestock production as opposed to other land uses which may require less or no fencing, such as wildlife production.

In African countries where pastoralism is still a major source of livestock production, the role of fencing may be even more acute, such as around Nairobi National Park (partially fenced), where wildlife dispersal areas are being blocked by the subdivision of the land into parcels 'protected' by fencing. Reid et al. (2008) argue that this fencing will isolate water points and good grazing areas from the general matrix, thereby not only reducing the land area available to wildlife but also the diversity of patch types available. Within the enclosed patches wildlife may be deliberately or accidentally eradicated or excluded. Curtailment of wildlife dispersal corridors by fencing will also be exacerbated by drought, increasing urbanisation and the selling of land for infrastructural development. All of these fragmentary drivers will depress the resilience of the ecosystem and may in the case of wildlife lead to a threshold to be crossed that culminates in 'mega-faunal' collapse.

Estimating the direct cost of fencing materials, construction and maintenance (including salaries) over time is again difficult to sustain in any meaningful way, largely due to inflationary pressures. Electric fencing in Zimbabwe from 1990-1998 cost approximately US$1,900 per kilometre, but this would be considerably higher today (Price Waterhouse Coopers, 1998). Ideally estimates of fence 'capital costs' should include the benefits accrued in terms of square kilometres protected (state or private land), households protected, or disease outbreaks averted. Fencing designs and purposes have to be carefully matched and related to long-term financial management. This requires skills in terms of sourcing materials, competent contractors, and fence planning and auditing in general, especially in the case of community based fencing projects whereby early successes with electric fencing in the longer-term lead to most projects 'being stuck in a partially functioning state' as the electric fence degrades (Price Waterhouse Coopers, 1998).

The Karoo National Park in South Africa has recently upgraded its original 'cattle-stock' fence to a fully operational 2.4 m electrified fence with a length of 175km and a cost of US$1.86 million to meet the legal requirements for the re-introduction of species such as cheetah (*Acinonyx jubatus*) and buffalo. It is assumed that benefits of the expected tourist increases related to the presence of more 'desirable' viewing species and the

13mm cable fencing damaged by elephants at Kruger National Park © Ken Ferguson

natural regulation of prey by introduced predators outweighs the cost to the public purse of the initial capital outlay.

De Boer et al. (2007) introduced a fencing element directly into a cost-benefit analysis of elephant conservation efforts in southern Africa. A projection of tourist numbers and increasing elephant density (both perceived benefits) in terms of profit were compared with costs as exemplified by poaching losses, costs of crop raiding by elephants and electric fencing construction to contain these animals in the Maputo Elephant Reserve in Mozambique. They concluded that 'costs generated' through elephant poaching and elephant crop raiding were higher than fence construction costs at a population size >100 for this species. Fence capital outlay became profitable only after elephants exceeded this number.

Perry et al. (2001) suggested that the discipline of veterinary epidemiology should be directly integrated into the economics of disease control implementation and also into which selected interventions to use. Fencing should thus also be considered as part of the economic assessment of the entire control strategy deployed and would have to be balanced against the potential for developing effective vaccines or the attempted eradication of a particular disease.

Measuring the livelihood and health impacts on livestock owners and their dependents of serious zoonotic outbreaks is not often attempted. Quantifying this in terms of human psychological impact, let alone general health and financial loss, is a mammoth task. In 2001, an FMD outbreak in the United Kingdom led to a spate of farming related suicides and surprisingly an upsurge in 'grounded poetry' based on the experiences of the farming communities (Nerlich & Doring, 2005). In the Netherlands an outbreak of FMD disease, in the same year as the one in the UK, led to an increase in levels of stress, feelings of marginalization and clinical depression amongst the dairy farming families (Van Haaften et al., 2004).

The importance of fencing for the future protection of national livestock herds from disease and HWC has to be offset against the potentially negative impacts on conservation. There is a clash between these two objectives when it comes to prioritising the Millennium Development Goals, all of which are required to be met by 2015. Perhaps unsurprisingly the sustainable environment goal (Goal 7) is the one that is most unlikely to reach its target and it is the goal which has 'fencing issue' nested as a minor subset within it. In summary fencing structures undoubtedly have far reaching regional and global environmental and economic impacts, extending beyond the physical situation of the fence itself.

LOCAL COMMUNITY PERSPECTIVES AND FENCING

People are rarely asked what they think about a fence that restricts their movement (Chaminuka, 2010). Various social studies appraising attitudes by people (amongst them some of the poorest people in South Africa) who live next to the KNP and are separated from it by a fence have shown that despite this obstruction there is a level of goodwill and understanding of why the park should continue to exist (e.g., see Lagendijk & Gusset, 2008). Several years ago, KNP management attempted to co-opt an element of local management and control into two trial sections of fence line, with generally promising results (B. Schraader, pers. comm. January 2009), an approach which could be extended to new ways of enticing participatory co-management (between state and local communities) for the future benefit to both the park and people.

Van Ierland (2010) has explored ways that people could be brought into conservation around KNP's border. His community 'biogas' work also raises the enticing prospect of a win:win situation, in that kraaling cattle at night is essential for collecting enough fresh dung to convert to 'biogas'. Kraaling should also decrease the amount of livestock killed by lions, which again occurs mostly at night when lions exit the park via its porous fence, and hopefully at the same time decrease the rate of lion

Cattle outside the fence at Kruger National Park © Ken Ferguson

poisonings in the area. The win:win scenario would be that cattle are protected, free domestic gas produced, lions protected and there is less pressure on the riverine forests to produce charcoal in order to provide household energy.

FENCING AND GOVERNANCE ISSUES

The combined total area of the GLTFCA and KAZA TFCA is nearly half a million km² (Cumming, 2008; AHEAD-GLTFCA, 2008), with an ambitious vision of creating a diverse approach in terms of a conservation strategy. But, fulfilment of this innovative approach is called into question when fences appear to 'stand in the way'. Alexander & Ferguson (2010) have shown how, over a long period of time (over eight years thus far), fences can be successfully removed within a TFCA. The removal of KNP's eastern border fence with Mozambique is a seminal event in the history of these types of barriers in southern Africa. This acclaim must be tempered by the fact that the removal of the fence will allow both animals and pathogens to repopulate the neighbouring Limpopo National Park.

The process of fence removal, realignment or erection is long and arduous and it is well explained in political terms by Schoon (2010) and in practical terms by Bewsher (2010). What emerges from these recent contributions is that the involvement of all stakeholders is critical to the success or otherwise of reducing the negative impacts of fencing. The issues of concern encapsulate 'top-down' and 'bottom-up' hierarchical scales mixing and meeting at critical junctures in the 'life history' of a fence, which, translates into the involvement of many diverse groups of people. Fences are often viewed as a front-line defence against epizootic outbreaks (Burroughs, 2010; Thomson, 2010). The rationale, perhaps flawed in some cases, of a disease control fencing strategy can be subverted if nation states begin to fail. Zimbabwe shows clearly how marked societal change can impact massively on fencing structures and wildlife/livestock related disease control strategies (Foggin, 2010).

Placing fencing into its human cultural and historical dimension illustrates once again that a fence may look

simple but that its impacts can be wide reaching, and its construction and use can even be related to the quest for power and control by dominant social forces. Fencing, has been and is, a tool of land privatisation and appropriation that exists to delimit and exclude people and animals from state and private land assets, with the perception generated that fences 'seize' and fragment the natural capital of land (Nkedianye, 2010), even on occasion causing 'fence rage' amongst rural people. Kloppers (2010) chronicles the sad 'stand-off' between conservation aims and rural development that led to the destruction of a small, but critical area of Ramsar wetland in KwaZulu Natal (South Africa) and he also documents the incredibly protracted negotiations relating to the building of a fence that would protect both people and animals as they traversed parts of the newly formed Lubombo TFCA.

FUTURE DIRECTION

Containing wildlife by means of fencing has four main purposes, namely (i) reduction of HWC, (ii) reduction of the disease transmission risk between wild and domestic animals, (iii) increase the security of a protected area, and (iv) where applicable to demarcate an international boundary (Newmark, 2008). The complexity of boundary management and the use of fences is well-illustrated by the KNP where the entire 480 km western boundary is demarcated by a veterinary fence, primarily designed to contain the FMD virus, carried by its major wild host, the African buffalo, within the park (Bengis et al., 2005). The western fence varies in structural types and different sections can be exposed to different degrees and causes of damage and permeability to large mammals; issues which are quantified in Ferguson et al., 2012 and Jori et al., 2009). The resultant large mammal fence permeability patterns represent a vital prerequisite to an understanding of the underlying processes and the potential mitigation of the impacts of such cross boundary animal movement. A new participatory fence monitoring system has been developed by Ferguson et al. (2012) which forms a time-series of data that highlights areas of permeability. We believe that sound scientifically validated data are required as the first step to coming to terms with the impacts of fencing on biodiversity conservation. New thinking will also be required on the role of fences within TFCAs.

The review by Ferguson and Hanks (2010) does not represent an exhaustive array of research on the impacts of fences (and, more broadly, habitat fragmentation research), but it does give an insight into the multi-dimensionality of the impacts of these relatively simple physical structures that engender complex and radiating effects. To gain an understanding of this complexity is a prerequisite to ameliorating, where possible, the worst excesses of fencing in term of impacts on conservation efforts. This approach is especially important given the recent stated intention by the Uganda Wildlife Authority to fence all of its national parks in a bid to stem human-wildlife conflict (Government of Uganda, 2012).

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RESUMEN

El uso de parques y cercos veterinarios para separar la vida silvestre, la gente y el ganado está provocando una creciente fragmentación de los pastizales africanos. Sin embargo, la reducción y erradicación de las enfermedades transmitidas por animales silvestres ha hecho necesario el uso de los cercos como instrumento general. El dilema inherente a la eliminación de los cercos para dar paso a grandes áreas transfronterizas y contiguas de conservación de vida silvestre es que los vectores de enfermedades de los reservorios de fauna silvestre pueden propagarse y causar dificultades a las comunidades rurales y perjudicar las exportaciones nacionales de ganado. Es preciso desarrollar un pensamiento nuevo y creativo para equilibrar estos resultados opuestos y fomentar el desarrollo sostenible de los pastizales africanos.

RÉSUMÉ

L'utilisation de barrières géographiques (parcs) et vétérinaires pour séparer la faune sauvage, les populations et le bétail menace de plus en plus une part croissante des pâturages africains. Pourtant, l'utilisation de barrières a été nécessaire pour réduire et éradiquer les maladies animales transmises par la faune sauvage, même si cet instrument manquait de précision. Mais aujourd'hui, leur suppression pour laisser la place à de vastes zones de conservation transfrontalières contiguës pose un autre problème : les vecteurs et réservoirs de maladies que constitue la vie sauvage peuvent se répandre et causer des dommages aux communautés rurales et aux exportations nationales de bétail. Il convient d'avoir une pensée nouvelle et créative pour équilibrer ces résultats contraires et encourager le développement durable des pâturages africains.

CONNECTIVITY CONSERVATION OF THE GREAT GREEN MACAW'S LANDSCAPE IN COSTA RICA AND NICARAGUA (1994-2012)

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ABSTRACT

Important fragments of primary and secondary forest in southeastern Nicaragua and northern Costa Rica are being threatened by anthropogenic actions. Since 1994, a research and conservation project focused on the great green macaw (*Ara ambiguus*) has allowed us to implement integral conservation actions at the landscape level including the creation of an alliance of 22 organizations working together to establish and develop the San Juan-La Selva Biological Corridor and the Maquenque National Wildlife Refuge as its core area. Since 2000, this experience has been replicated in Nicaragua and the links between both countries have been strengthened, resulting in a grassroots transboundary campaign focused on promoting the awareness of the ecology and conservation of the great green macaw in the lowlands of the San Juan River. The most important results to date have been the understanding, acceptance and concern of the major stakeholders regarding the challenges faced by the great green macaw, a positive shift in land use change dynamics at the landscape level and the recuperation of the population of the great green macaw.

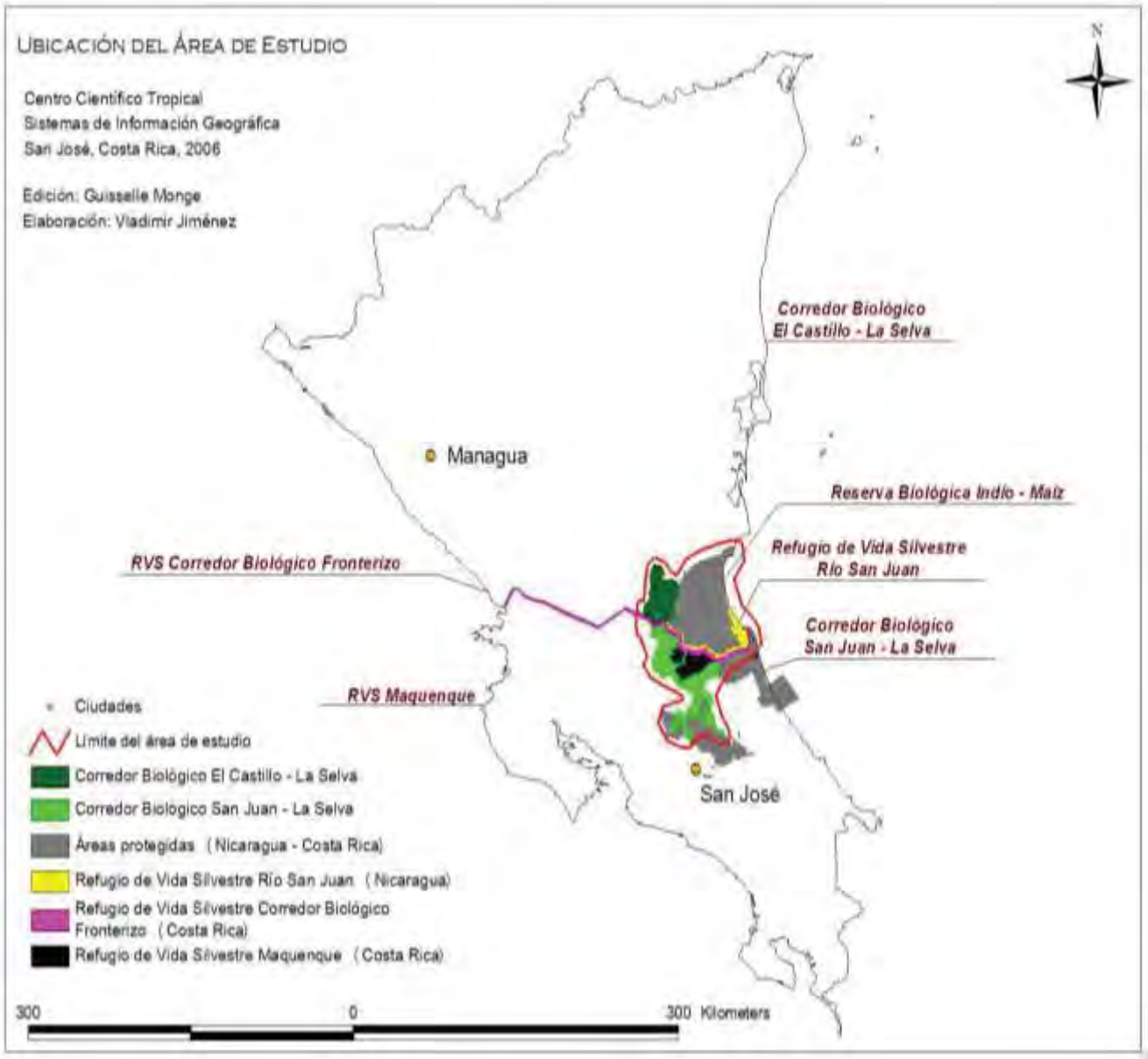
THE GREAT GREEN MACAW

The great green macaw (*Ara ambigus*) has a limited distribution in the Atlantic wet lowlands of Central America, from eastern Honduras to northern Colombia, with a small isolated population in the Pacific in Esmeraldas and Guayaquil, Ecuador. The total population is about 7,000 individuals (Monge et al., 2009) and the macaw is assessed as endangered by IUCN's Species Survival Commission. In Costa Rica, this species is currently limited to 600 km^2 of tropical very wet forest in the northern part of the country on the border with Nicaragua. The macaw depends on the mountain almendro tree (*Dipteryx panamensis*), both for feeding and nesting substrate (Monge et al., 2003). This magnificent bird has been in serious danger of disappearing from Costa Rica, although recently its population has increased due to improved policy, governance and to the implementation of a connectivity conservation initiative (Chassot et al., 2010a).

THE PROJECT

The '*Great Green Macaw Research and Conservation Project*' was launched by George V. N. Powell in 1994 and aims to study the conservation biology of the macaw in northern Costa Rica. It has developed a major biological data base on this species. The project's first-year findings highlighted that the nesting range of the macaws in Costa Rica had been reduced by 90 per cent since the early 20th Century (Powell et al., 1999). Preliminary studies found that the great green macaw's limited distribution and relatively large home range, combined with its dependence on a complex array of food resources, implied that the protection of its habitat and resources would benefit a multitude of other species that reside in these lowland wet forests. The potential of this species as an 'umbrella species' for the fauna and flora of the habitat where it thrives makes it a key species to study in order to set conservation priorities, particularly due to the fact that the study site was lacking an important protected area. The northern zone of the range had suffered the highest deforestation rate in Costa Rica in the 1980s and 90s, leaving less than 30 per cent of the original forest standing (Chassot et al., 2005). Nevertheless, several studies found that the forests in this region remained amongst the most diverse in Central America (Chassot et al., 2005).

In 1994, we estimated the great green macaw population in Costa Rica to be approximately 210 individuals with 25 -35 breeding pairs. The population has a more extensive habitat and presumably larger macaw population than in the Indio-Maíz Biological Reserve in Nicaragua. Nevertheless, logging incursions across the San Juan



Map of the project area

River into the Indio-Maíz are common, and even this reserve, Central America's most important on the Atlantic slope, is not free from deforestation. Consequently, today the great green macaw population is in a precarious and fragile condition, and the loss of remaining forest habitat in northern Costa Rica or southern Nicaragua may result in regional extinctions (Monge et al., 2009).

RESEARCH RESULTS

At the onset of the project in the 1990s, little was known about the ecology of the great green macaw. While it was thought to migrate seasonally and use a variety of habitats at different elevations, its nest had not been described and its primary habitat and food sources were largely unidentified. The research objective, therefore, was to compile basic data on the macaws' habitat and spatial requirements in order to set priorities for the conservation of sufficient habitat to support a viable population of the macaw in Costa Rica.

We used radio-telemetry to determine macaw home ranges and habitat use. In addition, we have monitored the status of all known (N=85, 2010) or suspected nest sites and collected data on nest site characteristics. Finally, we studied the fruiting phenology of tree species that we discovered form part of the macaws' diet.

The extensive data base developed includes information on breeding range in Costa Rica, general nesting data, nest sites, nest fidelity, nesting resources, nest productivity, first-year survival of juveniles, non-nesting population, migration patterns and foraging behaviour, amongst others (Powell et al., 1999; Monge et al., 2003).

THE CONSERVATION PLAN

In Nicaragua and Costa Rica, areas of pristine and degraded forests are threatened by logging and conversion to monocultures such as pineapple and African palm (Chassot et al., 2008; Fundación del Río, 2012). The forest industry and large agro-industrial corporations take advantage of the absence of governance and adequate policies for sustainable management of natural resources.

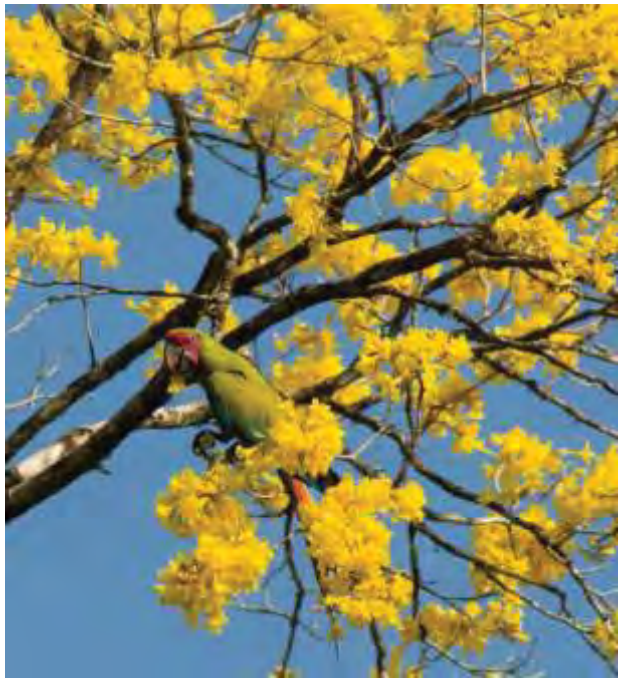
The survival of the great green macaw depends on the availability of adequate forest habitat. In 1998, working with local and national stakeholders, the research team proposed the implementation of a conservation plan that could protect enough habitat to maintain a viable breeding population in Costa Rica. Known as the 'San Juan-La Selva Biological Corridor', the plan included the creation in 2005 of the 'Maquenque National Wildlife Refuge', Costa Rica's last large protected area, extending 54,000 hectares of natural ecosystems embracing the breeding range of the great green macaw (Chassot et al., 2005; Villate et al., 2009).

The research project succeeded in restricting timber cutting in the critical nesting area of the macaw as well as halting the unsustainable harvest of the mountain almendro. To promote sustainable development and conservation in the northern part of Costa Rica, local farmers and communities were encouraged through incentives from the government, to support reforestation initiatives with native trees that are both commercially important and of benefit to the great green macaw.

To resolve nest poaching, during the early stages of the project the research team developed an 18 month intensive environmental education programme for different communities within the influence area.

THE BIOLOGICAL CORRIDOR

The area of humid Atlantic tropical forest in the north of Costa Rica maintains the only viable lowland habitat able to maintain the continuity of the Mesoamerican Biological Corridor between Costa Rica and Nicaragua. The San Juan-La Selva Biological Corridor (246,608 hectares) promotes restoration and preserves connectivity conservation between remnants of forest in the Central Volcanic Mountain range and the La Selva Biological Station (125,691 hectares) in the north of Costa Rica, and the Barra del Colorado National Wildlife Refuge (102,165 hectares) and Tortuguero National Park (29,068 hectares) in the Caribbean coast of Costa Rica. This connectivity is even more important given its link with the extensive conservation complex, which includes



Great Green Macaw © Roland Seitre

the Indio-Maíz Biological Reserve (306,980 hectares), Punta Gorda (54,900 hectares) and Cerro Silva (339,400 hectares) in Southeastern Nicaragua. The San Juan-La Selva Biological Corridor consolidates these six protected areas into a single biological unit, covering 1,204,812 hectares (Monge et al., 2002).

The central conservation unit of the San Juan-La Selva Biological Corridor is the Maquenque Mixed National Wildlife Refuge (54,000 hectares), located to the south of Indio-Maíz Biological Reserve and contiguous with the westernmost limits of Barra del Colorado. This new protected area conserves the area of the corridor with the highest percentage of forest cover. The humid tropical forest of the Atlantic included within the biological corridor and adjacent connected protected areas are biologically diverse, considered the home of 6,000 (36) species of vascular plants (number of vulnerable and endangered species in parenthesis), 139 (32) species of mammals, 515 (64) birds, 135 (35) reptiles and 80 (45) amphibians (Chassot et al., 2005).

COMMUNITY GOVERNANCE AND OPPORTUNITIES

The Local Council of the San Juan-La Selva Biological Corridor was officially formed in March 2001 as a result of an alliance between the Tropical Science Center, the Wildlife Conservation Society, the Organization for Tropical Studies, the Mesoamerican Biological Corridor-Costa Rica, and the Great Green Macaw Research and Conservation Project. Likewise, in 2002, the local office of the San Juan-La Selva Biological Corridor was created

Tropical wet forest landscape © Roland Seitre

in Puerto Viejo de Sarapiquí. The Council has its headquarters at the Tropical Science Center, in San José, and is responsible for coordinating and promoting the implementation of the corridor. Currently, the Council includes 22 organizations from the state and the civil society and each organization has clearly defined responsibilities within the Council, according to its own agenda and field of expertise (Chassot et al., 2005).

The territory of the Maquenque National Wildlife Refuge, the principal conservation area within the Corridor, is considered the Council's highest priority. Three tracts of forest are seen as the priority and constitute the 'nuclei' of the Corridor, the remaining territory makes up the Corridor 'matrix'. The goal of the Corridor initiative is to preserve 100 per cent of the nuclei and 50 per cent of matrix habitat via environmental service payments to private landowners. Such financial incentives strongly influence land use trends in the country and have been specifically expanded and better publicized in the Corridor to foster landowner participation at the larger, more biologically relevant scales required to implement the Corridor initiative (Chassot et al., 2005).

The Council plans to generate employment opportunities in an area that is economically depressed. Employment currently depends on limited forestry and agricultural activities, such as pineapple monoculture, which has aggressively expanded throughout the landscape, further limiting connectivity restoration opportunities (Chassot et al., 2010a). A shift from these activities to a more integrative socio-economic vision based on small-scale ecotourism promoted through capacity-building aims to foster more long-term and sustainable employment opportunities. For example, there is a community-based ecotourism development strategy with local landowners, enhanced by the 'San Juan-La Selva Birding Route', which has developed birding routes, tours and easily accessible tourism information on the internet (Rainforest Biodiversity Group, 2010).

Costa Rican and Nicaraguan people are becoming increasingly aware that species such as the West Indian manatee (*Trichechus manatus*) and the great green macaw are part of their national heritage. The environmental education programme informs schoolchildren how conservation efforts that preserve and connect habitats can help protect such species of national importance.

NICARAGUA-COSTA RICA

The environmental partnership between Costa Rica and Nicaragua is the result of various workshops held to build an integrated conservation model that led to the SI-A-PAZ initiative (International System of Protected Areas for Peace) in the 1980s. In April 1999, the

Bi-national Great Green Macaw Festival 2011 © Allan Valverde

Biosphere Reserve of Southeast Nicaragua was created, while in 2006 the 'Agua y Paz' Biosphere Reserve was created in Northern Costa Rica (Moreno, 2007).

In 2000 and 2001, The United Nations Development Programme (UNDP) facilitated bi-national meetings amongst Nicaraguan and Costa Rican institutions, establishing a working network of environmental, academic, cultural and media sectors from both countries. Since 2001, the Mesoamerican Biological Corridor has supported a bi-national collaborative process which originated as part of the SI-A-PAZ process. This led to the identification of the bi-national El Castillo -San Juan-La Selva Biological Corridor, where the great green macaw, a flagship species for these territories, thrives and reproduces (Chassot et al., 2003; Chassot and Monge, 2008).

A bi-national campaign 'Save the Great Green Macaw' has been running since 2001 in conjunction with Fundación del Río in Nicaragua and the Tropical Science Center in Costa Rica. This bi-national experience has illustrated how protected areas can maintain the biological and social relationships within the San Juan-La Selva basin (Chassot et al., 2010b). In 2002, eleven workshops on the biology and conservation of the great green macaw were held in Nicaragua and ten bi-national festivals were organized. This process also led to the creation of the Bi-national Commission of the El Castillo-San Juan-La Selva Biological Corridor (which includes government agencies, local governments and NGOs from both countries) in November 2002, which formalises the development of bi-national activities (Chassot et al., 2006).

Some outcomes from the transboundary conservation process include (Chassot and Monge, 2008):

- Integration of local communities into monitoring and raising awareness to protect the habitat of the Great Green Macaw.
- Development of a participative process to build up stakeholders' capacity.
- Integration of policy planning at the local government scale.
- Dramatic increase in available information.
- Sharing of experience (for example: environmental services payment).
- Assimilation of different topics related with natural resources management by local people.

Thus the effort to conserve the meta-population and habitat of great green macaws has helped strengthen collaborative links between Nicaragua and Costa Rica – at least on some levels. Even after more than 10 years of transboundary cooperation between Nicaragua and Costa

Bi-national Great Green Macaw Monitoring Children's Network 2009 © Guisselle Monge

Rica built on the SI-A-PAZ initiative, institutional arrangements at the governmental level have not been adequately addressed, as political differences have emerged and a common agenda has not been implemented despite the interests of bilateral cooperation agencies. On the other hand, civil society has successfully implemented the agenda of peaceful collaboration amongst local stakeholders for the sake of connectivity conservation through an ecosystem based approach, and through sustainable development of remote communities that failed to be represented properly by central governments.

LESSONS LEARNED

The history of this connectivity conservation initiative, with a strong influence on sustainable development, has provided many lessons.

From its very beginning, the San Juan-La Selva Biological Corridor in Costa Rica has invested a great deal of its resources in raising a strong scientific database that justifies the different actions implemented. The information generated by the research and conservation project focused on the great green macaw has yielded political influence at different levels. An important lesson has been the implementation of environmental policies that favour decentralization processes, seeking local governance with capacity to address regional needs. The incorporation of local stakeholders from different sectors has favoured participation for decision-making processes. The result is a social cohesion that starts from a shared cultural identity (Villate et al., 2009).

The long and intense process of environmental education and capacity-building, along with information campaigns, cultural events and other activities has allowed many communities to identify themselves with the plight of the great green macaw (Fundación Loro Parque, 2010). Furthermore, the direct and active participation of the community in the research and conservation process of the macaw has favoured its empowerment in conservation and sustainable development issues. Thus, these direct investments in social capital strengthen cultural values that permeate the social level, with shared ideas around an environmental concept (Villate et al. 2009).

The connectivity conservation concept to promote the protection of the great green macaw has proven to be a promising model for natural resources and landscape management. As part of its success, it is important to highlight that the implementation of this strategy is based on an absolute institutional transparency (information and resources management) and a solid scientific basis, and has always been open to include all stakeholders willing to participate. This generated institutional trust and helped the initiative grow year after year (Chassot et al., 2010b).

Other processes which contribute to the optimal functioning of the Council of the San Juan-La Selva include:

- An adaptative management and multidisciplinary approach.
- Horizontal participatory management.
- Consensual decision-making process.
- Good leadership, effective follow-up and ethical process from the coordinators of the Council.
- Efficient budgeting, in terms of funds spent and investments made.
- Applied research for management.

These elements have contributed to create a unique organizational culture that has served as a model for many similar initiatives. San Juan-La Selva has been considered the most advanced conservation connectivity project in Mesoamerica by CATIE and is often regarded as a model to inspire countless other conservation connectivity initiatives in Costa Rica and Mesoamerica. This connectivity conservation has cost US$650.000 for ten years of project work.

In terms of conservation success, studies show that the population of great green macaws has increased in size, from 210 to 302 individuals since 1994; and that deforestation rates within the San Juan-La Selva Biological Corridor are below the national mean deforestation rate and the deforestation rate just outside the territory of the corridor (Chassot et al., 2010a).

Table 1: Project timelines

Year	Event
1993	Preliminary field study Great Green Macaw population estimate for Costa Rica: 210 individuals
1994	Launching of the Great Green Macaw Project Intensive environmental education programme (pride campaign)
1996	Creation of the National Commission of the Great Green Macaw National decree of partial prohibition of Almendro tree harvest
1997	Administrative back-up from the Tropical Science Center to the Great Green Macaw Project
1998	First draft of the Conservation Plan for the Great Green Macaw
1999	Feasibility study for the implementation of the San Juan-La Selva Biological Corridor
2000	Dissolution of the National Commission of the Great Green Macaw
2001	Creation of the Executive Committee of the San Juan-La Selva Biological Corridor Start of the partnership between the Tropical Science Center and Fundación del Río
2002	Creation of the Bi-national Commission of the El Castillo-San Juan-La Selva Biological Corridor First Great Green Macaw Bi-national Festival Conclusion of the telemetry monitoring programme
2003	Strategic Planning of the San Juan-La Selva Biological Corridor
2004	Appointment of two officials to follow up the project of Maquenque National Wildlife Refuge
2005	Creation of the Maquenque National Wildlife Refuge Update of the Red List category of the Great Green Macaw (from VU to EN, IUCN)
2006	Publication of the Technical Characterization of the El Castillo-San Juan-La Selva Biological Corridor Publishing of the Management Plan of the Maquenque National Wildlife Refuge Systematization of the bi-national experience around the conservation of the Great Green Macaw Creation of the Agua and Paz Biosphere Reserve
2007	Acquisition of the Great Green Macaw Field Station in Boca Tapada
2008	Systematization of the bi-national campaign for the Great Green Macaw Deforestation of the gold mining project in Crucitas Great Green Macaw PHVA Workshop
2009	Bi-national census show an increase in the population of the Great Green Macaw Systematization of the San Juan-La Selva Biological Corridor
2010	Project field house in Boca Tapada burnt down Great Green Macaw population estimate for Costa Rica: 302 individuals
2011	Official recognition of the Local Council of the San Juan-La Selva Biological Corridor Development of a communication strategy for the San Juan-La Selva Biological Corridor
2012	Creation of the Cureña Ecotourism Association (AECOTUCU)

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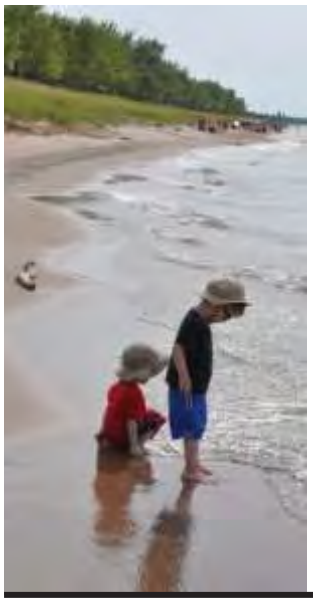
RESUMEN

Importantes fragmentos de bosque primario y secundario en el sureste de Nicaragua y en el norte de Costa Rica están sujetos a la amenaza de acciones antropogénicas. Desde 1994, un proyecto de investigación y conservación de la guacamaya verde mayor (*Ara ambiguus*) nos ha permitido implementar acciones de conservación integral en el ámbito del paisaje, incluyendo la creación de una alianza de 22 organizaciones que trabajan en conjunto para establecer y desarrollar el Corredor Biológico San Juan-La Selva y el Refugio Nacional de Vida Silvestre Maquenque como área núcleo. Desde el 2000, esta experiencia ha sido replicada en Nicaragua y los vínculos entre ambos países se han fortalecido, generando una campaña transfronteriza desde las bases y enfocada en la promoción de la conciencia acerca de la ecología y conservación de la guacamaya verde en las llanuras del río San Juan. Los resultados más importantes hasta la fecha han sido el entendimiento, aceptación y preocupación de los actores principales en relación a los desafíos enfrentados por la guacamaya verde, un cambio positivo en la dinámica de cambio de uso de la tierra en el paisaje y la recuperación de la población de la guacamaya verde.

RÉSUMÉ

D'importantes zones de forêt primaire et secondaire du sud-est du Nicaragua et du nord du Costa Rica sont menacées par les activités anthropiques. Depuis 1994, un projet de recherche et de conservation de l'ara de Buffon (*Ara ambiguus*) a permis de mettre en place des actions de conservation intégrales liées au paysage, notamment la création d'une alliance de 22 organisations qui travaillent ensemble pour créer et mettre en place le couloir biologique San Juan-La Selva et le Refuge national de faune Maquenque comme aire centrale. Cette expérience a été reproduite au Nicaragua à partir de l'année 2000 et les liens entre les deux pays ont été fortifiés, avec notamment le lancement d'une campagne de sensibilisation transfrontalière auprès du grand public, orientée vers l'amélioration de la prise de conscience du milieu naturel et la conservation de l'ara de Buffon dans les plaines du fleuve San Juan. Jusqu'à présent, les résultats les plus importants sont la compréhension, l'acceptation et la préoccupation des acteurs principaux face aux défis auxquels sont confrontés les aras de Buffon, une dynamique de changement positive dans l'utilisation des terres au sein du paysage et le redressement de la population d'aras de Buffon.



HUMAN HEALTH AND WELL-BEING MOTIVATIONS AND BENEFITS ASSOCIATED WITH PROTECTED AREA EXPERIENCES: AN OPPORTUNITY FOR TRANSFORMING POLICY AND MANAGEMENT IN CANADA

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ABSTRACT

This paper reports the results of a study from two protected areas that identifies visitors' perceived health and well-being motives and benefits associated with visitation to, and experiences provided by, protected areas. First, the expected human health benefits received from visits, and in particular the anticipated improvements associated with psychological/emotional and social well-being, were perceived to be a major personal value in the preference and choice to visit protected areas. Second, the perceived benefits received from the experiences were substantial. Visiting protected areas can be considered a highly positive life experience, and the greatest well-being benefits were perceived to be psychological/emotional, social, cultural, and environmental. Finally, visitation to parks was perceived to have important benefits for child development, especially in terms of physical development, social knowledge and competency, and cognitive learning and language. Interestingly, the well-being benefits received from visits were often perceived to be greater by women than men, and especially with respect to several aspects of child development. These results suggest that the social capital housed within Canada's protected areas estate deserves consideration alongside ecological capital in policy and management programmes pertaining to conservation. Research is necessary to confirm if these findings are applicable more broadly.

INTRODUCTION

All levels of government in Canada, federal, provincial/territorial, and municipal, sponsor legislation, policies, and programmes for protected areas, including national and provincial parks, migratory bird sanctuaries, national wildlife areas, wilderness areas, conservation areas, ecological reserves, marine conservation areas, city parks, and many other designations. Canada's terrestrial protected areas at the provincial and national levels number more than 5,900, including approximately 97.5 million hectares and representing 9.6 per cent of Canada's total land base (CCEA, 2012).

In an era characterized by rapid socio-economic and environmental transformation, it will be increasingly important for protected area organizations to identify and implement programmes that are society-oriented, and to develop outreach strategies that communicate this relevance to elected officials, key decision-makers, and the public. Even though protected areas make an important contribution to the conservation of biodiversity and maintenance and enhancement of ecological integrity, these areas also deliver essential ecosystem services, including the provision of clean air, clean water (see Costanza et al., 1997; Naidoo et al., 2008; Dudley et al., 2011), and spaces for human recreational use (Priskin & McCool, 2006; Stolton et al., 2010). An economic impact study conducted by the Canadian Parks Council (CPC), a consortium of federal, provincial and territorial protected areas' Ministers, revealed that the 43 million visitor days of activity provided by protected areas add over $4.6 billion to Canada's Gross Domestic Product (CPC, 2010). The study also indicated that $337.3 million (44 per cent of

Pinery Provincial Park, Ontario © Christopher Lemieux

the $0.8 billion spent by national and provincial park agencies) was returned to three levels of government in taxes. Therefore, these areas are also of economic importance.

Research conducted primarily in the context of urban and suburban parks in developed countries suggests that the social benefits of parks and other forms of protected areas are substantial. A comprehensive literature review conducted to understand better how humans benefit from nature, carried out by Deakin University for Parks Victoria in Australia, indicated that humans are dependent on nature in a number of ways (Maller et al., 2008). The most obvious includes exposure to, and participation in, physical activities such as walking, hiking, cycling, swimming, canoeing and other outdoor activities. In turn, contact with nature, plants, animals, landscapes, and wilderness, offers a range of medical benefits to visitors, including: faster recovery from surgery (Ulrich et al., 1991) and better pain control (Diette et al., 2003), reductions and prevention of hypertension, enhanced ability to concentrate (Kuo, 2001) and lower self-reported stress (Kaplan & Kaplan, 1989; Kaplan, 1995; Lewis, 1996; Parsons et al., 1998; Frumkin, 2001). Children with attention and behavioural disorders have shown significant improvement after being in contact with nature (Frumkin, 2001). Research also suggests that exercise is more beneficial, leading to relief of anxiety and depression, when it occurs in natural settings like parks, rather than along urban streets (Hartig et al., 1991; Bodin & Hartig, 2003). Interestingly, it has been found that the psychological benefits of natural areas increase with an increase in biodiversity (Fuller et al., 2007).

Because these studies have largely focused on urban and suburban parks and none have been conducted within the context of Canadian provincial and national parks, a prominent gap within the literature exists. Furthermore, most studies focused primarily on the benefits associated with attention restoration and physical activity in natural environments, and ignored other aspects that affect both individual and collective health and well-being (e.g., social, cultural, economic, and intellectual well-being, see also Stolton & Dudley, 2010). Overall, Canada has fallen behind the U.S. (America's Great Outdoors Initiative, 2011), the U.K. (Pretty et al., 2009), and Australia (Maller et al., 2005) both in terms of understanding the relationships between nature, parks and protected areas, human health and well-being, and in the development of integrated public policy and education, interpretation, and outreach strategies. Indeed, understanding the impact of conservation initiatives on the human health and livelihoods of Canadians is one of Canada's "Top 40" research questions for conservation policy (Rudd et al., 2010).

Within Canada, conservation objectives inscribed in legislation and related policies on management remain primarily ecologically-focused [see Section 8(2) of the *Canada National Parks Act* (S.C.2000 c.32)] and administrators predominantly direct policy and state-of-the-park reporting on maximizing ecological integrity and biodiversity-related outcomes (Environment Canada, 2005). Despite the popularity of protected areas as places to visit for recreation and leisure purposes (e.g., physical activity and relaxation), and the large potential for promoting protected areas as places that support human health and well-being, scant research exists on

the diverse perceived health and well-being motivations and benefits associated with visitation, much less about specific management and policy interventions and their effects on subgroups (e.g., youth and the elderly). Accordingly, the role that protected areas play in human health has not been fully recognized (Stolton & Dudley, 2010). As the CPC concluded, *"...while a healthy ecosystem is recognized as essential to human health, it seems that the development of programs that use the natural environment as a foundation to promote human health have only been explored in a very preliminary way"* (CPC, 2006: 1).

Accordingly, it is important to explore systematically the human health and well-being values pursued through visits to parks, and especially to non-urban parks. The overarching objective of such research is to establish an empirical, baseline understanding of perceived health and well-being motivations and outcomes associated with visitation to, and experiences provided by, protected areas. To achieve this objective, a survey was undertaken of park visitors to determine an understanding of: (1) visitor motives related to human health and well-being; (2) perceived health and well-being outcomes associated with visitation (including the perceived developmental benefits for children); and, (3) the perceived adequacy of attention given to human health and well-being and conservation in terms of public policy. In so doing, this paper represents a first response to Canadian federal, provincial, and territorial calls for this type of research (CPC, 2006), and contributes to the larger discussion and debate on the role of health and well-being benefits associated with protected areas visitation.

METHODS

Perception is an essential part of how people experience and use natural areas (Relph, 1976), and the personal benefits obtained from visitation are the key element in societal acceptance and the approval of protected areas and their management (Bushell & Eagles, 2007). Research reveals multiple motivations for visiting and participating in activities provided by protected areas, including satisfaction from the realization of personal values (Manzo, 2003; Kreninchyn, 2006; Manning, 2011). Protected area values have been classified as: intrinsic (e.g., fauna, flora, ecosystems); on-site goods and services (e.g., plant products, animal products, scientific research and knowledge, education); community-oriented (e.g., culture, identify, spiritual meaning, social well-being, bequest for future generations); and individual-oriented (e.g., existence, physical health, psychological health, spiritual well-being) (Lockwood et al., 2006). While increasing attention has been paid to on-site goods and services of the natural environment in recent years (i.e., the value of ecosystem services and natural capital, e.g., Costanza et al., 1997; Howarth & Farber, 2002; Anielski & Wilson, 2009), less attention has been given to the community and individual health values and benefits that visitors obtain from visitation to, and experiences provided by, protected areas.

SURVEY DESIGN

This paper uses a case study design to characterize systematically perceived health and well-being motives for visiting a park and the benefits obtained from visiting two protected areas in Canada. In so doing, *health* was defined as per the *Ottawa Charter* (Epp, 1986) as: *"a resource for everyday living, which allows us to manage, cope with and even change our environments"*. This definition moves beyond the relatively passive 1948 WHO definition of *"the state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity"* (World Health Organization, 1948). Grounded in several distinct but complementary sets of literature, including subjective well-being (Diener et al., 2009), population well-being (e.g., Bobbit et al., 2005; Foster & Keller, 2007; Bradshaw & Richardson, 2009), and from theory and research on human health, well-being, and place (e.g., Manzo, 2003; Patterson & Williams, 2005; Eyles & Williams, 2008; Muhajarine et al., 2008), the research adopted a positive approach to measuring health-related factors that we refer to as "health and well-being assets" (i.e., outcomes) rather than focusing solely on deficits (e.g., specific diseases). In so doing, a questionnaire was developed to reflect the comprehensive suite of health and well-being indicators (or attributes), including those that extend beyond the physical and psychological/emotional (e.g., economical, intellectual, cultural, social, intellectual, and occupational). The Scale of Positive and Negative Experience (SPANE), developed by Diener et al., (2009) was also adopted in the survey. The SPANE assesses the full range of possible desirable and undesirable experiences and has been found to have several advantages over other measures of feelings.

Demographic questions about the visitors covered gender, place of residence, age, annual household income, and highest level of education completed. Visit characteristics included length of stay, type of travel group (i.e., single, couple, family), numbers in travel group, and activities undertaken (e.g., camping, hiking, reading, canoeing). A non-probabilistic convenience (opportunity) sampling technique was employed, which

may not be a representative sample of the park population. The questionnaire targeted individuals based on the common characteristic that they were visiting a protected area during the sampling periods. Potential respondents over 18 years of age were intercepted at various points in October 2011 (e.g., campsites, trails, and interpretive displays), on a next available basis, meaning the next adult and the researcher were ready to continue with surveying. All participants were informed about their anonymity and the confidentiality of the survey. Visitors' participation was voluntary. The questionnaire was completed onsite using isurveysoft's iSurvey, an Apple® iPad™ survey application software. Questionnaire results were merged and formatted for descriptive statistical and correlation analysis using IBM SPSS Statistics version 20.0.

Questionnaire responses were coded as follows. *Visitor motivations* for visiting each protected area were measured with 10 items assessing diverse motivations [e.g., physical well-being (for physical activity like hiking, bicycling, swimming, canoeing), psychological/emotional well-being (for restoration from mental fatigue, relaxation, solitude and quiet)] assessed on a 5-point likert-type response scale (not at all important = 1, of little importance = 2, moderately important = 3, important = 4, very important = 5). *Well-being benefits* (outcomes of visitation) derived from visiting the protected areas were measured with a set of questions assessing the extent to which participants perceived visiting the park affected various aspects of their well-being (e.g., physical well-being, psychological/emotional well-being, social well-being) measured on a 7-point likert-type response scale (greatly worsened = 1, worsened = 2, somewhat worsened = 3, neutral = 4, somewhat improved = 5, improved = 6, greatly improved = 7). *Benefits for children* associated with park experiences were also assessed. Child development benefits was a measure of participants' perceived benefits from visiting parks and protected areas for children's health and well-being in general (e.g., physical development, social knowledge and competence, etc.) assessed on a 7-point likert-type scale (strongly disagree = 1, disagree = 2, slightly disagree = 3, neither agree or disagree = 4, slightly agree = 5, agree = 6, strongly agree = 7).

Also, Diener et al.'s (2009*) Scale of Positive and Negative Experience* (SPANE) was applied to assess visitor perceptions of overall experience. This psychometric scale produces a score for positive feelings (SPANE-P) (six items: Positive, Good, Content, etc.), a score for negative feelings (SPANE-N) (six items: Negative, Bad, Angry, etc.), and the two can be combined to create a balance score (SPANE-B). Each item is scored based on how often one experiences those feelings during a visit using a 5-point likert type scale (very rarely or never = 1, rarely = 2, sometimes = 3, often = 4, very often or always = 5). The positive and negative scales are scored separately because of the partial independence of the two types of feelings (Diener et al., 2009). The total positive score (SPANE-P) can range from 6 to 30, as can the negative score (SPANE-N). However, the two scores can also be merged by subtracting the negative score from the positive score, the result of which can range from - 24 to 24 (SPANE-B). While normally employed using a four-week frame of reference, the scale converges well with measures of emotions and affective well-being and assesses the full range of possible desirable and undesirable experiences, based on the total amount of time having an experience. Therefore, the scale is applicable in all experience scenarios and situations, and can be used in many research situations and within the varying temporal frame of reference associated with park visits. The SPANE reflects well across different cultures (Diener et al., 2009).

The beach at Pinery Provincial Park, Ontario © Paul F. J. Eagles

CASE STUDY LOCATIONS

Survey sampling occurred in autumn 2011 in two protected areas: Pinery Provincial Park, Ontario (October 8-11, 2011) and Gatineau Park, Québec (October 21-23, 2011) (Figure 1). The Pinery Provincial Park is located in southern Ontario and attracts over 600,000 visitor days

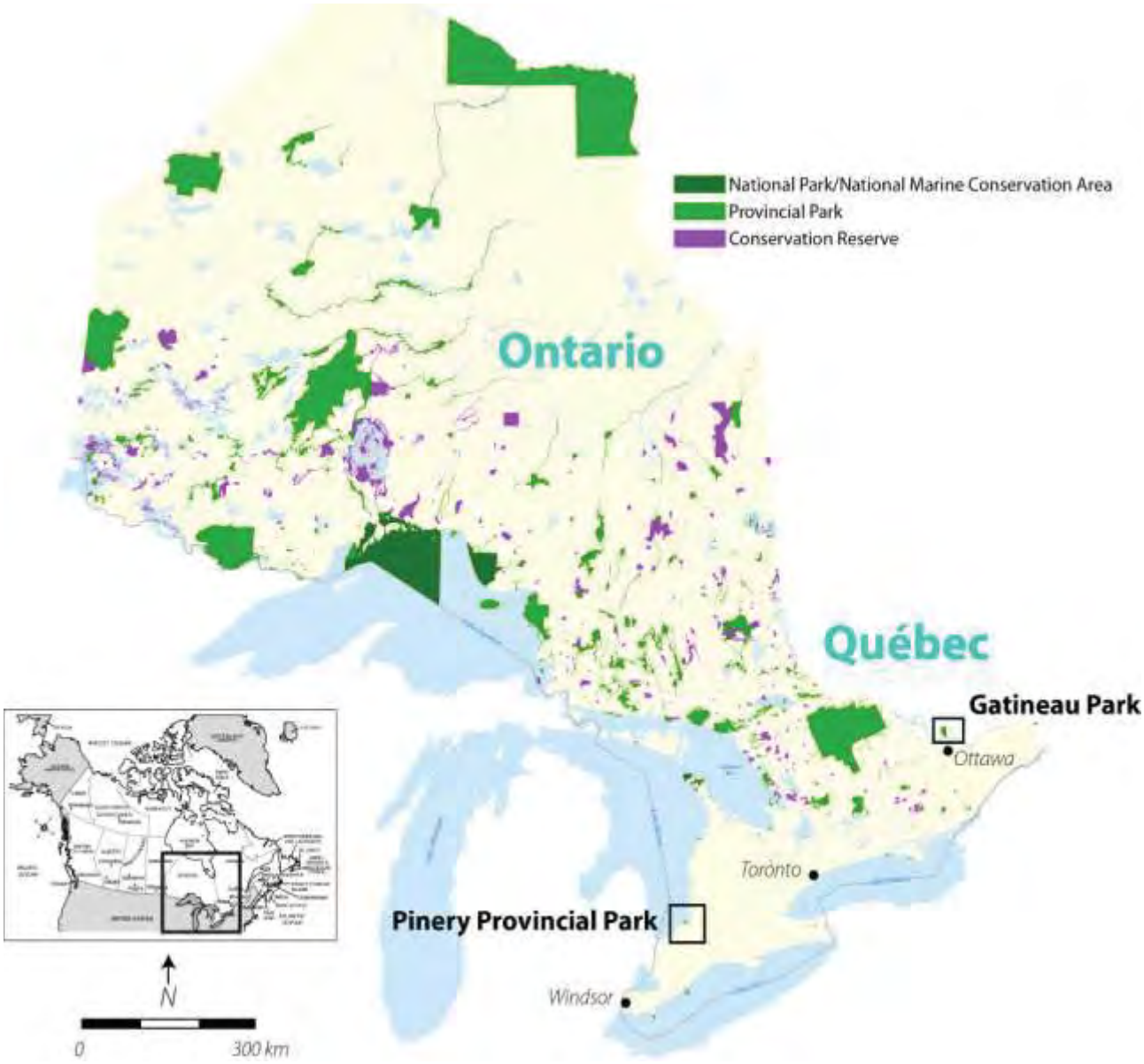

Figure 1: Location of study sites within the geographical context of Ontario's federal and provincial protected areas network. Map data from Ontario Parks.

of activity annually, the third highest of 335 provincial parks in the province (Ontario Parks, 2011). Administered by Ontario Parks it occupies an area of 25.32 km^2 and is classified as a Natural Environment Park and as IUCN category II (Gray et al., 2009). The protected area houses the largest oak savanna woodland remaining in North America, and offers outdoor recreational opportunities, including birding, bicycling, Nordic skiing, and swimming. It protects over 15 species at risk. The park has a long history of innovative ecological and outdoor recreation planning, with the first recorded use of the concept of carrying capacity in park management planning (Eagles, 2010).

Gatineau Park is located in Canada's National Capital Region, in southern Québec. Administered by the National Capital Commission, the protected area occupies an area of 363 km^2 and is IUCN category II. Attracting over two million visits annually (National Capital Commission, 2011), Gatineau Park is a popular recreational destination offering a diversity of public facilities including beaches, campgrounds, picnic areas, trails, and parkways. There are 165 km of hiking trails and 90 km of trails for mountain bikes, and the Trans Canada Trail passes through the park. The protected area supports a broad diversity of wildlife, including many species at risk.

These protected areas were selected for their high autumn season visitor numbers, thereby providing a reasonable sample size over a short surveying period. Furthermore, both protected areas offer a diversity of activities and services allowing a range of attributes to be included in the survey.

Table 1: Sample demographic characteristics (n=166).

	Count	(%)
Age		
19-34	57	(34.3)
35-65	94	(56.6)
66+	12	(7.2)
Missing	3	(1.8)
Sex		
Male	92	(55.4)
Female	74	(44.6)
Missing	0	(0.0)
Income		
0-60K	36	(21.7)
60-100K	44	(26.5)
100 - 150K	33	(19.9)
150K+	35	(21.1)
Missing	18	(10.8)
Education		
Less than bachelors	55	(33.1)
Bachelors or higher	101	(60.8)
Missing	10	(6.0)

RESULTS

Collectively, 166 responses were collected (Gatineau n=57; Pinery n=109). The sample is slightly over-represented by males, at 55 per cent. All ages are represented, with the average of 43. The population is highly educated, with 61 per cent had having a university degree (Table 1). Also, 47 per cent were visiting with children and 85 per cent were employed.

HEALTH AND WELL-BEING MOTIVATIONS FOR VISITING PROTECTED AREAS

This section illustrates the visitors' reported motivations for visiting the protected areas (Tables 2 and 3). At least 80 per cent of the sample evaluated 8 of the 10 health and well-being indicators included in the study as either a 'very important', 'important', or 'moderately important' motivation for the visit. With means greater than 4, the two most significant health and well-being motivations were social and psychological/emotional. Nearly 80 per cent of respondents indicated these motivations to be 'very important' or 'important'. The least important motivations were associated with economical and occupational well-being, with means less than 3 and less than 58 per cent of the sample indicating these attributes as 'very important', 'important', or 'moderately important'.

Gatineau Park, Québec © Christopher Lemieux

Table 2: Perceived importance of health and well-being indicators related to respondents' motivations for visiting the protected areas (per cent of respondents) (n = 166).

Health and Well-being: Attribute and Description	Not At All Important	Of Little Importance	Moderately Important	Important	Very Important
Physical Well-being (for physical activity like hiking, bicycling, swimming, canoeing)	1.9%	5.0%	22.5%	35.0%	35.6%
Psychological/Emotional Well-being (for restoration from mental fatigue, relaxation, solitude & quiet)	1.3%	3.1%	16.9%	36.9%	41.9%
Social Well-being (for opportunity for increased social interaction/bonding with family, friends)	1.2%	6.8%	14.3%	34.8%	42.9%
Intellectual Well-being (for opportunity to engage in creative and stimulating activities)	3.8%	15.6%	30.6%	30.6%	19.4%
Spiritual Well-being (to connect with nature, inspiration of nature, seek meaning/purpose of life)	7.7%	10.3%	21.8%	31.4%	28.8%
Ecological Well-being (to experience the natural environment, sense of ecological citizenship)	2.6%	6.4%	21.8%	35.3%	34.0%
Environmental Well-being (to experience sense of place, outdoors, desirable weather conditions)	2.6%	11.5%	25.0%	35.9%	25.0%
Cultural Well-being (to experience cultural and historical heritage)	0.6%	17.9%	18.6%	32.7%	30.1%
Occupational Well-being (to improve my ability to work after my visit)	17.5%	26.6%	22.7%	25.3%	7.8%
Economic Well-being (to support local economy)	20.6%	30.3%	27.1%	14.2%	7.7%
Mean	**6.0%**	**13.4%**	**22.1%**	**31.2%**	**27.3%**

Table 3: Descriptive statistics and tests of significance for the importance ratings of health and well-being motivations of visitors for visiting the protected areas (n=166).

	Descriptive		Tests of Significance p-values			
	Mean	SD	Age[1]	Sex[2]	Income[1]	Education[2]
Physical Well-being	3.98	.98	.235	.055	.397	.096
Psychological Well-being	4.15	.90	.681	**.002**	**.004**	.307
Social Well-being	4.11	.97	.952	.080	.463	.719
Intellectual Well-being	3.46	1.09	.602	.499	.101	.370
Spiritual Well-being	3.63	1.22	.265	**.016**	.096	.576
Ecological Well-being	3.92	1.02	.286	.372	.153	.719
Cultural Well-being	3.74	1.10	.110	.296	.064	.783
Environmental Well-being	3.69	1.05	.563	.341	**.034**	.207
Occupational Well-being	2.79	1.22	.314	.364	.113	.641
Economic Well-being	2.58	1.19	.539	.088	.121	**.036**

[1] p-values associated with one-way ANOVA of mean rating by age and income categories
[2] p-values associated with t-tests of mean rating by dichotomous variables sex and education

When examined by demographic variables, there were no statistically significant differences in the rankings of motivations according to age. Therefore, age does not affect a person's rankings of the various health and well-being motivations to visit the park. There were a few significant differences in importance ratings, including that females tended to rate psychological and spiritual motivations higher (p=.002 and .016, respectively), those with higher education tended to rate economic motivations somewhat lower (p=.036), those with the highest income tended to rate psychological motivations somewhat lower (p=.004), and those with lowest incomes tended to rate the environmental motivations higher (p=.034).

Table 4: Perceived health and well-being benefits (outcomes) associated with visiting the parks (per cent of respondents) (n = 166).

Health and Well-being Attribute and Description	Greatly Worsened	Worsened	Somewhat Worsened	Neutral	Somewhat Improved	Improved	Greatly Improved
Physical Well-being (from physical activity like hiking, bicycling, swimming, canoeing)	0.0%	0.0%	0.6%	14.7%	37.8%	35.3%	11.5%
Psychological/Emotional Well-being (from restoration from mental fatigue, relaxation, solitude & quiet)	0.0%	0.0%	0.6%	8.9%	24.1%	44.3%	22.2%
Social Well-being (from opportunity for increased social interaction/bonding with family, friends)	0.0%	0.0%	0.6%	16.6%	27.4%	42.0%	13.4%
Intellectual Well-being (from opportunity to engage in creative and stimulating activities)	0.0%	0.0%	0.0%	34.6%	33.3%	26.3%	5.8%
Spiritual Well-being (from connecting with nature, being inspired by nature, seeking meaning/ purpose of life)	0.0%	0.0%	0.0%	29.3%	31.1%	30.0%	12.3%
Ecological Well-being (from experiencing the natural environment, sense of ecological citizenship)	0.0%	0.0%	0.7%	24.2%	31.4%	32.7%	11.1%
Environmental Well-being (from experiencing sense of place, outdoors, desirable weather conditions)	0.0%	0.0%	1.9%	41.3%	32.3%	20.0%	4.5%
Cultural Well-being (from experiencing cultural and historical heritage)	0.0%	0.0%	0.6%	14.1%	27.6%	39.1%	18.6%
Occupational Well-being (by improving my ability to work after my visit)	0.0%	0.7%	2.0%	42.5%	30.7%	16.3%	7.8%
Economic Well-being (by supporting local economy)	0.6%	0.6%	1.3%	57.8%	24.7%	11.0%	3.9%
Mean	**0.1%**	**0.1%**	**0.8%**	**28.4%**	**30.0%**	**29.7%**	**11.1%**

PERCEIVED HEALTH AND WELL-BEING BENEFITS RECEIVED FROM VISITING PROTECTED AREAS

This section reports the visitors' benefits obtained from visiting the park (Tables 4 and Table 5 overleaf). Several of the 10 indicators exhibited means greater than 5 on the 7 point scale, and similar to the motivation results noted above, psychological/emotional and social benefits were perceived to be the most significantly improved aspects of well-being. This suggests that the perceived benefits, or actual outcomes, largely match the motivations for the visit. Even though the least significant benefits were economical and occupational well-being, 40 per cent or more of the respondents indicated some degree of improvement with respect to these attributes. Of the 1,554 responses for set of attributes, 72 per cent were associated with a health and well-being improvement, while only 0.6 per cent were associated with a perceived worsened state.

When examined by demographics, the benefits received did not vary by the age of respondent. Therefore, age does not affect a person's rankings of the various health and well-being benefits receiving from visiting the park. Several significant trends were evident for sex and income. Females tended to rate the social (p=.018), spiritual (p=.003) and environmental (p=.022) benefits

Table 5: Descriptive statistics and tests of significance for the importance ratings of health and well-being benefits (outcomes) associated with visiting the parks (n=166).

	Descriptive		Tests of Significance p-values			
	Mean	SD	Age[1]	Sex[2]	Income[1]	Education[2]
Physical Well-being	5.42	.90	.826	.166	.245	**.041**
Psychological Well-being	5.79	.91	.394	.091	.116	.480
Social Well-being	5.51	.94	.456	**.018**	.088	.667
Intellectual Well-being	5.03	.92	.755	.599	**.006**	.109
Spiritual Well-being	5.24	1.01	.730	**.003**	**.003**	.953
Ecological Well-being	5.29	.98	.801	.122	**.009**	.653
Cultural Well-being	4.84	.92	.901	.316	**.021**	.943
Environmental Well-being	5.61	.97	.968	**.022**	.123	.779
Occupational Well-being	4.84	1.01	.730	.121	**.044**	.822
Economic Well-being	4.54	.92	.504	.643	.185	.548

[1] p-values associated with one-way ANOVA of mean rating by age and income categories
[2] p-values associated with t-tests of mean rating by dichotomous variables sex and education

Table 6: Perceived improvement in various child development attributes associated with visits to parks (per cent of respondents) (n = 166).

Aspect of Child Development	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Physical development	0.0%	0.6%	0.0%	2.5%	10.6%	35.6%	50.6%
Social knowledge and competence	0.0%	0.0%	1.3%	5.0%	14.4%	37.5%	41.9%
Cognitive learning and language (e.g., concentration)	0.0%	0.0%	1.3%	7.5%	18.9%	34.0%	38.4%
Communication skills	0.0%	1.9%	0.6%	15.9%	18.9%	33.3%	30.2%
Anxiety	0.6%	1.9%	1.9%	17.7%	15.8%	33.5%	29.1%
Hyperactivity/Inattention issues	0.6%	1.3%	3.8%	14.4%	23.1%	31.3%	25.6%
Personal-social behavior (e.g., self-discipline)	0.0%	1.9%	1.9%	27.0%	15.4%	27.7%	25.2%
Respiratory issues	0.0%	2.7%	2.0%	42.3%	13.4%	22.1%	17.4%
Mean	**0.2%**	**1.3%**	**1.6%**	**16.5%**	**16.3%**	**31.9%**	**32.3%**

as higher than males, whereas the lowest (less than $60K) and middle ($100-150K) income groups tended to rate the intellectual (p=.006), spiritual (p=.003), ecological (p=.009), cultural (p=.021) and occupation (p=.049) benefits higher.

Results revealed significant perceived health and well-being benefits identified by the respondents associated with children's visits to the case study protected areas across the entire suite of developmental attributes included in the study (Tables 6 and 7). Three of the eight child development attributes exhibited means greater than 5 on the scale up to 7. The most significant improvements in child development attributes were perceived to be those associated with physical development, social knowledge and competence, and cognitive learning and language (e.g., concentration). Interestingly, 50 per cent or more of respondents agreed that some form of developmental improvement was achieved through visits to protected areas. Notably, the females rated 7 of the 8 benefits for children significantly higher than males (Table 7 overleaf).

SCALE OF POSITIVE AND NEGATIVE EXPERIENCE (SPANE)

The SPANE analysis revealed that visiting a protected area is perceived to be a highly positive life experience. Mean results indicate that the frequency of negative feelings experienced during a park visit is extremely low, and rank in the 6th percentile in terms of SPANE-N norms identified by Diener et al. (2009). The Cronbach's alphas, a measure of reliability of a psychometric test score, are good (SPANE-N = .82, SPANE-P = .84).

Table 7: Descriptive statistics and tests of significance for the importance ratings of perceived improvement in child development attributes associated with visits to parks (n=166)

	Descriptive		Tests of Significance p-values			
	Mean	SD	Age[1]	Sex[2]	Income[1]	Education[2]
Physical development	6.33	.84	.714	**.000**	.321	.455
Social knowledge	6.14	.93	.956	**.005**	.154	.739
Cognitive learning	6.01	1.00	.187	**.005**	.801	.501
Communication skills	5.72	1.18	.373	**.008**	.073	.649
Anxiety	5.62	1.28	.235	**.010**	.161	.793
Hyperactivity	5.54	1.25	.572	**.023**	.431	.969
Personal-social behaviour	5.42	1.28	.695	**.017**	.303	.133
Respiratory allergies	5.03	1.29	.600	.723	.226	.390

[1] p-values associated with one-way ANOVA of mean rating by age and income categories
[2] p-values associated with t-tests of mean rating by dichotomous variables sex and education

Table 8: Visitor perceptions of various statements associated with nature, protected areas and human health and well-being (per cent of respondents) (n = 166).

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Contact with nature improves the quality of life of Canadians.	0.0%	0.0%	0.6%	3.8%	8.8%	30.8%	56.0%
The health and well-being benefits associated with experiencing nature should be reported alongside other health indicators in Canada.	0.0%	0.6%	1.2%	3.7%	9.3%	31.7%	53.4%
Having nature in close proximity, or just knowing it exists, is important to people regardless of whether they are regular users of it.	0.0%	0.0%	0.0%	3.2%	10.8%	28.5%	57.6%
Government agencies should develop education, interpretation, and outreach messaging that communicate the health and well-being benefits of protected areas.	0.7%	0.0%	0.0%	5.3%	11.3%	28.5%	54.3%

BROAD SOCIETAL IMPLICATIONS

The visitors provide strong support for the concept that the human health and well-being benefits of protected areas extend beyond users, and also hold the position that government agencies should begin reporting the health and well-being benefits of nature in Canada (Table 8). Furthermore, visitors strongly perceived that contact with nature improves the quality of life of Canadians. Visitors also agreed very strongly that government agencies should develop education, interpretation, and outreach messaging that communicate the health and well-being benefits of protected areas. While the Government of Canada's *Pan-Canadian Integrated Healthy Living Strategy* (Health Canada, 2005) recognizes that the natural environment has an impact on healthy living, greater recognition of contribution of protected area settings to the pursuit of healthy lifestyles is required.

DISCUSSION AND CONCLUSIONS

The analyses reveal findings with policy and management implications. First, results suggest that the expected human health and well-being motivations for visitation and benefits received from visitation are a major personal value in the preference and choice to visit. This finding from non-urban parks is consistent with studies at suburban parks that the emotional response evoked by a visit plays a significant role in choice processes (e.g., Araña & León, 2009; Lopez-Mosquera & Sanchez, 2012). Second, with 72 per cent of responses being associated with a health and well-being improvement, and only 0.6 per cent associated with a perceived worsened state, the benefits received from protected area experiences are substantial, with psychological/emotional, environmental, social, and physical benefits identified as the most significantly improved aspects. The SPANE results reveal that visiting

Interior river and boardwalk at Pinery Provincial Park, Ontario © Paul F. J. Eagles

protected areas is considered by visitors to be a highly positive life experience. Also, visitation to parks is perceived to have important benefits for child development, especially in terms of physical development, social knowledge and competence, and cognitive learning and language.

The authors feel that the results from the current study are sufficiently important that implications can be suggested. First, the research found that the survey instrument is a useful tool for future research. Since this study had a modest sample size from only two parks, more research is needed across space (i.e., in other locations across Canada and indeed globally), time (e.g., seasons), and different forms and classifications of protected areas (e.g., national, conservation areas, ecological reserves, migratory bird sanctuaries, etc.).

Second, the research revealed that the social, cultural, spiritual, and ecological/environmental aspects of human health and well-being suggest increased consideration within visitor experience monitoring and management programmes and associated reporting (e.g., 'state of the park' reporting). Given the substantial perceived benefits for child development associated with visitation to protected areas (especially by females), including those related to social knowledge, competence, and cognitive learning and language, the intellectual and developmental attributes of well-being deserve particular consideration.

Third, it is desirable to develop appropriate indicators that reflect the comprehensive suite of population health and well-being indicators, including those that extend beyond the physical and psychological/emotional. Visitor experience data is fundamental to increasing the likelihood of the 'best' facilities and services for meeting visitor needs, rather than management decisions being the result of *ad hoc* decisions by managers (Wardell & Moore, 2005).

Fourth, it is possible to use this information to justify financial and political support for protected areas. The findings provide an opportunity to transform protected areas' policy mandates and management protocols with a greater emphasis given to the social capital of protected areas. The Government of Canada recently committed to the *Aichi Target*, which will guide efforts to save biodiversity through enhanced action to meet the objectives of the *Convention on Biological Diversity*. As such, the Government of Canada committed to protecting, by 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas (Environment Canada, 2010). This new strategic

direction is intended to conserve and sustain biodiversity and ecosystem services for present and future generations. Accordingly, it appears that there is sufficient justification to include social capital in ecosystem service assessments and strategic land-use planning exercises to provide additional compelling rationale towards such ambitious conservation targets.

Fifth, the research findings suggest that it might be desirable to redesign education programmes within protected areas, and communication and outreach strategies outside of them. For example, protected area agencies and public health agencies could work together to develop communication and outreach strategies aimed at informing the public on how protected areas enhance the quality of life and environments for all Canadians and contribute to healthy communities.

Sixth, increased levels of health research can help protected area practitioners and public health authorities more systematically address the health potential of protected areas, and better ensure that informed decisions are made in all areas of the health system including treatment, prevention, public programme and policy development. There is a need for more protected areas and public health policy integration. Over recent years, greater attention has been paid by governments and the public to aggregate reporting, largely due to increasing requirements for public accountability by government departments (including protected area managers) and the need for such data in pursuing funding (Wardell & Moore, 2005). Protected areas organizations will need to place greater emphasis on the social capital housed within protected areas in policy, management programmes, and state of the park reporting, and will need to develop strategic education, interpretation, and outreach programmes to communicate these values to elected officials, key decision-makers, and the public. As the Canadian Parks Council emphasized in the 'Healthy by Nature' discussion paper, "*Encouraging Canadians to spend more time in parks will support improved physical and mental/ emotional health, and can also serve to provide opportunities to inform and educate them about the important connections between healthy ecosystems and healthy human populations.*" (CPC, 2006: 2).

Despite the important social and well-established economic contributions that protected areas provide to society, visitor data are omitted from virtually all forms of protected areas status and state of the park reporting in Canada (see Environment Canada, 2005 for example). However, the environmental, ecological, and educational motivations and benefits associated with protected area experiences were revealed to be substantial in this study. Furthermore, our study also revealed that the environmental benefits associated with protected area experiences exceed personal motivations or expected outcomes associated with this attribute. These findings are important for two reasons. First, there appears to be a net benefit associated with environmental well-being after people make the decision to visit a protected area. Second, these findings support the hypothesis that visitors to parks do so to satisfy certain values, including those that relate to conservation, which fosters greater understanding and support for protected areas (Priskin & McCool, 2006). In meeting the health needs of visitors, protected area managers should pay increasing attention to the type and quality of visitor experiences offered. In order for this expanded role to be realized, public health and park managers will need to work collaboratively toward understanding the links between the natural environment and human health and well-being.

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DISCLAIMER

The views expressed in this manuscript are those of the authors and do not necessarily represent the opinions of Ontario Parks, the Ontario Ministry of Natural Resources, the National Capital Commission, or other agencies and organizations referred to in the manuscript.

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RESUMEN

Este documento informa de los resultados de una investigación sobre dos áreas protegidas que destaca los motivos y beneficios que en materia de salud y bienestar perciben los visitantes como resultado de las experiencias relacionadas con sus visitas a las áreas protegidas. En primer lugar, los beneficios para la salud humana y, en particular, las mejoras anticipadas asociadas con el bienestar psicológico/ emocional y social, se percibieron como un valor personal importante en la preferencia por las áreas protegidas. En segundo lugar, los beneficios percibidos de las experiencias fueron sustanciales. Las visitas a las áreas protegidas pueden ser consideradas como una experiencia muy positiva, y el mayor beneficio percibido fue en términos de bienestar psicológico/emocional, social, cultural y ambiental. Por último, se percibió que las visitas a los parques tenían importantes beneficios para el desarrollo de los niños, especialmente en lo atinente a desarrollo físico, conocimiento y competencia social, y aprendizaje cognitivo y del lenguaje. Curiosamente, fueron las mujeres quienes más bienestar percibieron como resultado de las visitas, y sobre todo con respecto a ciertos aspectos relacionados con el desarrollo infantil. Estos resultados sugieren que el capital social inherente a las áreas protegidas de Canadá merece ser considerado junto con el capital ecológico en los programas relacionados con las políticas y la gestión de la conservación. Es preciso profundizar las investigaciones para confirmar si estos hallazgos son aplicables en un contexto más general.

RÉSUMÉ

Ce document analyse les résultats d'une étude menée dans deux aires protégées et identifie les perceptions des visiteurs en termes de santé, les raisons de leur visite et les bénéfices attendus en termes de bien-être, et l'expérience procurée par ces visites. Tout d'abord, les bénéfices attendus de ces visites sur la santé et notamment les améliorations anticipées du bien-être psychologique/émotionnel et social sont perçues comme une valeur personnelle essentielle dans la décision et le choix de visiter des aires protégées. Deuxièmement, les bénéfices de cette expérience sont jugés importants par les visiteurs. Visiter des aires protégées est perçu comme une expérience humaine extrêmement positive, dont les plus grands bénéfices en termes de bien-être semblent se faire sentir dans les domaines psychologique, émotionnel, social, culturel et environnemental. Enfin, les visiteurs estiment que les parcs ont des bénéfices importants pour le développement de l'enfant, notamment en termes de développement physique, de connaissances et de compétences sociales, d'apprentissage cognitif et de langage. Il est intéressant de remarquer que les femmes sont plus sensibles aux bénéfices de ces visites sur le bien-être que les hommes, notamment en ce qui concerne plusieurs aspects du développement de l'enfant. Ces résultats suggèrent que le capital social de l'ensemble des aires protégées mérite d'être autant pris en compte que le capital écologique dans les politiques et les programmes de gestion liés à la conservation. De futures recherches confirmeront si ces résultats sont applicables plus largement.

PROTECTED AREAS AND THE CHALLENGE OF CONSERVING CROP WILD RELATIVES

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ABSTRACT

Crop wild relatives are a critical resource for sustaining future food security. It is widely recognized that many of the world's protected areas contain CWR diversity. Despite this, it has not yet proved possible to undertake significant actions to conserve the CWR they contain. Many challenges and obstacles need to be addressed in order to improve this situation. Recent initiatives have started to address these challenges and uncovered some key lessons. Still, the need for action is urgent and the paper concludes by drawing attention to the need for a global approach to conserving priority and threatened CWR in the wild.

INTRODUCTION

Crop wild relatives (CWR) - wild plant species closely related to crops to which they may contribute beneficial genes - constitute an enormous reservoir of genetic variation for crop improvement and are an important socio-economic resource. Genes from wild plants have provided crops with resistance to many pests and diseases and improved their tolerance to extreme temperatures, salinity and drought - a value of CWR that is of growing importance under the changing climate. CWR have also contributed more generically to improving variety, yield and quality. Most modern crop cultivars contain some genes that were derived from wild relatives (Maxted & Kell, 2009) and the worldwide value of these new gene introductions in increasing crop yields per year has been estimated at US$115 billion (Pimentel et al., 1997). A review of the use of CWR in crop improvement programmes by Maxted and Kell (2009) found that for 29 crop species important for food security, there are at least 183 CWR taxa containing useful traits for crop improvement. The authors found that reported uses of CWR for crop improvement have increased significantly in the last 40 years and that the most widespread CWR use has been in the development of pest and disease resistance, with the references citing disease resistance objectives accounting for 39 per cent, pest and disease resistance 17 per cent, abiotic stress 13 per cent, yield increase 10 per cent, cytoplasmic male sterility and fertility restorers 4 per cent, quality improvers 11 per cent and husbandry improvement 6 per cent of the reported inter-specific trait transfers. It is also worth noting that the same study found breeders' use of CWR taxa was increasing year on year, even though it was recognized that they were still far from being systematically exploited.

Some idea of the scale of benefits may be obtained from published estimates referring to a selected number of crops. For example, the desirable traits of wild sunflowers (*Helianthus* spp.) are worth an estimated US$267 to US$384 million annually to the sunflower industry in the United States; one wild tomato species (*Lycopersicon peruvianum* (L.) Mill.) has contributed to a 2.4 per cent increase in solids contents worth US$250 million; and three wild peanuts (*Arachis batizocoi* Krapov. & W. C. Gregory, *A. cardenasii* Krapov & W. C. Gregory and *A. diogoi* Hoehne) have provided resistance to the root knot nematode, which costs peanut growers around the world US$100 million each year (Hunter & Heywood, 2011). Of course, the commercial contributions of the majority of CWR are likely to be on a much smaller scale. Godfray et al. (2010) acknowledge the important role that CWR are playing and will continue to play in broadening the current narrow genetic base of the world's important food crops, improving food production and contributing to the food security of a world projected to be home to nine thousand million people by 2050.

However, it cannot be assumed that this valuable resource will continue to be available for current and future exploitation. CWR occur in a wide range of habitats, but as numerous assessments testify, habitats

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Ugam Chatkal Nature Reserve, Uzbekistan © S. Djataev

continue to be lost or degraded across the world, putting many of these economically important species at risk. For most parts of the world, information is lacking on the occurrence and status of CWR. Bolivia was the first country to publish a Red List specifically dedicated to CWR. It lists 152 CWR species of which 45 are threatened (VMABCC-Bioversity, 2009). In a recent joint IUCN/ European Commission initiative to produce a European Red List, a selection of 572 native European CWR of high priority human and animal food crops were regionally assessed. At European level, at least 11.5 per cent (66) of the species are threatened, with at least 3.3 per cent (19) of them being Critically Endangered, 4.4 per cent (22) Endangered and 3.8 per cent (25) Vulnerable – a further 4.5 per cent (26) of the species are classified as Near Threatened and one species (*Allium jubatum* J.F. Macbr.) is Regionally Extinct (Bilz et al., 2011; Kell et al., 2012). The remaining species were regionally assessed as Data Deficient (29 per cent) or Least Concern (54.7 per cent); however, of the species assessed as being of Least Concern, around a third are threatened at national level (Kell et al., 2012).

In addition, the limited studies that have so far been undertaken on the potential impacts of climate change indicate that individual CWR species vary significantly in their likely responses and that in some areas CWR species will significantly decrease in their range, with some possibly going extinct by the middle of this century (Jarvis et al., 2008). It can also not be taken for granted that the wide genetic diversity of CWR is safeguarded and available in the world's gene banks. In Europe, for example, based on data available via EURISCO[1], only around nine per cent of total germplasm accessions in gene banks are of wild origin (Dias et al., 2012). Further, the ratio of the number of accessions of cultivated species to wild species is striking, with an average of 167 for each cultivated species and 14 for each wild species, giving a ratio of 12:1, which is particularly surprising, given that most diversity is located in wild species (Maxted et al., 2008a). Both editions of the *Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 1997, 2010) draw attention to this and highlight the limited and precarious nature of the world's gene bank holdings of CWR accessions. CWR, despite recognition of their importance, remain seriously under-conserved both *in situ* and *ex situ*.

CROP WILD RELATIVES AND THE IMPORTANCE OF PROTECTED AREAS

In situ conservation of CWR allows natural evolutionary processes to be maintained, thus providing a continuous source of novel genetic variation for crop improvement. However, despite the immense global value of CWR species and the emphasis placed on their *in situ* conservation by international treaties, conventions and agreements, as well as international organizations and academics, relatively little evidence to date of practical action to implement their conservation *in situ* exists (see review by Heywood & Dulloo, 2005). Underpinning the conservation strategy of most countries is a protected area system and this is reflected in the Convention on Biological Diversity (CBD), where the main thrust of biodiversity conservation is *in situ*. We know that populations of many CWR occur in these protected areas (Figure 1); however, although some of them have been in existence for centuries and many changes have been made in the ways they are managed, significant actions to conserve the CWR protected areas contain have only been undertaken in a few cases (Maxted & Kell, 2009; Maxted et al., 2012; and Box 1).

Figure 1. 105 global protected areas known to contain CWR diversity (Source: Maxted et al., 2010a)

The assumption is often made that all species in protected areas are passively conserved if the entire ecosystem or habitat is stable and there are no threats to individual species. However, without monitoring and active management of individual species, the genetic diversity within and between CWR populations could be eroded over time and entire populations could even go extinct (Maxted et al., 2008b). Furthermore, management interventions in protected areas for other species, such as burning, erosion control, increasing tree cover and productivity (in the case of forest reserves) and other habitat disturbance may not be suitable, or worse, may be to the detriment of the CWR populations that occur there. Shands (1991) cites the example of the establishment of a genetic reserve for the maize relative *Zea diploperennis* in the tropical forest of Sierra de Manantlan, Mexico. Initially all grazing at the site ceased but routine monitoring of population sizes showed that wild maize populations within the reserve were decreasing because they were being out-competed by other forest plants. In this case, a certain level of grazing was required for the target CWR population to thrive. Also, as Hunter and Heywood (2011) note, nature reserve design and management practices that focus on the landscape level, community level or species level may conflict with one another.

Apart from two reserves for the *in situ* conservation of CWR (in both cases wheat relatives) that were established in the 1980s – the Erebuni Reserve in Armenia and the Ammiad Project Reserve in Israel – and a number of reserves for wild fruit trees (see below), it is only in the last 10–15 years or so that some serious efforts have been made to conserve CWR in their natural wild habitats. These include two major Global Environment Facility (GEF)/World Bank-funded projects on the conservation of genetic diversity in Turkey (1993–1998) and the Fertile Crescent (2000–2006) in which CWR of wheat, barley, lentil, faba bean, pea, olive, pistachio, sweet chestnut, fir and pine (*Triticum*, *Hordeum*, *Lens*, *Vicia*, *Pisum*, *Olea*, *Pistacia*, *Castanea*, *Abies* and *Pinus* species) were selected as

BOX 1: CONSERVATION OF *CINNAMOMUM CAPPARU-CORONDE* IN SRI LANKA

The Sri Lankan endemic species *Cinnamomum capparu-coronde* is a wild relative of commercial cinnamon (*C. verum*) or 'true' cinnamon. It occurs in a number of the country's protected areas and forest reserves (FR): Sinharaja Forest Biosphere Reserve, Kanneliya-Dediyagala-Nakiyadeniya Biosphere Reserve, Gilimale-Erathne FR, and Walankanda FR. The Sri Lanka component of the UNEP/GEF CWR Project selected the Kanneliya-Dediyagala-Nakiyadeniya reserve as a priority area for the conservation of this CWR and worked closely with the protected area's governing body – the Department of Forest Conservation – to modify the existing management plan for to include a species management plan for *Cinnamomum capparu-coronde*. The species is normally harvested for medicinal and commercial purposes. Awareness-raising activities were also carried out to inform local communities of the importance of preserving these species and CWR in general.

target species for *in situ* conservation in genetic reserves – natural and semi-natural areas that are designated for maintaining genetic diversity in a natural setting for the species concerned. However, it is not known in all cases to what extent the results of these projects were sustainable (i.e. that the genetic reserves are still in existence and that the CWR populations are monitored and managed).

Unfortunately, there are very few examples of *in situ* conservation of CWR in the tropics. Rare exceptions include the establishment of genetic reserves for various species of fruit tree such as the gene sanctuary for citrus species in the Nokrek National Park, in northeast India, which was created in 1981 and apparently the first reserve specifically set up for the *in situ* conservation of tropical trees; the genetic reserves for the conservation of wild relatives (and landraces) of rice, taro, litchi, citrus and tea in Vietnam established under a GEF-supported project; and in Mexico an *in situ* reserve that was created in 1987 in the Biosphere Reserve of the Sierra de Manantlán for *Zea diploperennis*, a wild relative of maize (*Zea mays*). For examples of Forest Genetic Reserves see FAO/DFSC/IPGRI (2001, 2004).

More recently, the United Nations Environment Programme (UNEP)/GEF-supported project, '*In situ* conservation of crop wild relatives through enhanced information management and field application' (CWR Project)[2], coordinated by Bioversity International in five countries – Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan – has expanded substantially the previously limited body of knowledge on *in situ* CWR conservation in developing countries. Through the involvement of protected area authorities and other relevant stakeholders, such as indigenous and local communities, the project has facilitated the development of CWR species management plans for implementation in protected areas, as well as the adaptation of protected area management plans to take into account the needs for CWR conservation[3]. The project has also highlighted the considerable challenges and obstacles facing CWR conservation in protected areas.

WORKING IN PROTECTED AREAS TO CONSERVE CROP WILD RELATIVES – SOME LESSONS LEARNED

Populations of many CWR occur in existing protected areas (Figure 1), although the lack of inventories means that detailed information on their distribution is seldom available. However well managed these areas may be, passive conservation alone is not sufficient to ensure the effective *in situ* conservation of CWR, which should be accompanied by some degree of active management or at least recurrent monitoring of the populations of the target species, particularly if these species are threatened (Maxted et al., 1997, 2008b; Hunter & Heywood, 2011; Iriondo et al., 2012).

Until recently, there have been limited examples of protected area management plans that incorporate specific CWR management practices. Further, there has been little information published or documented that provides guidance in working with protected area authorities and managers or other relevant actors. For example, no mention is made of CWR, genetic reserves or genetic resource management in the global guide for managing protected areas by Lockwood et al. (2006). Attention should be drawn, however, to the detailed recommendations and case studies for the *in situ* conservation and management of forest genetic resources, including CWR, given in volumes 1 and 2 of the guides published by FAO, FLD (Forests & Landscape Denmark) and IPGRI (2001, 2004) (see Box 2). Recently detailed guidelines on the planning and implementation of genetic reserves for CWR *in situ* conservation have been published by Iriondo et al. (2008) and a set of CWR *in situ* conservation quality standards has also been proposed by Iriondo et al. (2012). However, although considerable attention has been devoted in recent years to the theory of design, establishment, management and

BOX 2. THE MAIN STEPS IN PLANNING A PROGRAMME TO CONSERVE THE GENETIC RESOURCES OF A PARTICULAR TREE SPECIES

1. Set overall priorities, i.e. identification of genetic resources at the species level based on their present or potential socioeconomic value and their conservation status.
2. Determine or infer the genetic structure of the priority species at the landscape level.
3. Assess the conservation status of the target species and their populations.
4. Identify specific conservation requirements or priorities, typically at the population level for single species and at the ecosystem level for groups of species, i.e. identify geographical distribution and number of populations to be conserved.
5. Identify the specific populations to be included in the network of *in situ* conservation stands.
6. Choose conservation strategies or identify conservation measures.
7. Organize and plan specific conservation activities.
8. Provide management guidelines.

(from: Thomson et al., 2001)

Discussing the implications of wild yam conservation for local communities bordering Ankarafantsika National Park, Madagascar © SJ. Ramelison

monitoring of CWR diversity in reserves or protected areas, practical implementation on the ground has remained limited (Maxted et al., 2010b; Hunter & Heywood, 2011). Further, Meilleur and Hodgkin (2004) drew attention to the weak links existing between site selection and/or management recommendation processes and the official protected site and/or management designation processes, along with lack of clarity as to whom recommendations are made to or who is ultimately expected to act on them.

Examples of the kinds of active management that may be needed to conserve CWR populations are actions to counter or contain threats to the survival of the population such as:

- Weeding to remove competitors
- Removal of invasive species
- Control of unregulated cattle grazing
- Restrictions or promotion of burning
- Effective control of illegal seed or fruit collection
- Halting the decline in population size
- Habitat restoration and population reinforcement
- Control of fungal disease
- Strengthening legal protection
- Nutrient and soil erosion control
- Restrictions or promotion of disturbance
- Human cultural education

The likely intervention will be CWR and location specific and may be opposite in two diverse locations, so in one grazing/fire may need to be decreased, while in the other levels of grazing/fire may need to be increased. See Maxted et al. (2008b) for a detailed discussion of the options for CWR population management intervention. Several reasons can be suggested for these shortfalls. For example, it has too often been assumed that affording CWR conservation in protected areas is a relatively easy task that can be achieved with minimal effort. Also, where intervention in the area might be required to achieve conservation of the target species, the CWR community has generally left the task up to the protected area manager, assuming that modifying the management plan and the corresponding management actions are sufficient for effective CWR conservation. This reasoning

is partly a result of the failure to distinguish between the management needs of an area and that of a target species; the latter in many cases requiring a dedicated management plan. With rare exceptions, the management of protected areas does not address the conservation of genetic variation in individual species, but is usually concerned with maintaining overall biodiversity and ecosystem function and interactions between species within the area. However, it is possible to conserve the ecosystem properties of a protected area but still lose individual species (Maxted et al., 1997; Kjaer et al., 2004). The effective conservation of target species/ populations of CWR, especially if they are threatened, usually requires specific interventions. The preparation of a species/population management plan requires a large amount of information about the distribution and ecology of the populations that comprise the target species and the nature and distribution of the genetic variation within it (Thomson et al., 2001; Iriondo et al., 2008; Hunter & Heywood, 2011). This is not a task that a protected area manager would be expected to undertake. Also, one has to take into account the many other duties and responsibilities of a protected area manager (in terms of time and resources) and the fact that management plans do not exist for most protected areas. Moreover, limited technical and financial resources are available to protected area authorities in developing countries. Another reason is the fact that most practical experience of *in situ* conservation of target species has been obtained from the design and implementation of recovery plans for endangered species, mainly in Australia, the United States and several European countries (Heywood & Dulloo., 2005; Hunter & Heywood, 2011) and to a lesser extent in the forestry sector (see above). There is a general lack of awareness by these different sectors of each other's work.

It should not be assumed that persuading the protected area manager to amend the area's management plan to meet the management needs of a target species will be a simple matter. This is by no means certain and often protected area managers are resistant to such proposed changes for a variety of reasons. Managers tend to be generalists and are interested in matters that relate to the current concerns and issues in their park. The distribution of genetic variation amongst the populations of a target species is unlikely to have much management relevance unless the area was set up with the needs of the target species specifically in mind. Of course, many CWR are exploited by local communities (e.g., for timber, fuel wood, food and medicine) and in preparing a management plan, delicate and difficult negotiations between the various stakeholders may be needed if restrictions or even prohibition of access for such purposes are to be included. Likewise, agreement will have to be reached on permitting controlled access to the genetic resource in the form of seed or vegetative propagules so that it can be exploited for breeding purposes or other scientific use. However, in many countries, the need for protected area managers to demonstrate the 'value' of their reserve and, perhaps as a result of this pressure, the recent recognition of the importance of maintaining ecosystem services means that the conservation of CWR diversity in existing protected areas should now be viewed as a priority for both individual protected area managers and national protected area networks. This has been demonstrated by the scoping exercise for the establishment of the first genetic reserve for CWR conservation in the UK by Natural England (Hopkins & Maxted, 2010).

Generally, there still remains a disconnection between the CWR conservation community (i.e., researchers, project managers and others interested in CWR conservation) and protected area managers. For example, the International Union for Conservation of Nature and Natural Resources (IUCN) has a World Commission on Protected Areas and has established the CWR Specialist Group of the Species Survival Commission. However, limited communication occurs between the two groups, which could collaborate more to bridge such 'weak links' and thus safeguard this vital resource. The establishment of actively managed genetic reserves for the *in situ* conservation of CWR diversity will require collaboration between the CWR and protected area communities as well as greater appreciation of the effort, time and resources required to facilitate the integration of CWR conservation into protected area management. We now have a useful body of knowledge, including recommendations, lessons learned and good practice on how to achieve the effective conservation of CWR based on experience from the five countries involved in the recent UNEP/GEF CWR Project (Hunter & Heywood, 2011). For the first time, comprehensive CWR species management plans were prepared for wild yams (*Dioscorea maciba, D. bemandry, D. antaly, D. ovinala* and *D. bemarivensis*) in Ankarafantsika National Park, Madagascar; wild cinnamon (*Cinnamomum capparu-coronde*) in Kanneliya Forest Reserve, Sri Lanka (see box 1); wild almond (*Amygdalus bucharica*) in the Chatkal Biosphere Reserve, Uzbekistan; wild wheat (*Triticum araraticum*, *T. boeoticum*, *T. urartu* and *Aegilops tauschii*) in Erebuni State Reserve, Armenia; and wild cacao (*Theobroma* spp.) in the Parque Nacional y Territorio Indígena Isiboro-Secure, Bolivia. More importantly, the project

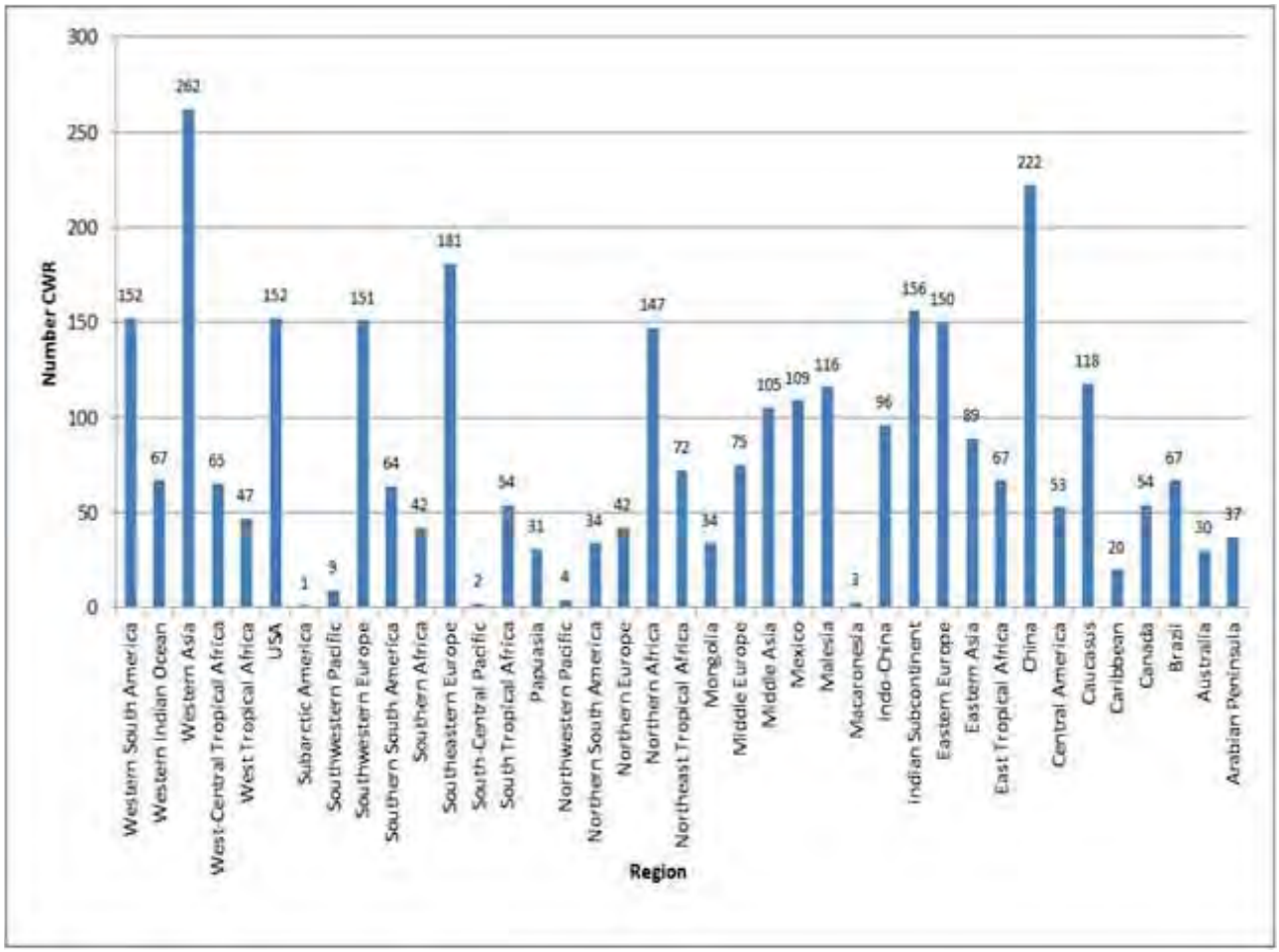

Figure 2. Number of priority CWR per world region (Source: Vincent et al., In Press)

generated tried and tested methods for establishing effective working partnerships among the agriculture sector, protected area staff and local and indigenous communities that can be used by other countries to guide future work in this area[4].

FUTURE PROTECTION: A CALL FOR ACTION

Despite some good examples, there is a serious lack of *in situ* conservation of CWR in protected areas on a global scale — a situation of great concern and requiring urgent action. It has been known for some time that CWR are not spread evenly across the world, but are concentrated in relatively small regions often referred to as 'centres of crop diversity' and subsequently known as 'Vavilov centres' (Vavilov, 1926). As a proxy for the assessment of their global conservation status, the World Wide Fund for Nature and the Nature Conservancy compared levels of habitat protection and habitat loss in centres of crop diversity against global averages for terrestrial ecoregions (Stolton et al., 2008). Based on ecoregion descriptions and related literature, the research identified 34 ecoregions that overlap with these centres of crop diversity and that contain habitats particularly important for CWR. The extent of habitat protection was calculated as the per cent area of each ecoregion covered by a designated protected area according to the 2004 version of the World Database on Protected Areas. In total, 29 (82 per cent) of the 34 ecoregions that include major centres of crop diversity have protection levels of under 10 per cent, and six areas (18 per cent) have protection levels of one per cent or less. Furthermore, a recent study by Vincent et al. (in press) established a global CWR list, prioritized on the basis of their degree of relationship to the associated crop and/or published evidence of their use or potential use as trait donors to crops. The list includes 1,392 species for 183 temperate and tropical crops, with the highest diversity found in Western Asia and China (see Figure 2)[5]. Yet, these centres of crop diversity have experienced proportionately greater habitat loss. Globally, 21.8 per cent of land area has been converted to human dominated uses, whereas average habitat loss in centres of crop diversity is 35.9 per cent with a maximum of 76.6 per cent. That the world's centres of crop diversity have relatively little habitat protection and considerable habitat loss should be a clarion call for protected area strategies to maximize *in situ* conservation of priority and threatened CWR.

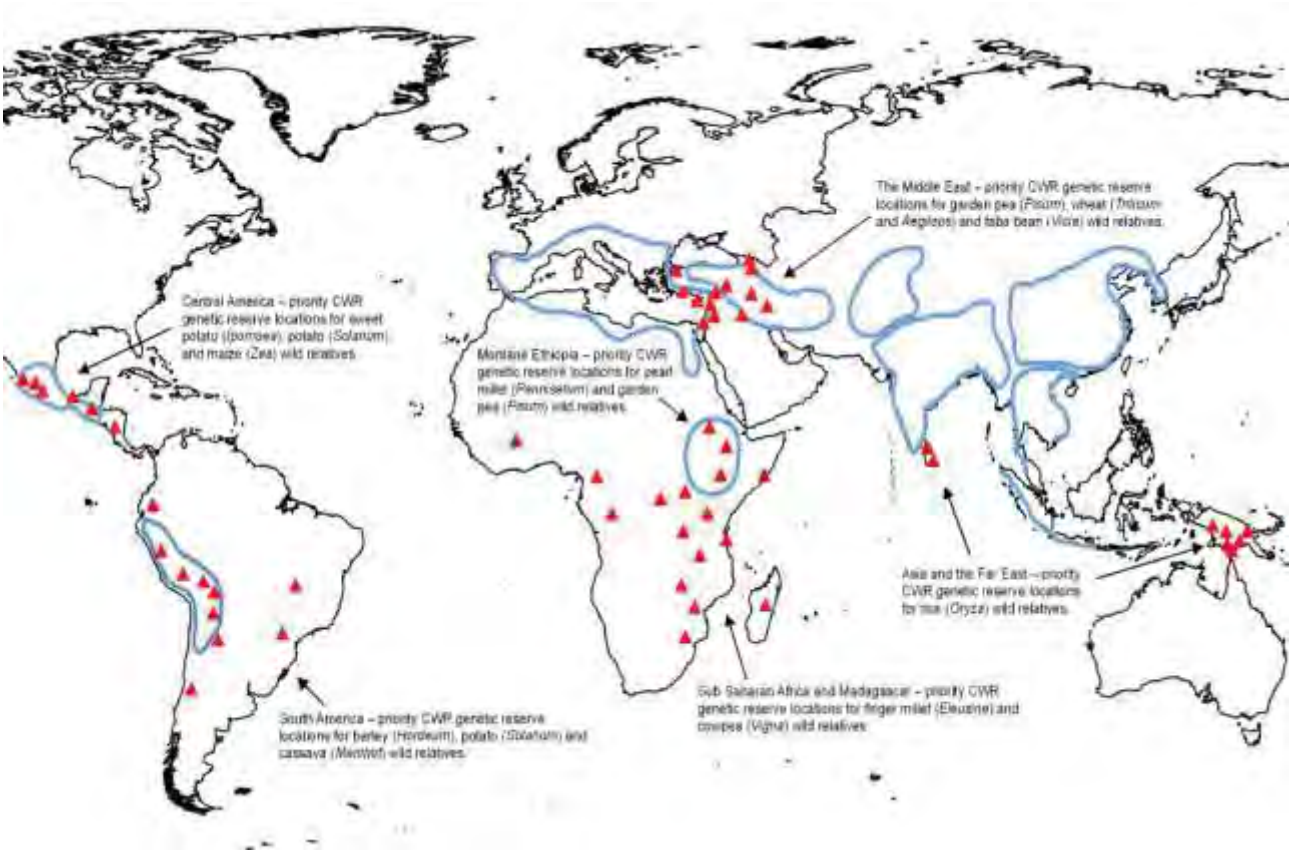

Figure 3. Global priority genetic reserve locations for wild relatives of 12 food crops. The 'centres of crop diversity' (indicated by the enclosed lines) are likely to contain further priority sites for other crop gene pools. (Source: Maxted & Kell, 2009)

In response to the growing concern over the lack of conservation of CWR diversity, the Commission on Genetic Resources for Food and Agriculture of the United Nations Food and Agriculture Organization (FAO) has called for the development of a global network of *in situ* conservation areas for CWR. In a background study to support the *Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 2010) and as a basis for updating the Global Plan of Action, Maxted and Kell (2009) identified priority locations for CWR genetic reserve establishment in Africa, the Americas, the Middle East and Asia, and the Far East (Figure 3). The authors found that a high proportion of priority CWR (i.e., the closest wild relatives and those under greatest level of threat) are not currently found within existing protected areas and that there is therefore an urgent need to instigate the establishment of further protected areas as well as to investigate the conservation management status of the CWR populations recorded within existing designated sites.

These priority sites can and should be used to begin recommendations and the search for sustainable long-term funding for the establishment of the global network of *in situ* conservation areas for CWR. To complement the long term need for secure *in situ* CWR conservation, a global project to sample and *ex situ* conserve CWR has already begun (see endnote 5) and this conservation is explicitly linked to CWR utilisation by breeders. However, conservation of CWR diversity in protected areas offers an almost unique opportunity for the biodiversity and agrobiodiversity sectors to work together to maintain evolving populations that can respond naturally to environmental and agro-environmental changes - a challenge that requires international attention.

RECOMMENDATIONS FOR ACTION

In conclusion, we recommend that protected area managers should consider taking steps to enhance the role of protected areas for CWR conservation, through:

- Taking into account the presence of CWR when planning new protected areas;
- Taking steps to enhance the protection of CWR in existing protected areas;
- Furthering the active management of CWR within protected areas by cooperating in the preparation and implementation of species/population management plans;
- Undertaking active monitoring and detailed surveys of CWR in protected areas;
- Improving linkages and coordination between the various agencies involved in CWR conservation,

forest genetic resources and those involved in protected area establishment and management;

- Involving all relevant stakeholders in the preparation of management plans for target species;
- Ensuring individual CWR genetic reserves or protected areas are linked with other national, regional or global genetic reserves or protected areas in networks to maximise conservation efficiency;
- Ensuring active *ex situ* complementary conservation that will facilitate exploitation by plant breeders and other stakeholders;
- Promoting greater awareness, education and understanding the importance of CWR in protected areas and promoting collaboration between the protected area and genetic resource communities.

ENDNOTES

[1] EURISCO is a web-based catalogue that provides information on *ex situ* collections maintained in Europe, eurisco.ecpgr.org/

[2] See: www.thegef.org/gef/node/3285 for an overview of the CWR project. In addition, the CWR Project has developed the Crop Wild Relatives Global Portal (www.cropwildrelatives.org) that links to national information systems in participating countries as well as other relevant information and resources.

[3] See: www.iucn.org/about/union/commissions/wcpa/?5664/Crop-Wild-Relatives for further details regarding the CWR species and protected areas targeted by the UNEP/GEF CWR Project in Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan.

[4] See: www.iucn.org/about/work/programmes/pa/pa_what/?5664/Crop-Wild-Relatives

[5] See www.cwrdiversity.org/home/checklist/

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RESUMEN

Los parientes silvestres de cultivos (CWR, por sus siglas en inglés) son un recurso crítico para el futuro de la seguridad alimentaria. Es ampliamente reconocido que, si bien muchas de las áreas protegidas del mundo contienen diversidad de CWR, aún no ha sido posible materializar acciones importantes para conservar las CWR que contienen. Son muchos los retos y obstáculos que deben abordarse para mejorar esta situación. Algunas iniciativas recientes han comenzado a abordar estos desafíos y han puesto de manifiesto algunas lecciones importantes. Sin embargo, es preciso adoptar medidas urgentes, y el artículo concluye destacando la necesidad de un enfoque global para la conservación de CWR prioritarias y amenazadas en la naturaleza.

RÉSUMÉ

Les espèces sauvages apparentées aux espèces cultivées sont des ressources essentielles pour le futur de la sécurité alimentaire. Tout le monde s'accorde pour reconnaître que les aires protégées du monde entier abritent souvent une grande diversité d'espèces sauvages apparentées aux espèces cultivées,

mais malgré tout, il n'a pas été encore possible de mener des actions significatives pour les conserver. De nombreux obstacles et défis doivent être relevés pour améliorer cette situation. À cet égard, des initiatives ont récemment été mises en œuvre et les principaux enseignements tirés. Cependant, il est urgent d'agir et l'article conclut en attirant l'attention sur le besoin d'une approche mondiale pour conserver les espèces sauvages apparentées aux espèces cultivées prioritaires et menacées à l'état sauvage.

APPLYING A CULTURAL LANDSCAPE APPROACH IN PARK MANAGEMENT: AN AUSTRALIAN SCHEME

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ABSTRACT

The cultural landscape concept has considerable currency in global heritage management practice. The cultural landscape idea challenges enduring distinctions in heritage management, largely Western in origin, between nature and culture as well as between tangible (material) and intangible (immaterial) forms of heritage. It offers a conceptual bridge that can link very different western, eastern and Indigenous world views. Nevertheless there remain genuine challenges in applying cultural landscape approaches in the real world of day-to-day park management. This paper focuses on work undertaken in New South Wales, Australia, to construct an operational guide to applying a cultural landscape approach. A step-by-step method is outlined and three case study examples, related to landscapes where pastoralism, forestry and holidaying are dominant historical themes, are presented to illustrate the development of the approach.

INTRODUCTION

Cultural landscape as a heritage management concept has flourished since the adoption of the World Heritage categories of cultural landscape by UNESCO in 1992, a landmark event in heritage practice. In the language of World Heritage, three categories of cultural landscape are recognised: 'designed landscapes' (landscapes that are designed and intentionally created such as gardens and parklands), 'organically evolved landscapes' (large areas resulting from social, economic, administrative and/or religious activities over time including agricultural landscapes) and 'associative landscapes' (locations with powerful religious, artistic or cultural associations) (UNESCO, 2011: Annex 3).

The World Heritage process, however, largely provides a framework for identifying, assessing and inscribing outstanding cultural landscapes (as well as 'mixed cultural and natural heritage' properties; UNESCO, 2011) and does not stipulate on-ground management practice in any great detail. Indeed, there is a divide in this system between the cultural landscape concept and operational management. This situation stands in contrast to the IUCN protected area system approach that links each of six protected area categories with management objectives (Dudley, 2008). Within the IUCN categories, category V protected areas (i.e., protected areas where the interaction of people and nature over time have produced an area of distinctive character; Phillips, 2002) overlap in many ways with the World Heritage notion of cultural landscape (sites that are the combined work of nature and humanity; UNESCO, 2011).

A key issue in the management of cultural landscapes concerns governance. Since cultural landscapes recognise the mutually constituted relationships between humans, ecosystems and landscape, there are a diversity of ways in which communities can be included in management regimes (cf. Mitchell & Buggey, 2001). Approaches can include the transfer of ownership of protected area landscapes and Community Conserved Areas (Brown & Kothari, 2011) to, and/or joint management with, Indigenous people (e.g., Uluru-Kata Tjuta National Park, Australia, and Sacred Mijikenda Kaya Forests, Kenya) and the implementation of a variety of shared governance-stewardship models in the management of multi-tenured landscapes (e.g., National Heritage Areas, USA (cf. Mitchell & Melnick, 2012), and the Loire Valley Cultural Landscape, France). However, in this paper I am principally concerned with national parks reserved for the purpose of nature conservation and education/ recreation (IUCN category II) where governance is primarily a state responsibility.

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The paper describes a project undertaken in the state of New South Wales (NSW), Australia, to develop an on-ground approach to park management that draws on the cultural landscape concept. The paper outlines the reasons for adopting the approach, presents three case studies used to develop the approach and presents a step-by-step method. The project has resulted in the publication *Cultural landscapes: a practical guide for park management* (Brown, 2010).

TOWARD A CULTURAL LANDSCAPE APPROACH

A cultural landscape perspective, which recognises the entanglement of history and ecology with landscape, provides an opportunity to address a number of concerns common in park management, such as separate management regimes for natural and cultural heritage (Adams & English, 2005; Meskell, 2012; Taylor & Lennon, 2012) and management focused on material or tangible cultural heritage. The idea of cultural landscape offers a conceptual tool that can integrate separations between culture and nature, tangible and intangible, and biological and cultural diversity (Buggey, 1999; Pretty et al., 2009; Rössler, 2006) for the purpose of heritage management.

Within the NSW National Parks and Wildlife Service (NPWS), as in many protected area agencies across the world, heritage management is segregated such that natural (ecosystems and geodiversity) and cultural (Indigenous and non-Indigenous) heritage are managed separately (see Lockwood et al., 2006). This is evidenced for example in legislation, bureaucratic structures, budgets and park plans of management that separate natural, Aboriginal and 'historic' (in Australia meaning post-1788 non-indigenous) heritage. In addition, an Indigenous presence in Australia for more than 45,000 years, and Aboriginal world views that construct culture and landscape as inseparable, make problematic Western natural landscape concepts (Head, 2010).

A related and overlapping issue in park management is that cultural heritage management has, until recently, conceptualised heritage mainly as physical traces of the past (isolated sites or objects such as a hut, fence, bridge, Aboriginal rock art site, shipwreck, grave or piece of machinery). A 'site-based approach' is thus an 'easy' concept for land managers and heritage practitioners as it supports separating the natural and cultural for research and management purposes. It effects this separation by treating heritage as items contained within the natural environment rather than as traces of historical behaviour that have helped constitute the 'natural' environment. A cultural landscape perspective offers an opportunity to move away from a focus on objects and sites as ends in themselves, toward managing the material record in its historical and broader landscape, including ecosystem, context. A socio-nature approach also offers opportunities to better integrate natural and cultural heritage conservation, particularly in an agency like the NPWS that traditionally has had an organisational culture that favours natural heritage conservation. Thus, a cultural landscape approach offers an opportunity to integrate natural and cultural heritage conservation by seeing culture and nature as interconnected dimensions of the same space. That is, the social and the natural are co-constituted rather than oppositional (Head, 2010). The implication for park management, particularly in an agency like the NPWS, is that natural and cultural heritage conservation requires holistic and integrated management approaches.

A CULTURAL LANDSCAPE APPROACH FOR NSW PARKS

Drawing from a review of global literature on cultural landscapes (Brown, 2007), two key ideas underpin the cultural landscape approach adopted in NSW. First, that history has taken place across all parts of the landscape and, second, that the form of the present landscape is the product of long-term and complex relationships between people and the environment. Evidence of human activity may be detectable in the vegetation or in landscape modifications (e.g., from sand mining) as well as in built structures, historic documents and archaeological evidence. Some pasts have 'touched the landscape only lightly' (Nugent, 2005: 5) while some places of historical activity are marked by imposing built structures or are commemorated for their association with important events or people.

Applying a cultural landscape approach to managing the NSW park system is underpinned by a number of general principles.

1. Landscape is a living entity, and is the product of change, dynamic patterns and evolving inter-relationships between past ecosystems, history and cultures.
2. The interactions between people and landscape are complex, multi-layered and are distinctive to each different space and time.
3. Community engagement and dialogue, where all people's values are noted and respected, are characteristic of a cultural landscape mentality.
4. All parts of Australia's landscape have community connection and associated values and meanings.
5. A key element of cultural landscapes is the continuity of past and present.

Camping Area, Yuraygir National Park © Andrew Lugg

In considering how these principles might be applied 'on the ground', field work was undertaken in three case study park landscapes to document the histories of past and present human-environmental interactions, as well as the surviving material traces of those histories (archaeology). The case study parks were selected to represent, very broadly, different environments across NSW (coast, mountain and semi-arid interior) and different historic themes (recreation, forestry and pastoralism). These historic themes are common to much of the NSW protected area system and therefore any approach to represent them in one landscape will have broader application. It is significant to note that the historic themes integrate Aboriginal historic experience (e.g., Aboriginal people worked in the forestry and pastoral industries) with non-Indigenous histories and that each case study landscape has deep time and ongoing Aboriginal presence. This point emphasises the many-layered and entangled histories of the park landscapes even though the focus of each case study was one particular historical activity.

A COASTAL HOLIDAY LANDSCAPE: YURAYGIR NATIONAL PARK

Yuraygir National Park (YNP) (declared in 1980) is located on the north coast of NSW near the regional centres of Grafton and Coffs Harbour and approximately 600 km north of Sydney. The park boasts over 65 km of coastline, encloses a number of small coastal villages and covers an area over 35,000 hectares. The Solitary Islands Marine Park, established in 1998, adjoins the southern coastline of YNP.

The park lies within an ecological transition zone between the temperate southern areas of eastern Australia and the tropical north. The zone of overlap has significance for the number and diversity of both plant and animal species (NPWS, 2003a). Nine major groupings of plant associations have been identified and mapped within the park. Fire regimes and sand-mining, as well as introduced plants and feral animals, have resulted in considerable ecological change and, for example, 14 of 30 mammal species recorded in YNP are considered threatened.

The landscape/seascape that is now YNP has been, and remains, the Country of Aboriginal people, a concept that does not refer to legal tenure in the Western sense but rather to deep-time Indigenous custodianship. Aboriginal stories from the area tell of the creation of this landscape (Heron, 1993), while regional archaeological evidence suggests usage for over 20,000 years. Aboriginal people maintained connections with the park landscape throughout the nineteenth and twentieth centuries and continue to do so (Kijas, 2009).

From the historical and archaeological narratives that have been constructed for YNP (Kijas, 2009; Tuck, 2007), ten overarching historical themes or layers have been developed (Brown, 2008). Historical themes are a tool that can be used to understand, interpret and map the history and storylines of a place or landscape (Australian Heritage Commission, 2001). In the case of YNP, they have proved a useful tool for organizing and ordering a large amount of heritage information, as well as for explaining the connectivity between history, people and landscape.

One of the overarching themes for YNP is 'enjoying the landscape', meaning the landscape associated with recreation and relaxation. For YNP the combination of coastal villages and the national park provides opportunities for boating, picnicking, camping, fishing, swimming, surfing and bush walking on some of the best beaches in Australia (NPWS, 2003a). The park landscape has always been a place of escape and relaxation for local and distant groups of people. Recreation has shaped the landscape through physical features such as villages, camping areas and access roads as well as via social meanings evident in local stories and holidaying practices (Brown, 2008).

Two features of recreational places within YNP, which are not discussed below, are worth noting. First, camping locations most frequented by Anglo-Australians, including the formalised camping areas of YNP, coincide with evidence of deep-time occupation by Aboriginal people. These locations require management for their multiple cultural values. Second, evidence of camping within YNP is ephemeral ('touched lightly') and few archaeological traces survive of previous access tracks, campsites or recreational activities such as fishing, surfing or boating. This means that most evidence of recreational use and activity is derived from historical records and from oral testimony. The historical and archaeological studies prepared concurrently for the park by historian Johanna Kijas (2009) and archaeologist Dan Tuck (2007), emphasise the landscape-scale of history (a 'physically located history-making' approach) as well as community connections and associations (social values) with landscape.

Holidaymaking is a land-use that links cultural values at two levels in Australia. On a national level White (2005) observes that by the beginning of the twentieth century an Australian holiday 'tradition' was discernable, with distinctive customs and practices. At local levels camping and associated activities such as swimming, fishing and walking are social practices that serve to reinforce identity and connection to place (Harrington, 2007). Along the Yuraygir coastline recreational camping has taken place since 1860, when the settlement of the first coastal villages began. Each village has a distinctive history of occupation by different communities and family groups from within the region (Kijas, 2009). Thus, the pattern of coastal recreation reinforced a sense of identity, difference, separation and community for many residents of the north coast region.

Within YNP there are seven designated camping and day-use areas and two areas that provide for day-use only. The management framework for these and other recreational facilities such as walking tracks is set out in the plan of management for the park (NPWS, 2003a) and, more broadly, outlines policy with regard to visitor management, services and infrastructure. However, strategies for understanding the cultural values of recreation visitors have not been developed.

The landscape of Pebbly Beach Camping Area in the south of YNP is a good example of management practice recognising and supporting historical and social values (Kijas, 2009). Pebbly Beach is an isolated camping location. It has been regularly used over a long period by large parties of families and friends who live in the immediate local area, but also by campers from south-eastern Queensland. The camping area has always been accessed using four-wheel-drive (4WD) vehicles and is characterised as a low-key camping experience.

By respecting the history and character of recreational camping, the local park management regime has sought a balance between continuity and change at Pebbly Beach. Continuity has meant allowing access to the area for those people with long-term connections, retaining the isolated campsite setting, maintaining 4WD access and facilitating the low-key camping experience. On the other hand, changes have included formalising the camping area (installing toilets, defining campsites and protecting Aboriginal shell middens and vegetation), formalising the access route, employing a care-taker, charging fees and closing parts of the beach to vehicles. Collaborative clean-ups of the camping area surrounds are undertaken by NPWS staff and regular camp-users.

The management of intangible cultural heritage values and landscape change at Pebbly Beach is successful because the history of holidaying and people's connection to place has been acknowledged and respected in a way that also integrates the conservation of ecosystem values.

Discussing grazing practices in former Curramore State Forest, Washpool National Park © Steve Brown

A MOUNTAIN FOREST LANDSCAPE: WASHPOOL NATIONAL PARK

Washpool National Park (WNP) comprises a landscape of diverse forest types that form a complex mosaic of vegetation assemblages on the Great Dividing Range (NPWS, 2005). Core areas of the park were gazetted in 1982 following one of the highly publicised 'battles' over rainforest protection that characterised Australian forestry and conservation policy debate in the late 1970s and early 1980s. In 1985 the bulk of the newly proclaimed WNP was declared a wilderness area and in 1987 was included as part of the World Heritage listing, based on natural criteria, for 'Gondwana Rainforests of Australia' (whc.unesco.org/en/list/368). The western parts of WNP, formerly parts of the Curramore and Spirabo State Forests, were added to the protected area in 1996.

As part of the cultural landscapes project, work was undertaken in WNP to investigate the extent to which the forests, constructed as natural for the purpose of wilderness declaration and World Heritage listing, are a product of cumulative transformation through seasonal grazing and forestry operations (Dean-Jones & Brown, in press). Did past cattle grazing and forestry shape the structure and character of the present forest? This question has broader implications for the management of humanly modified forests now within reserves managed for conservation.

The 'forest as historic artefact' study in WNP endeavoured to integrate information derived from both historical and ecological sources. The historical methods involved a literature review of the history of the landscape including existing written and oral histories. The field study involved field-based discussions with current and former land-users, which provided invaluable understandings of vegetation-based evidence of past and current land-use and land management practices. The ecological methods utilised for the study involved a literature review of the ecology of the landscape as well as a field recording programme.

Existing ecological/land-use studies in the Washpool region provided a basis for understanding present vegetation structure in eucalypt forests where there has

been a history of grazing and regular burning. For example, Henderson and Keith (2002) report a detailed ecological study of the impacts of fire and grazing in the temperate forests in a nearby national park, focusing particularly on changes to the shrub layer in the understorey. The study results support the hypothesis that grazing and associated burning practices are associated with a simplified understorey. Tasker and Bradstock (2006) surveyed 58 eucalypt forest sites on the northern tablelands of NSW to test the significance of grazing practices on forest understory structure. Their results indicate that cattle grazing practices (i.e., grazing and the associated frequent fire regimes) can have major effects on forest structure and composition at a regional level.

The field study undertaken within WNP as part of the cultural landscape project examined 12 sample plots, each 100x100 metres (one hectare) in size. The plot size, required to document both vegetation indicators and land-use indicators, provided a sufficient area to gain an appreciation of large tree density, but also allowed observations to be made of the variability of understorey species. Two examples, simplified for the purpose of this paper, illustrate the field process and results.

A field sample plot was located in the former Curramore State Forest, an area that has never been logged and was leased for cattle grazing by the Sloman family from the early years of the twentieth century to the 1990s (see picture on previous page). Seasonal (winter) grazing in the local dry open forest involved regular (spring) low intensity burning to encourage understorey regrowth. Two features of the vegetation structure were recognized that result from high frequency fire regimes and grazing pressure on vegetation. First, the firing regime and seasonal grazing changed the species composition and structure of the forest understorey and increased the density of naturally occurring grass species. Second, there has been a reduction in the regeneration capacity of canopy trees leading to a longer term change in vegetation structure attributable to cultural factors.

A second field sample plot (Coombadja Creek) was located in an area of dry sclerophyll forest that was selectively logged in the late 1960s. Material evidence of logging includes multiple cut tree stumps (over 20 within the sample plot), reject saw logs on the ground (5-10 trunks unsuitable for milling because either the central pipe is rotten or there is extensive branching and/or burls on the trunk), a heavily overgrown track, a log loading ramp, log loading area and evidence of tree damage caused by forestry machinery. A key feature of the local vegetation subject to logging is, not surprisingly, reduced density of old-growth trees (less than 10 per hectare based on the sample plot), significantly less than in local unlogged forests (30-40 per hectare), reflecting the resource focus of foresters on trees for saw log timber production.

Disentangling disturbance evidencing past and present historical activity from ecosystem processes within a forested landscape is a complex task. Nevertheless, a cultural landscape approach is useful in conceptualising forested landscapes as continually transforming as a result of complex interactions between ecological processes and human values/activities. It follows that forested areas, such as those of WNP, that have been modified by historical activity do not 'revert' to 'natural' landscapes. The effect on vegetation from cattle grazing and selective logging activity, which in Washpool followed from past Aboriginal use (plant gathering, burning practices) and precedes conservation practice (burning regimes, invasive species control), was not simply additive or consecutive but *cumulative*. That is, each historical activity not only adds a new and distinct layer, but also influences the trajectory of later forest regeneration and transformation processes.

The implication for forest management is not that forested landscapes should or can be 'frozen' in time such that markers of historical activity are conserved, but rather that documenting and understanding ecosystems and past/present human land-use is an essential part of conservation. Documenting and integrating ecological and human histories of vegetation is necessary for evidence-based adaptive management and essential for the public interpretation of forests. Such an approach does not undermine an aim of optimum biodiversity and ecosystem health and resilience, but does challenge park management to be clear concerning what it is that is being conserved.

AN INLAND PASTORAL LANDSCAPE: CULGOA NATIONAL PARK

Culgoa National Park (CNP) is located north of Bourke in north-western NSW and adjoins the NSW-Queensland border. CNP is situated in a semi-arid environment and is a landscape that has deep time Aboriginal connection (at least 30,000 years) and a continuous pastoral history from the 1840s to 1996 (Veale, 1997). The protected area was reserved in 1996, primarily to protect a section of the Culgoa River and associated extensive floodplain with riverine woodland and open grassland vegetation (NPWS, 2003b), vegetation communities that are rare,

Documenting stories with former property owners, Culgoa National Park © Allan McLean

and poorly represented in NSW reserves. The protected area initially covered 22,430 hectares and comprised three former pastoral properties; Byerawaring, Cawwell and Burban Grange. It was extended in 2006 to cover over 36,000 hectares with the acquisition of the pastoral leases of Old Toulby, Diemunga and Pine Grove.

A considerable amount of cultural heritage documentation and research has been undertaken within CNP, including an Aboriginal archaeological field survey (English, 1997), a land-use history (Veale, 1997), buildings conservation assessment (Stacy, 1997), research on the pastoral labour camp of Dennawan (Harrison, 2004), and an inventory of historic items (Smith, 2006). Together, these studies document over 500 tangible heritage items which can be organized under five historic themes – Aboriginal cultures (Muruwari Country); marking the land (surveying); working the land (pastoralism); living on the land (homesteads and settlements); and conserving the landscape (Brown, 2011).

Despite the extent of cultural heritage research and documentation, it was not clear (in 2006) that the landscape-scale of the pastoral heritage of the park had been fully captured. What had been recorded was a series of heritage 'nodes', representing the material expressions of Culgoa's history. What seemed to be lacking was information on the way that these places were linked/connected to each other and also to the world outside the park. Mapping the recorded items on a corporate database as points also served to reinforce the impression that the pastoral heritage of CNP is extremely limited in a spatial sense (Moylan et al., 2009). To begin to address this issue, oral histories were undertaken at CNP with former property owners Bruce and Ian Ponder to illustrate the way in which the whole of the landscape was used in the practice of pastoralism and the ways in which the material nodes documented by English (1997), Stacy (1997), Harrison (2004) and Smith (2006) were each part of a larger interconnected system. Essentially then, this was about using people's lived experiences (intangible heritage) to enrich the meaning of the material traces of the protected area's history.

The information provided by the Ponders served to outline the late twentieth century pastoral system applied to properties within CNP. Water, either too little or to much, was a major theme, and was connected to the abundance and species composition of vegetation for stock feed. Into this management regime sat the watering points (bores, ground tanks and waterholes), the fences, tracks, mustering routes, stockyards, woolsheds, shearers' quarters and homestead complexes. The Ponders' stories also told of some of the connections between the properties and the outside world – for example, the places that sheep were purchased from and sold to, the transport of wool, the long road trips with stock to find feed, the origin of new fence posts from nearby Byra Station, Cawwell homestead's entrance gate from a house in Roseville (Sydney) and the origin of rocks in the Byerawering garden collected during a holiday in Tasmania. In World Heritage terminology, the organically evolved cultural landscape of pastoralism is made coherent through associative values and family knowledge.

A final project undertaken at Culgoa has been an attempt to represent all of the landscape as cultural (Moylan et al., 2009). Most government and non-statutory registers utilise point datasets (the heritage nodes discussed above) to represent cultural heritage items. An effect of this approach is to emphasise that cultural heritage comprises a series of spatially discrete material remains or heritage 'sites', suggesting separate locations which are somehow disconnected from their broader historical, ecological and landscape contexts.

Alternatively, spatial representation of heritage can be set within a cultural landscape framework, acknowledging that all parts of the landscape have cultural histories, associations and meanings resulting from long-term and ongoing human-environmental interactions (Moylan et al., 2009: Figure 1). The output of this project is the creation of a '*Cultural Landscape Atlas*' for CNP, a mapping product illustrating how all parts of the landscape have cultural meaning. For the purpose of the Atlas, cultural heritage information was entered as point, line and polygon data. In addition, selected historic aerial imagery and parish maps were georeferenced, with site plans and photographs incorporated into the Atlas as hyperlinks.

The mapping products produced by the project comprise an interactive electronic DVD-Atlas and hard copy maps. Both focus on meeting the management needs of field-based park-staff. The development of the *Cultural Landscape Atlas* has been undertaken to map heritage items as part of park management planning as well as to provide a centralised repository for relevant heritage information. The Atlas concept was devised in order to address a number of agency-specific needs. These include:

- To illustrate through spatial representation that all of the landscape (not just 'sites') has cultural values.
- To visually illustrate the complexity and extent of cultural heritage values in a way that is compelling to staff (who are unlikely to be easily engaged through a lengthy text-based planning document).
- The need to have an operational focus: this should be easily utilised for park planning purposes and for field-based management activities. That is, the Atlas should be a practical management tool that facilitates and invites staff participation.

Together, the physically located history-making approach that draws heavily on oral testimony (Brown, 2011; Veale, 1997) as well as the landscape scale cultural mapping project (Moylan et al., 2009), illustrate the complex socio-natural landscape of CNP.

TOWARD A PRACTICAL APPROACH TO MANAGING PARK LANDSCAPES

The field studies undertaken in Yuraygir, Washpool and Culgoa national parks provide case studies which were used simultaneously to develop and test a practical approach to park management in NSW. An important part of the case study work was the collaborative working process between researchers and local NPWS staff. This process was underpinned by a participation action research model whereby action (change, improvement) and research (knowledge, understanding) are achieved at the same time because people affected by the research were participants. Thus local park staff (field officers, rangers and managers) participated in fieldwork, discussions and workshops over the period of the project (2006-2008), conducted as an equal partnership between traditionally trained 'experts' (archaeologists, historians, spatial scientist) and local 'expert' staff. Active participation of the 'end-users' of the cultural landscape management approach was essential for a number of reasons. First, to obtain practical feedback on issues related to the idea and application of a cultural landscape approach to park management. Second, the work raised awareness of staff to the depth of information on cultural heritage available from existing data sources, but also served to highlight the continuing need to document living people's connections, associations and attachments to the park landscapes and to support the continuation of these linkages. Finally, the involvement of local park staff

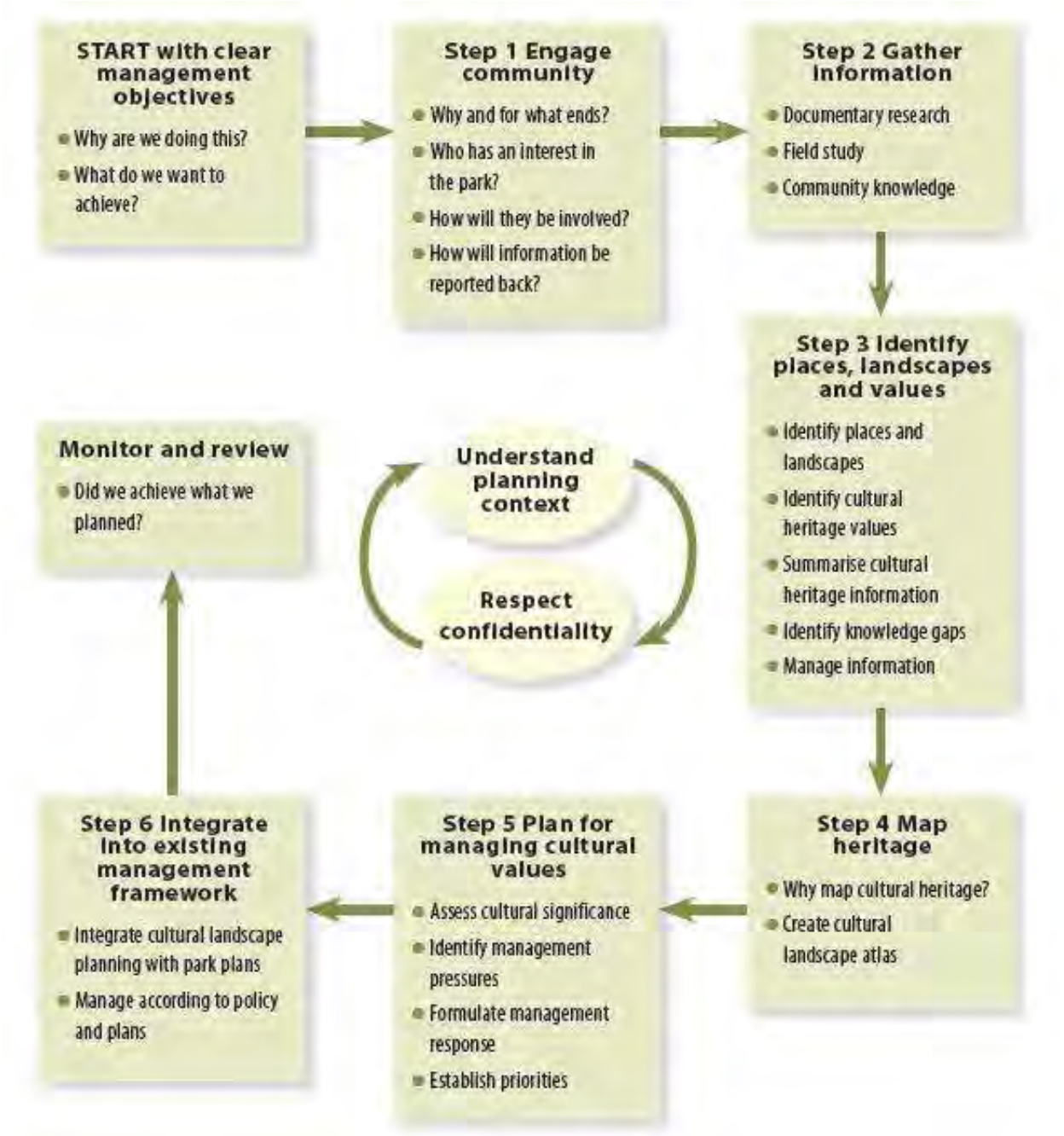

Figure 1: Steps in applying a cultural landscape approach. Source: Brown 2010.

served to ensure 'buy-in' for the cultural landscape concept. An expectation of this aspect was that local staff would then act as advocates for the approach across the wider organisation.

Based on the collaborative working process and field studies undertaken in the three case-study park landscapes, a six-step cultural landscape approach applicable to park management in NSW was developed (Figure 1). The approach draws on two main methodologies. First, the steps parallel an adaptive planning process, which treats management as an iterative process of review and revision (Lockwood, 2006). Second, the approach mirrors heritage management processes, such as those articulated in the Australia ICOMOS (1999) Burra Charter and Australian Natural Heritage Charter (Commonwealth of Australia, 2003), which emphasise significance as a basis for making management decisions. The Australian heritage system adopts a *thresholds-based values approach*, where the values attributed to heritage landscapes are assessed against a series of criteria to qualify for local, State, national or international heritage status. In general, for an item to meet the criteria it must either be an outstanding or rare example (e.g., most intact selectively logged dry sclerophyll forest) or representative (i.e., derives its values from the extent to which it can act as an exemplar of a class or type of

landscape: Harrison, 2010). The values approach is a method used to tease out the socio-natural values of each park landscape.

The cultural landscape approach advocated for NSW park management requires a clear statement of what park management is seeking to achieve before the six-step process is implemented. However, the steps are not always sequential. For example, both community engagement and information gathering are likely to be continuously ongoing activities; the completion of one step may lead to the re-examination or refinement of a previous step. Finally, these steps are a guide for park management – they are not a formula set in stone. Creativity, innovation and adapting to local circumstances will benefit applying the approach.

The application of the cultural landscape approach is presented in the publication *Cultural landscapes: a practical guide for park management* (Brown, 2010) and is available as a free internet download. Case studies are presented throughout the guide to ground it in the context of actual park management.

CONCLUSION

Landscapes, including protected area landscapes, are dynamic; co-produced by humans and non-humans. We need look no further than the multitude of books and television documentaries, such as *The Botany of Desire* (Pollan, 2001), *Catching Fire: How Cooking Made Us Human* (Wrangham, 2009) and even the BBC's *Time Team*, for evidence of the deep entanglement of human and planetary histories. Cultural landscape is a concept that recognises that the social and the natural are co-constituted and that nature is not external to humanity nor humanity to nature.

The idea of cultural landscape offers a conceptual tool that can be applied in protected area management to work toward the integration of natural and cultural, material and immaterial, and biological and cultural diversity. In order to achieve such integration, it is necessary for protected area staff trained in the Western traditions of environmental sciences, as well as those trained in the humanities/social sciences, to be able to break free of disciplinary boundaries in order to recognise the socio-natural construction of landscape. This can be a challenging task where traditional protected area structures conceptualise and manage nature and culture separately.

A key emphasis of the cultural landscape approach advocated in NSW is the need to integrate people's stories, memories and aspirations continually into management processes; that is, to recognize that the cultural values of landscapes are inextricably bound up with the lived experiences, identities and connections of past and present individuals and communities. If peoples' stories and attachments to protected area landscapes are not recorded, then an impression is created that the landscape is devoid of human history. Thus, active management programmes need to take into account the spiritual and symbolic meanings that people ascribe to protected area landscapes. Furthermore, protected area managers need to understand how these meanings support community identity, well-being and human rights. By respecting and acknowledging peoples' attachments to and feelings for landscapes, park managers can help ensure that there is long-term community support for protected areas. If the cultural landscape approach outlined here can go some way to achieving this goal, then it is a worthwhile project.

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RESUMEN

El concepto de paisaje cultural tiene gran prevalencia en la gestión del patrimonio mundial. La idea de paisaje cultural cuestiona diferencias pertinaces en la gestión del patrimonio, en gran parte de origen occidental, entre la naturaleza y la cultura, así como entre los aspectos tangibles (materiales) e intangibles (inmateriales) del patrimonio. Ofrece una conexión conceptual que puede entrelazar cosmovisiones occidentales, orientales e indígenas muy diferentes. Sin embargo, la gestión cotidiana de parques entraña retos reales en la aplicación de los enfoques basados en el paisaje cultural. Este documento se centra en los esfuerzos realizados en Nueva Gales del Sur, Australia, para el desarrollo de una guía operativa para la aplicación de un enfoque basado en el paisaje cultural. Se detalla un método paso a paso, y para ilustrar el desarrollo de este enfoque se presentan tres ejemplos de estudios de caso relacionados con el paisaje, en donde el pastoralismo, la silvicultura y el turismo son temas históricos dominantes.

RÉSUMÉ

Le concept de paysage culturel se développe considérablement dans les pratiques de gestion du patrimoine mondial. L'idée de paysage culturel remet en effet en cause les distinctions persistantes, essentiellement d'origine occidentale, entre la nature et la culture dans la gestion du patrimoine, ainsi qu'entre les formes de patrimoine tangible (matériel) et intangible (immatériel). Ce pont conceptuel peut ainsi relier des vues très différentes sur le monde occidental, oriental et autochtone. Cependant, de vrais défis restent encore à relever pour appliquer les approches de paysage culturel dans la gestion réelle et quotidienne des parcs. Ce document se concentre sur le travail réalisé en Nouvelle Galles du Sud, en Australie, pour rédiger un guide opérationnel permettant d'appliquer l'approche des paysages culturels. Une méthode pas à pas est exposée et trois études de cas liées aux paysages où le pastoralisme, la foresterie et le tourisme vacancier sont des thèmes historiques dominants, sont présentées pour illustrer la mise en œuvre de l'approche.

CONSERVATION IN TROPICAL PACIFIC ISLAND COUNTRIES: CASE STUDIES OF SUCCESSFUL PROGRAMMES

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ABSTRACT

Biodiversity in the tropical Pacific is seriously threatened as a result of decades of habitat destruction and degradation. Intensive conservation efforts and considerable financial investment have failed to stem this crisis. To understand better how to achieve conservation success, this paper examines six case studies of conservation area programmes in five independent Pacific Island nations: Sovi Basin Conservation Area (Fiji), Tetepare Island and Bauro Highlands Conservation Area (both Solomon Islands), Takitumu Conservation Area (Cook Islands), Pohnpei Island (Federated States of Micronesia), and Adelbert Ranges (Papua New Guinea). Four common themes emerge from these case studies: active participation of landowning communities; involvement of all relevant stakeholders; the generation of tangible benefits for landowning communities, and external support for the project over long (five years or more years) time periods. Although the socio-cultural situation differs among locations, these themes should be considered when conservation projects in the Pacific are initiated.

INTRODUCTION

Oceania has high terrestrial diversity and endemism (Keast & Miller, 1996, Kier et al., 2009), including more than 30,000 plant and 3,000 vertebrate species (Legra et al., 2008, Mittermeier et al., 2004). More than half of this diversity is found in the 14 independent developing island nations of the tropical Pacific (Keppel et al., 2012, Mittermeier et al., 2004). However, much of this rich and unique biota is poorly known and afforded little protection (Wardell-Johnson et al., 2011). The government departments dealing with the environment and conservation in these countries are poorly funded (Axlford et al., 2008; Lees & Siwatibau, 2009) and protected area systems fail to protect major components of the biodiversity (Lees, 2007, Shearman & Bryan, 2011). As a result, habitat loss and degradation remains the biggest threat to biodiversity, and an increasing number of invasive species and anthropogenic climate change are likely to exacerbate the effect of these stressors (Wardell-Johnson et al., 2011).

To address this biodiversity crisis, developed nations have invested considerable funding into the conservation sector of these 14 countries over the last three decades, either through support for local and regional conservation organisations and projects or by an increasing presence of international non-government organisations. Despite these efforts biodiversity continues to decline and most conservation programmes have been considered unsuccessful (Hunnam, 2002; Lees & Siwatibau, 2009). In fact, environmental degradation has continued at similar rates or even accelerated in some Pacific Island countries (Lees & Siwatibau, 2009; Shearman & Bryan, 2011).

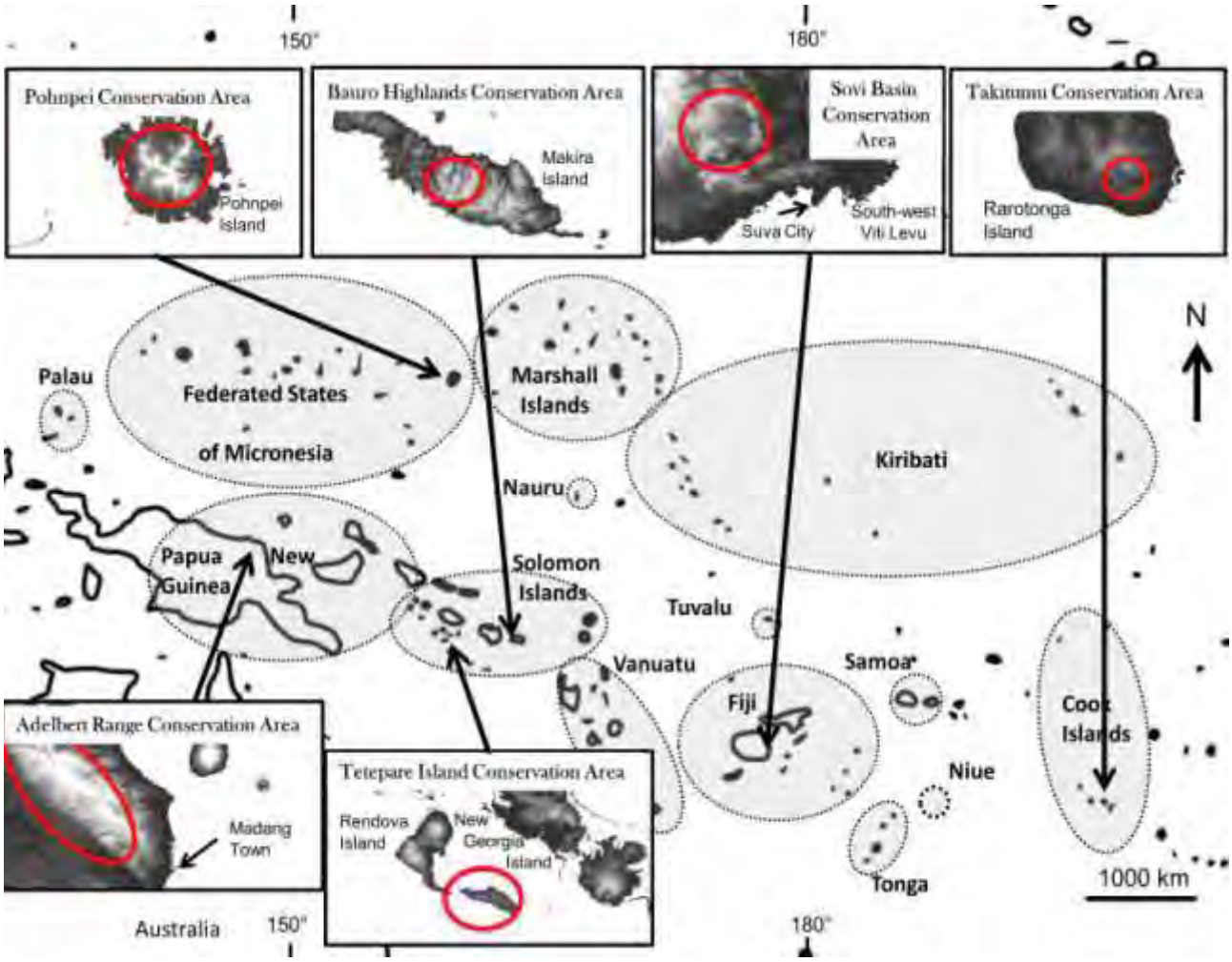

Figure 1. Location of the 14 independent Pacific Island nations and the six conservation areas (red circles in insets) used as case studies

Keppel et al. (2012) suggest that the lack of conservation success can also be attributed to the differences in cultural, economic, landownership and social situations in developing Pacific Island countries compared to developed nations that are often the source of conservation funding and programme planning. They argued that increased and improved landowner involvement and participation, creation of alternative (to resource exploitation) income generating strategies, better socio-cultural-political understanding of stakeholders, improved management of conservation funding, increased stakeholder collaboration, capacity building at all levels, and a commitment to longer project funding cycles would greatly improve conservation efforts in the region.

In this paper we present six conservation projects (see Figure 1 for locations) that have successfully implemented several of these strategies. A common theme for success is the active involvement of landowners and stakeholders at all stages of the conservation programme and the generation of tangible benefits for landowners from conservation, often using highly innovative approaches. However, these case studies not only illustrate the successful implementation of these strategies but also document that each conservation project is unique with regard to the challenges and stakeholders involved.

CASE STUDY 1: SOVI BASIN CONSERVATION AREA, VITI LEVU, FIJI

The Sovi Basin Conservation Area (SBCA) covers 20,421 mostly forested hectares and consists of the gently sloping Sovi Basin (100–600 m in altitude) surrounded by the Medrausucu, Korobasabasaga and the Nakeva-Naitaradamu ranges (the highest peaks rising to more than 1,100 m). The basin drains several rivers and streams and harbours the largest remaining lowland tropical rainforest in Fiji (Keppel et al., 2011). The streams, rivers and rugged landscape make the SBCA one of the most scenic places in Fiji.

Sovi Basin Conservation Area, Fiji © Gunnar Keppel

The SBCA contains several forest types, ranging from tropical lowland rainforest to tropical montane cloud forest, and high species diversity. More than 700 vascular plant species have been recorded from the conservation area (Keppel et al., 2011; Tuiwawa, 1999), comprising about half of the total native flora known from Fiji (Heads, 2006). More than 50 per cent of the SBCA flora is endemic to Fiji. Several IUCN red-listed species (IUCN, 2011) have also been reported, including the critically endangered long-legged warbler (*Trichocichla rufa, Sylviidae*) and *Acmopyle sahniana* (Podocarpaceae), a conifer.

While the basin is currently uninhabited, landowners are largely dependent on natural resources and utilise the basin for hunting. A total of 13 landowning family clans (mataqalis) located in six villages of two different provinces own land in the SBCA. As a result, the needs of mataqali members and two provincial governments must be considered in conservation planning. Furthermore, the involvement of several government departments, including the iTaukei Land Trust Board, Department of Forests, Department of Environment and the National Trust of Fiji, is critical for achieving protection of the Sovi Basin.

The importance of protecting the Sovi Basin has been highlighted several times, including a Maruia Society report (Lees, 1989), the National Environment Strategy (Watling & Chape, 1993), and the Fiji Biodiversity Strategy and Action Plan (Government of Fiji, 2007). After initial multi-organisational biodiversity surveys confirmed the environmental importance of the Sovi Basin, a steering committee and working group were formed in 2005. These represented all major stakeholders, including the Department of Forests, National Trust for Fiji, University of the South Pacific, iTaukei Land Trust Board, Conservation International and landowners.

The biodiversity surveys and formation of the steering committee resulted in a five-year short-term conservation lease over the Sovi Basin, after landowners and the iTaukei Land Trust Board decided to revoke a previously awarded logging concession. During this short -term lease, a management plan for the Sovi Basin was developed, the timber value of the forests determined, and the terms for a 99-year, long-term lease established. This process was facilitated by Conservation International in close collaboration with the Department of Forestry, University of the South Pacific, iTaukei Lands Trust Board and landowner representatives. Under the management plan, landowners may use the protected area for traditional harvesting and fishing purposes and will be involved with the implementation of the management plan at all levels.

To generate revenue for the landowners, a trust fund was created and endowed by the bottled water company Fiji Water. The interest accumulated by this trust fund facilitates the payment of lease premiums, compensates foregone timber royalties, provides community

Tetepare Island Conservation Area © TNC

development opportunities, and implements the management plan for the SBCA. In addition, a scholarship programme was created for landowning communities and has supported more than 150 students. Since the initiation of the scholarship programme in 2005, the number of students from the Sovi Basin in tertiary institutions has grown from two to over 20.

CASE STUDY 2: TETEPARE ISLAND COMMUNITY CONSERVATION AREA, WESTERN PROVINCE, SOLOMON ISLANDS

Tetepare is a 120 km^2 forested island in the New Georgia group in the Solomon Islands. It is a raised coral island with rich biodiversity and has received international recognition for its conservation and archaeological significance (Morrison & Buckley, 2010). A total of 73 bird, 24 reptile, 13 mammal and four frog species have been recorded on Tetepare, including several rare and endemic bird and bat species (Read & Moseby, 2006). In the marine reserve area, three species of marine turtles – the critically endangered leatherback and hawksbill turtles and the endangered green turtle – nest on the volcanic black sand beaches. Sharks, dolphins, crocodiles, dugongs and a high diversity of fish species are found on the reefs and in the seagrass lagoons (Farrington, 2009; Filardi & Pikacha, 2007). The coral reefs of the region are part of the Coral Triangle – the global centre of coral diversity, and support one of the highest diversities of fish and coral in the world, second only to Raja Ampat in Indonesia (Allen, 2008).

Although Tetepare has been largely uninhabited since the mid-1800s (Read & Moseby, 2006), the traditional landowners, now living across the entire Western Province, established the Tetepare Descendants Association (TDA) when the island was threatened by logging in 2001. They converted the entire island to a community conservation area, including marine as well as terrestrial ecosystems (Read et al., 2010). Their goal was to protect and conserve the island for the benefit of all descendants and future generations. Since its formation, the TDA has transformed from a local landowners organisation to a world-class community-based conservation organisation responsible for one of the largest integrated land and marine conservation initiatives in the South Pacific.

The Tetepare project, supported by the Sustainable Forestry Conservation Project of the European Union, WWF, Australian Volunteers International and others, is a leading example of how a conservation programme promoted by a dedicated local community can succeed in the Pacific region. The success of the Tetepare project primarily lies in its strong local leadership, the inclusion of local communities at all stages of development and implementation, and its ability to provide real economic benefits.

To support the conservation work on Tetepare, the TDA in collaboration with the European Union set up the Tetepare Island Ecolodge that attracts international visitors and provides employment for the local community. Profit from all revenue collected from visitors for accommodation, transport and activities is channelled directly to conservation efforts on the island and to support local communities. The lodge employs 30 casual staff and a further 12 rangers are employed to run the conservation programme resulting in increased local capacity in the conservation management and practice field. Many more local community members have benefited from the project through casual work in construction on the island, and through the sale of fruit, vegetables and fish to the Ecolodge. The TDA also runs a scholarship programme for school aged children and have ensured that women are actively involved at all levels of the project. The TDA is currently exploring sustainable finance mechanisms to capture current revenues for long-term conservation and development activities.

CASE STUDY 3: BAURO HIGHLANDS CONSERVATION AREA, MAKIRA, SOLOMON ISLANDS

The Bauro Highlands Conservation Area (BHCA) is a 630 km^2 forest reserve in the central highland forest region of Makira Island. It contains some of the Solomon Islands last extensive lowland forest tracts and reaches tropical montane cloud forest at the highest peaks of about 1200 m, encompassing the full elevation gradient of forest zones. The Raro and Warihito River catchments within the BHC are bounded by steep-sided wide valleys, with numerous streams and waterfalls and small perched floodplains as high as 400 m in elevation.

While this spectacular landscape provides some of the most dramatic rainforest vistas in the Solomon Islands, it is the BHCA's unusual ecology, influenced by its separation from the rest of the Solomons archipelago by deep water, which results in its international significance. The forests of Makira support the highest levels of vertebrate endemism in the Solomon Islands with the lowland and montane forest home to 12 locally endemic bird species (out of 70 recorded species), as well as two endemic fig species.

The BHCA was established in 1995 by the Conservation in Development (CID) consortium which included Conservation International, the Solomon Islands Development Trust (SIDT) and a small former New Zealand NGO, the Maruia Society, in conjunction with local landowners to resist the threats posed by logging on Makira Island. At the time, it represented the second largest protected area in the South Pacific.

The programme worked with the Bauro communities to define the conservation area and to identify enterprises whose viability was linked to the need to conserve the area's biodiversity (Russel & Stabile, 2003). Several upland villages were situated deep within the conservation area, which made it a true community-based conservation effort.

An ecotour trail was established to provide an income for local communities which received several international ecotourism awards. However, while local guides and communities were paid directly by visitors for tours, the BHC Programme itself was heavily subsidized by Conservation International. When Conservation International withdrew its financial support in late 2008, the BHC Programme itself dissolved, despite the success of the conservation area (Morrison & Buckley, 2010).

CASE STUDY 4: TAKITUMU CONSERVATION AREA, RAROTONGA, COOK ISLANDS

The Takitumu Conservation Area (TCA) is a private tropical forest reserve managed by three landowning clans – the Kainuku, Karika, and Manavaroa families. It lies approximately 800 m from the main coastal road on Rarotonga, extends over 155 hectares of forested ridges and valleys and contains 70 per cent of all Rarotonga's inland plants. It includes the headwaters of two major streams and basins of a third. Located on the wettest part of the island, the TCA catchment provides 30 per cent of Rarotonga's drinking water.

The TCA was established in 1996 by the landowners and the Cook Islands Government, assisted by South Pacific Biodiversity Conservation Programme (SPBCP) to preserve the endemic endangered Rarotonga flycatcher or Kakerori (*Pomarea dimidiata*, Monarchidae) and built on an existing government programme, the Kakerori Recovery Project, initiated in 1987 (Morrison &

Watershed Community Action Group delineating boundaries and zones within the forest, Pohnpei, Federated States of Micronesia © Patterson Shed / CSP

Buckley, 2010). Throughout 1995 the Cook Island Environment Service discussed the idea of creating a Conservation Area in the Kakerori's core breeding area with traditional landowners and community leaders. Initially the landowners were reluctant to designate their land as a conservation area as they believed this would change its legal status and threaten their continued ownership of the land. Consequently, it was agreed that the designation as a conservation area would not formally be made part of legislation or officially recorded (Tiraa & Wilmott, 2001).

The TCA was initially funded by the SPBCP with follow-up funding from the Cook Island Environmental Protection Fund and the New Zealand Overseas Development Agency (SPREP, 2003). TCA planning and management is carried out by a committee consisting of representatives from the landowning tribes, which discuss issues and make all major decisions relating to the TCA. Up to 2001 the TCA contained the only protected population of the endangered Kakerori and its conservation success since its establishment has been dramatic. In 1989 only 29 Kakerori individuals remained in the wild. Since the establishment of the TCA and subsequent conservation actions, the numbers had recovered to 370 in 2011 (TCA, 2011). From 2001 to 2003, 30 Kakerori were translocated by the TCA project to the island of Atiu, and in 2011 more than 100 birds were recorded there.

To help the TCA become financially self-reliant and to provide reliable income for the Kakerori Recovery Programme following the end of SPBCP funding in 2001, a nature walk/bird-watching venture and gift store run by local landowners were established (Tiraa & Wilmott, 2001). Guided nature walks were an obvious choice for alternative income generation as there was already a well established tourism industry in the Cook Islands with more than 100,000 annual visitors in 2009 (Morrison & Buckley, 2009). The TCA's conservation and economic success has prompted active interest from other places in the Cook Islands. Residents of both Mangaia and Mitiaro

Adelbert Range forest landscape, Papua New Guinea © Francis Hurahura / TNC

Islands have visited the TCA to get ideas for protecting their own endemic species, and the Cook Islands Tourism Department frequently uses the TCA nature walk and bird-watching business as a case study in its ecotourism workshops. Of the 17 Conservation Areas funded by the SPBCP, the TCA is one of only two projects that were considered a success based on conservation achievements and project sustainability, which were attributed to extensive landowner involvement and capacity building, the generation of real economic benefits, relatively long-term supportive funding, and the successful conservation of the Kakerori (~10 years) (Hunnam, 2002).

CASE STUDY 5: POHNPEI WATERSHED FOREST RESERVE, FEDERATED STATES OF MICRONESIA

Pohnpei is the highest (791 m) and second largest (334 km^2) island of the Caroline Islands and is part of the Federated States of Micronesia (Merlin & Raynor, 2005). It is home to some 35,000 people residing in 200 villages (kousapw) that are divided into five traditional kingdoms (wehi). A complex hierarchical organisation exists within these traditional entities, headed by paramount chiefs (nahmwarki) and traditional title holders. On top of these traditional administrative systems are various, more recent, government levels, including the federal, state and municipal governments (Raynor & Kostka, 2003).

Pohnpei is of global biodiversity interest, with 110 plant (41 per cent of the flora), eight bird (16 per cent of the avifauna), about 25 snail, three fish and one skink species being endemic to the island (Merlin & Raynor, 2005). Ninety per cent of these endemics are now restricted to montane rainforest, as rainforest at lower elevations has been replaced by secondary vegetation types (Mueller-Dombois & Fosberg, 1998). Although the remaining montane vegetation still constitutes the largest intact inland forest in Micronesia, it is under considerable threat from population growth and kava (*Piper methysticum*, sakau) cultivation and some 70 per cent of native forest is believed to have been lost since 1975 (Merlin & Raynor, 2005).

In an attempt to protect remaining forests, 5,100 hectares of montane rainforest were declared a protected area in 1987. However, this protected area could not be implemented, as it had been established with little community consultation and involvement. Since 1992, efforts to develop community-based management were initiated, resulting in the Pohnpei Watershed Management Strategy and the Pohnpei Community Conservation and Compatible Management Project (Rose, 2004). Landowning communities, the Pohnpei State government, the Conservation Society of Pohnpei, the Nature Conservancy, and the South Pacific Regional Environmental Programme were key players in the conception and implementation of the Strategy and Project, with landowner consultation and involvement a major component.

The Pohnpei Watershed Forest Reserve now protects biodiversity and important food and cultural resources. It also provides important secondary benefits such as reducing erosion, cleaner water, water for lower-lying habitats, and maintenance of microclimatic effects. Several ongoing programmes have been and are continuing to protect the reserve, including community education, media campaigning, employment of 20 local rangers and two police officers, promotion and support of lowland kava farming, and invasive species control.

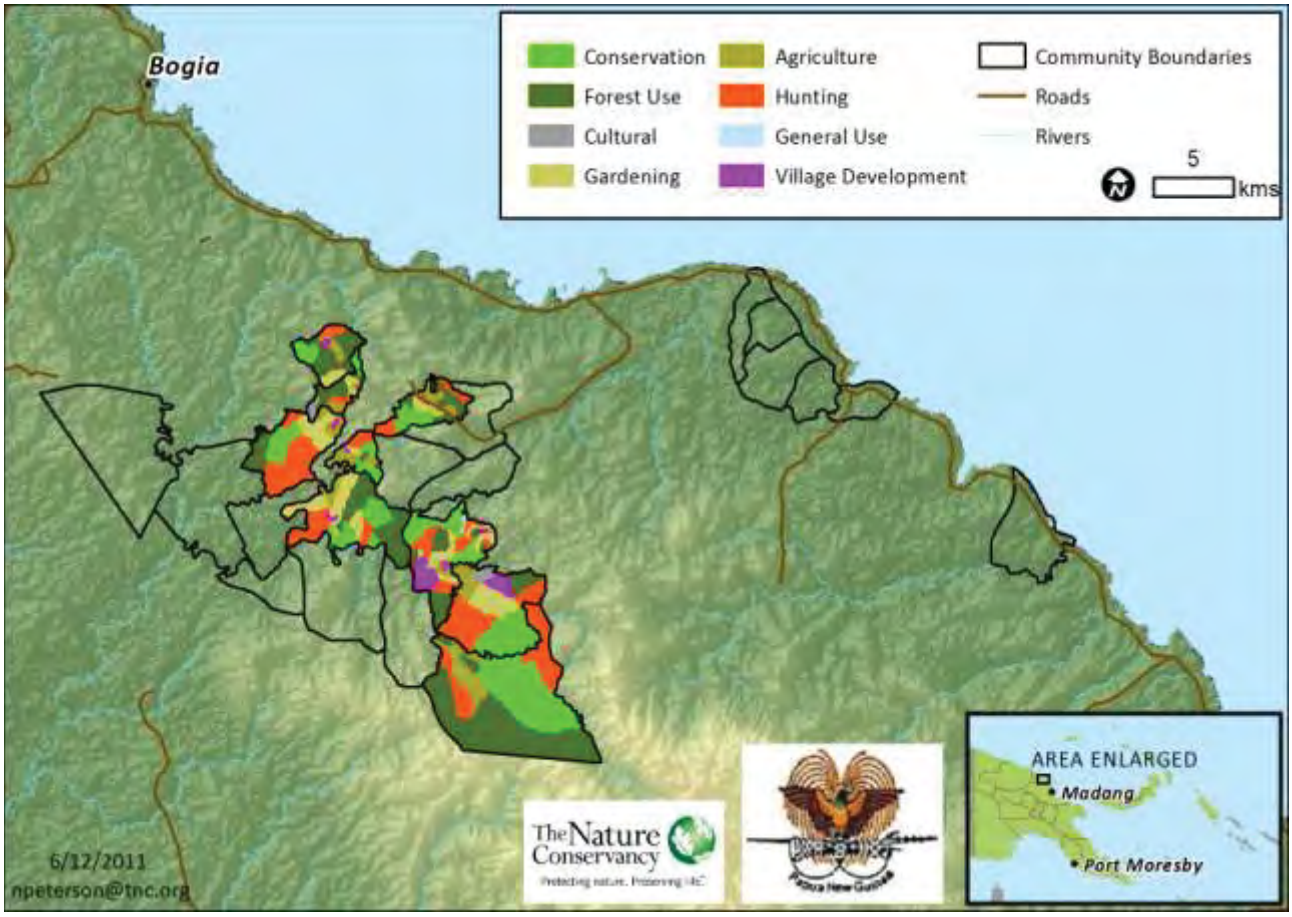

Figure 2. Consolidated conservation land use map from communities in the Adelbert Range, Papua New Guinea

CASE STUDY 6: ADELBERT RANGE MOUNTAINS, MADANG PROVINCE, PAPUA NEW GUINEA

The Adelbert Range runs parallel to the north coast of New Guinea covering more than 300,000 hectares and reaching to 1,672 m (Mt. Mengam) (Webb et al., 2005). The mountain range is a deeply dissected plateau that is mostly less than 1,000 m in altitude (Pratt, 1982). It is biodiverse and, together with the adjacent Huon Peninsula, has been considered a distinct biogeographic zone (Shearman & Bryan, 2011). More than 700 species of birds, including 38 species of bird of paradise have been recorded from the Adelbert Range. Several rare and endemic plant species have also been reported from the mountain range (Takeuchi, 2001), with a rich species diversity existing in at least 15 different vegetation types (Webb et al., 2005).

The Huon Peninsula and Adelbert Ranges region has undergone one of the highest rates of deforestation in Papua New Guinea (Shearman & Bryan, 2011). While much of this has occurred outside the Adelbert Mountains, 15,000 hectares of the northern part of the range was under logging concessions, with some logging occurring in the Josephstaal Valley. However, in 2001 local leaders managed to overturn this concession through a court decision, demonstrating illegal means in obtaining the concession and potential environmental damage.

Numerous family clans and villages are located in the Adelbert Mountains. Although population density is relatively low, subsistence agriculture and hunting are important for livelihoods and occur in many parts of the mountain range. This subsistence agriculture and harvesting, in combination with increasing cocoa and vanilla plantations, has led to decreased availability and quality of important forest and aquatic resources in some communities. In response to these challenges, the Almami Local Level Government Ward in conjunction with local communities and the support of The Nature Conservancy developed land use management plans to improve food security and environmental sustainability.

Land use management involved the zoning of land into conservation, subsistence agriculture, cash-crop production, hunting, forest use and general use areas, placing ecosystem services as a key element in the planning process. Furthermore, new legislation was established that allowed formal recognition and management of the conservation areas. This allowed

Table 1. Summary of key conservation factors in the six case studies

Site	Conservation Highlights	Stakeholders	Landowners	Benefits to landowners	External Support
Sovi Basin Conservation Area (Fiji)	• Largest intact lowland rainforest in Fiji including half vascular flora of Fiji • Numerous endemic and threatened species • Full elevation gradient from lowland rainforest to tropical montane cloud forest	• Landowners • Local & international NGOs • Government (national & provincial) • Academia • Business • Utility company	• Involved at all stages	• Trust fund for lease payments & harvesting compensation • Scholarships for local children	Continuing
Tetepare Island Community Conservation Area (Solomon Islands)	• One of the largest integrated land and marine conservation initiatives in the South Pacific • Largest uninhabited island in the Pacific	• Landowners • Local & international NGOs • Government • European Union • Academia	• Initiated conservation efforts • Involved at all stages • Run ecotourism operation	• Income from ecotourism lodge • Employment as lodge staff or rangers • Supply of materials and food to lodge	Continuing, local finance mechanisms being sought
Bauro Highlands Conservation Area (Solomon Islands)	• Highest levels of vertebrate endemism in the Solomon Islands • At time of establishment (1995) was second largest protected area in the South Pacific • Full elevation gradient from lowland rainforest to tropical montane cloud forest	• Landowners • International NGOs • Government • Development aid programmes	• Involved at all stages • Involved in ecotourism operations	• Income from internationally recognised and awarded ecotour adventure trail	Withdrawn in 2008
Takitumu Conservation Area (Cook Islands)	• Only protected population of Rarotonga flycatcher • Contains 70% of Rarotonga's inland plants • Catchment provides ~30% of Rarotonga's drinking water	• Landowners • Regional & International NGOs • Government • Development aid programmes	• Involved at all stages • Run ecotourism operation	• Income from ecotourism – nature-based walks • Souvenir/gift store	Continuing
Pohnpei Wildife Forest Reserve (FSM)	• Largest intact inland forest in Micronesia • High floral and faunal endemism	• Landowners • Local & international NGOs • Government (national & local)	• Limited involvement in initial, failed conservation attempts • Involved at all stages in ongoing project	• Employment as rangers • Food and water security	Continuing, but decreasing
Adelbert Range (Papua New Guinea)	• High diversity in vegetation types, flora and fauna • Numerous endemic and threatened species	• Landowners • Local & international NGOs • Government (national, provincial & local) • Development aid programmes	• Involved at all stages • Contribute land to conservation pool	• Income from development and sale of Fair Trade cocoa • Improved livelihoods through partnerships with aid organisations	Continuing

individual landowners to contribute land into a general "conservation area pool". This concept has been so successful that it is considered a possible mechanism for REDD+ in Papua New Guinea and the Adelbert Ranges were declared a national pilot site for the scheme (ITTC, 2011; TNC, 2011).

To create tangible benefits for landowning communities dedicated to conservation, partnerships were established with aid organisations to improve livelihoods and ways of value-adding farming products were considered (ITTC, 2011). In 2007 a coalition of farmers from communities with land use management plans, the Adelberts

Community rangers monitoring turtle populations, Tetepare Island Conservation Area © TNC

Conservation Cooperative Society (ACCS), was established with the help of TNC. They achieved Fairtrade certification for their low-impact cocoa production. Selling fair-trade products provides more stability to farmers, as it guarantees a minimum price for the produce, and also provides a benefit premium to the whole community.

DISCUSSION

The above case studies demonstrate that successful conservation is feasible in Pacific Island countries, despite a history of failure and the difficulties and complexities involved (Hunnam, 2002; Keppel et al., in press; van Helden, 2005). Each case study illustrates a unique response to the forces of commercially-driven land-use change, principally logging (Bauro, Tetepare and Adelbert Range). Four common themes emerge in successful projects: active participation and leadership of landowning communities, involvement of all relevant stakeholders, the generation of tangible benefits for landowning communities, and external support for the project over long (5 years or more) time periods. It therefore appears that these themes are important for success (see table 1).

Our study provides further evidence that intensive participation of landowners is essential for successful conservation projects in the Pacific, as it is in other community-based conservation projects in other parts of the world (Blom et al., 2010; Chase et al., 2000). Indeed, active landowner involvement has been considered a key to success or, conversely, a reason for failure (if absent) of conservation programmes (Hunnam, 2002; Keppel et al.; 2012, van Helden, 2005). Landowner participation needs to occur at all stages of the programme: planning, implementation, monitoring and evaluation. It has been argued that the chances for a programme to be successful are higher, if the initiative to conserve originates from the landowners (van Helden, 2005). Strong local leadership is a factor in each of the case studies, and the evolution of Tetepare Island from a community initiative into one of the largest and most successful conservation projects in the region supports this assertion.

The importance of involving all relevant stakeholders in the conservation programme has often been understated. Although government corruption is a major problem in many Pacific Island countries (Kabutaulaka, 2000; Laurance et al., 2011), the involvement of government departments is often essential or likely to increase the chances for success of the project. The case study of Pohnpei Island demonstrates the importance of comprehensive stakeholder involvement. Only after landowners, traditional leaders and municipal governments were incorporated into the programme, did conservation efforts on the island succeed. Indeed, the involvement of all stakeholders, and the associated concept of co-management, are increasingly recognized as essential components of effective conservation (Chase et al., 2000; Nielsen et al., 2002).

The issue whether to provide landowning communities with compensation or revenue for conservation or to encourage environmental ethics without financial initiatives has been the subject of considerable debate among conservationists (van Helden, 2005). The former can potentially result in unrealistically high expectations and produce a profit-oriented mentality, while the latter can be considered to disregard the developmental needs of communities. The fact that all successful case studies have provided communities with tangible benefits from conservation suggests that community development is an important aspect of successful conservation programmes. None of the projects however, provided cash handouts to landowning communities but designed innovative means to support development, adapted to the local circumstances. Ecotourism was established to generate revenue for the programme and local communities on Tetepare Island and Takitumu Conservation Area; scholarships and a trust fund were established to promote the development of Sovi Basin communities; employment as rangers and food and water security provide benefits to communities on Pohnpei; and Fair Trade produce provides better and

more stable income in the Adelbert Ranges. These results not only support the premise that biodiversity conservation and poverty alleviation can co-exist (Adams et al., 2004), but suggest that the latter increases the chances of the former succeeding.

Finally, all the programmes described differ from most other conservation initiatives in the Pacific in having received some external assistance over periods of more than five years. Indeed, the withdrawal of financial support for one of the projects (Bauro Highlands) led to its ultimate collapse. This reinforces the call for extended funding cycles to allow the adequate establishment of community-based conservation programmes. Indeed it is impossible to establish, implement and evaluate conservation programmes in the Pacific within the usual 3-5 year funding cycles because of cultural, social and political complexities (Keppel et al., 2012). This difficulty has also been realised in other regions (Blom et al., 2010; Lindemayer, 1999).

The above case studies make important contributions to the ongoing debate of how to achieve effective conservation in Pacific Island countries (Hunnam, 2002; Keppel et al., 2012; Lees & Siwatibau, 2009; van Helden, 2005). They suggest that extensive landowner participation, comprehensive landowner involvement, generation of alternative revenue and long-term project support are keys to project success. We therefore hope that these factors will increasingly feature in conservation programmes within the Pacific region.

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RESUMEN

La biodiversidad en el Pacífico tropical se encuentra seriamente amenazada como resultado de décadas de destrucción y degradación del hábitat. Los intensos esfuerzos realizados en términos de conservación e inversión financiera no han logrado detener esta crisis. Para ayudar a comprender mejor la manera de asegurar el éxito en las iniciativas de conservación, este documento examina seis estudios de caso de diferentes programas sobre áreas de conservación en cinco naciones independientes de las Islas del Pacífico: área protegida de la cuenca de Sovi (Fiji), área de conservación de la isla de Tetepare y las montañas de Bauro (ambas en las Islas Salomón), área de conservación Takitumu (Islas Cook), Isla Pohnpei (Estados Federados de Micronesia), y cordillera Adelbert (Papúa Nueva Guinea). Cuatro temas comunes surgen de estos estudios de caso: la participación activa de las comunidades propietarias de tierras; la participación de todos los interesados; la generación de beneficios tangibles para las comunidades propietarias de tierras; y el apoyo externo al proyecto durante períodos prolongados de tiempo (cinco años o más). Si bien la situación sociocultural difiere entre localidades, es preciso considerar estos temas al ejecutar proyectos de conservación en el Pacífico.

RÉSUMÉ

La diversité biologique dans l'océan Pacifique tropical est gravement menacée par des décennies de destruction et de dégradation des habitats. Des efforts importants de conservation et un investissement financier considérable ont échoué à enrayer cette crise. Pour mieux comprendre comment avoir des résultats positifs en matière de conservation, ce document analyse six études de cas, six programmes de conservation par zone dans cinq îles indépendantes du Pacifique : zone de conservation du basin de Sovi (Fiji), zones de conservation de l'île de Tetepare et des hautes-terres de Bauro (toutes deux situées dans les îles Salomon), zone de conservation de Takitumu (îles Cook), île de Pohnpei (États fédérés de Micronésie), et Monts Adelbert (Papouasie Nouvelle-Guinée). Quatre observations communes ressortent de ces études : la participation active des communautés propriétaires des terres ; l'implication de toutes les parties prenantes ; la génération de bénéfices tangibles pour les communautés propriétaires des terres ; et un soutien externe au projet sur des longues périodes de temps (cinq ans ou plus). Bien que la situation socioculturelle diffère selon les zones, ces observations doivent être prises en compte lors de la mise en place de projets de conservation dans la région Pacifique.

MEAT, MARKETS, PLEASURE AND REVENGE: MULTIPLE MOTIVATIONS FOR HUNTING IN BAMU NATIONAL PARK, FARS PROVINCE, IRAN

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ABSTRACT

In this study an informal, qualitative methodology is used to explore motivations for hunting in Bamu National Park, Fars Province, Iran. The park has probably the highest level of hunting-related conflict of any protected area in Iran. Two senior park staff members and fourteen hunters were interviewed individually and a further six hunters were interviewed in a group. Reported motivations for hunting included poverty, market-related profit, pleasure (the love of the hunt and its traditional value) and revenge, in that resentment of the protected area was cited in itself as a reason to hunt. It is concluded that strict enforcement is unlikely to decrease hunting on its own and may actually increase hunting as resentment against the park grows. Managed sustainable hunting is not permitted under Iranian law but the presence of a traditional moral concept (shogoun) that commercial hunting is wrong may offer a basis for a more collaborative approach, and there is evidence that an emphasis on positive engagement between park staff and local people could improve the situation quite quickly.

INTRODUCTION

Unsustainable hunting of wild species is prevalent in developing countries (Hayward, 2009), and is recognized to be a major challenge for wildlife conservation. It is often assumed to be driven either by poverty and subsistence needs (e.g., Bennett et al., 2006; Campbell & Nelson, 2001; de Merode et al., 2004; Grey-Ross et al., 2010; Kumpel et al., 2010) or by commercial profit and market demand for bushmeat and other valuable wildlife products (Duffy, 2010). Conservation strategies to counter unsustainable hunting frequently focus exclusively on these economic drivers and involve a mixture of financial incentives, such as the development of alternative livelihoods, and especially in protected areas, legal bans or restrictions on hunting. However, these measures have had limited success: in many protected areas throughout the world, illegal hunting remains widespread (Loibooki et al., 2002; Kumpel et al., 2010). In many cases this is at least partly due to weaknesses in implementation: livelihoods projects frequently fail to deliver results and enforcement regimes are often under-resourced or undermined by corruption. However, failures may also be due to insufficient information and incorrect assumptions about the drivers of hunting at particular sites. For example, Duffy (2010) argues that one common failing is the focus on supply – local hunters – rather than factors that maintain market demand. More fundamentally, drivers may include non-economic factors as well as economic factors. These include cultural values and prestige connected to hunting (e.g., Kaltenborn et al., 2005), and more simply, the 'love of the hunt', which has been documented across many cultures (for example see Kaltenborn et al. 2005; Dickson et al., 2009; Robinson & Bennett 2000 cited in Grey-Ross et al., 2010). Clearly, conservation strategies that are based on incorrect assumptions about why people hunt are unlikely to be successful.

In order to develop appropriate strategies to address illegal hunting at a specific site it is important to understand the full range of factors that drive hunting activities (Loibooki et al, 2002; Rao et al, 2005). However research on hunting is notoriously difficult, especially where hunting is illegal, because hunters are unlikely to respond openly to questions about their activities. The greater the level of conflict over hunting, the more problematic research is likely to be. St John et al. (2010) have recently developed a questionnaire-based methodology that minimises response biases related to poaching or other illegal behaviours in conservation, but it is still dependent on being able to persuade a representative sample of poachers to take part. In situations where conflict over poaching is very high this may not be the case and less formal, qualitative methods may be more successful.

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Figure 1. Bamu National Park, the Isfahan-Shiraz highway and the villages of this study

In this study we explore the factors that motivate local hunters in Bamu National Park, Fars Province, Iran and discuss the implications for management. There are very few (if any) published studies on hunting in Iran and therefore there is little information on what is driving it or how it could be reduced. Hunting is illegal in national parks in Iran (Iran Wildlife Reference, 2011: 13B) and is combated principally through strict enforcement of the law. Hunting in Bamu is of particular concern because the protected area is an important refuge for the endangered Persian leopard (*Panthera pardus saxicolor)*, which is the only remaining large felid in Iran and is a flagship species (Ghoddousi et al, 2010). Many of the species that are hunted are important prey species for the leopard, including wild sheep *Ovis spp.*, wild or bezoar goat *Capra aegagrus*, the goitered gazelle *Gazella subgutturosa,* wild boar *Sus scrofa* , Indian porcupine *Hystrix indica* and Cape hare *Lepus capensis* (Nowzari et al., 2007 cited in Ghoddousi et al., 2010). According to the testimony of several park authorities, the park has probably the highest level of hunting-related conflict of any protected area in Iran, resulting in the deaths of both hunters and protected area staff (over 16 people from both sides have been killed during the past 30 years.). Therefore research into the drivers of hunting in Bamu is both urgently needed and particularly challenging. This study used an informal, qualitative methodology for gathering information on hunting motivations that was more practicable under these tense conditions than a rigorous quantitative survey. It reveals that there are multiple motivations for hunting including both economic and non-economic factors, some of which are not addressed by current management strategies. Most importantly, it also reveals that the conflict between the protected area and local people is now perceived by some hunters to be a strong motivation in itself to hunt, as a way to express opposition to the park.

BAMU NATIONAL PARK

Bamu is a 486 km^2 national park located northeast of Shiraz city in Fars Province, Iran. It became a protected area in 1967 and a national park in 1970 (Darvishsefat, 2006). With elevations of 1,600 to 2,700 m, it has a continental and semi-arid climate and is restricted topographically by the northern slope of the Zagros Mountains (Darvishsefat, 2006). Mean annual precipitation is 400 mm and mean temperature is 16 °C. Flora and fauna include 350 vascular plant species, of which 51 are endemic, and 143 species of vertebrates (Darvishsefat, 2006), including the Persian leopard.

The national park is divided into two sections by the Isfahan-Shiraz highway (Figure 1). Populations of large mammals in the western section have been severely diminished by hunting (Ghoddousi et al., 2010) but the eastern section still contains leopard and several of the prey species listed above (Nowzari et al., 2007 cited in Ghoddousi et al., 2010).

There are nine villages adjacent to Bamu National Park (Figure 1) including people of two ethnic groups: Turks and people of Farsi origin. The dominant religion is Islam. Both park staff and local people report that illegal hunting by local people is widespread, and anti-poaching activities have been an important focus for leopard conservation projects (Ghoddousi et al., 2008 & 2010).

Panorama Bamu National Park © Mani Kazerouni

METHODS

The research was conducted in the five villages that are closest to the protected area, which were also reported by park staff and local people to be those with the highest levels of hunting: Tarbor Jafari, Badjgah, Sa'dieh, Zarghan, and Tarbor Labisheh. Data were collected by the lead author over a six-week period (26th May to 10th July 2011) during three trips to the area. The principal method was semi-structured interviews, which were carried out individually with two senior park staff and with local hunters in the five study villages. Hunters were contacted through a process of chain referral (Newing, 2011: 65-82). At the start of the fieldwork two hunters were contacted through their connection to a conservation NGO working in the area, and subsequently each hunter interviewed was asked either to suggest other hunters who might be willing to participate or else to let other hunters know of the study so that those who felt comfortable to do so could approach the researcher anonymously. In this way a total of 14 hunters were interviewed. One focus group was also carried out with six additional hunters after one interviewee who had been hosting the researcher in his house asked six other hunters to come to the house to be interviewed without giving their names. Informal interviews were carried out with hunters' wives and families as the opportunity arose. Both the interviews and the focus group with hunters focused on their own reasons for hunting and also on broader perspectives on drivers of hunting and differences between the villages. Park staff were also asked about possible reasons for hunting in the area and the differences between the villages.

Whilst the number of hunters who came forward to be interviewed was small, at the start of fieldwork those who did so were eager to talk about the issue. Some of them even invited the researcher to their homes and families and talked for hours; it was evident that feelings ran high. The fact that the field researcher was a compatriot who spoke the same language as the hunters and was a female appears to have allayed suspicions and facilitated the process of data collection. However towards the end of the fieldwork, hostilities between hunters and the park staff became acute after a conflict between the rangers and one hunter in which the hunter was shot dead. Not surprisingly, this incident had an impact on the willingness of the hunters to be interviewed about their illegal activity.

Interviews were not recorded; information was documented by note-taking alone. Personal information was recorded including age, marital status, size of household and occupation, but names were not recorded. All data were analyzed qualitatively using annotations, memos and coding in order to identify key topics and collate information on each topic (Newing 2011: 242-256). Coding was initiated in the field so that it could be used iteratively to inform data collection as the study progressed.

MULTIPLE MOTIVATIONS FOR HUNTING

Motivations for hunting included both economic factors related to subsistence or to commercial profit and also additional social and cultural factors. These included the value of hunting as a tradition; the love of hunting in its own right, and also the historical enmity between the park authorities and local people. This section outlines the evidence for each of these factors in more detail and the following section explores the implications for management.

In terms of economic factors, for some hunters hunting was driven by extreme poverty. Meat from hunting would either be eaten or else sold to provide money for food and other basic provisions, and a single hunting trip could provide for the household in this way for several months.

Game-Wardens Bamu National Park © Taher Ghadirian

Both the hunters and the park staff who were interviewed said that poverty-driven hunting was particularly prominent in one village (village A), where there were very limited options for employment or alternative sources of income.

Hunting was perceived in this village as a fall-back option (Kümpel et al., 2010): for example a 61-year-old hunter from village A said that: "*All my four sons aged 23, 24, 25 and 30 have finished their high school, they do not have money and are unemployed...if 2 to 3 years from now the situation does not change, it is obvious they'll become hunters as well.*"

Hunting on a commercial scale could be extremely lucrative; the minimum monthly wage of an unskilled worker in Iran in 2011 was 3,303,000 Rials (Government Help Desk, 2011: equivalent to £165.00), whereas a single successful hunting trip could bring in 5,000,000 Rials (£250.00). However, there was a strong traditional belief that whilst hunting to meet immediate needs was morally acceptable, selling bushmeat commercially was immoral, and this belief appeared to be limiting commercial hunting activities. For example when asked whether he ever sells meat commercially, one hunter from village A replied: "*Honestly we have never done that... it was just for the subsistence of the family and not for the trade...this is infamy, it is like selling blood*".

Commercial selling of meat was believed not only to be immoral but also to be back luck (*bad-shogoun* in Farsi). Another hunter from village A said: "*We all can recall stories of bad things happening to sellers of bushmeat and to their families.*"

Hunters from all five villages referred to the moral distinction between hunting for immediate needs and hunting for profit. Nonetheless there was some evidence that interpretations of what counted as 'immediate needs' were changing. One jobless 32-year-old hunter from village A explained his situation as follows: *"I am young, I need clothes, I need a motorcycle or for instance I need money to buy a 1,000,000 Rials trousers, so we arrange a hunting trip and the next day, we will have the money we need."*

In this statement the hunter reconciles cultural norms relating to the morality of hunting with his use of money from hunting to buy a motorcycle and expensive clothes by casting the latter as 'needs', although they are clearly not basic needs related to extreme poverty. Further research would be needed to determine how widespread this view is in the village but it may be part of a process in which the younger generation in the village is coming to perceive hunting not as a fall-back option, but as a "*viable and relatively profitable means of generating a cash income*" (Campbell and Nelson, 2001) that can lift them out of poverty.

Both park staff and several hunters indicated that in a second village (village B), commercial hunting for markets was common. Hunters from this village also mentioned the concept of bad 'shogoun' in relation to commercial hunting but in spite of this, some admitted to hunting as much as they could, without any moral restriction. People in this village were perceived to be far wealthier than those in village A; some had expensive hunting equipment and were making considerable amounts of money from hunting. One local hunter from village E, talking about village B, explained that: "*I know some people who earn something like 50,000,000 Rials per month, they don't have any other jobs...they go to hunt 10 times a month, let's say they can succeed 5 times out of 10, it is easy to reckon...this money makes you greedy.*"

Bamu National Park © Nosrat Dehghan

Village B was the only village where the majority of households were ethnic Turks rather than Fars and their commercial hunting was explained by the Farses in terms of ethnic stereotypes – particularly the 'greediness' of Turks. More in-depth research would be needed to determine whether the differences in hunting are related to genuine cultural differences, but it is clear that hunting practices and motivations vary significantly between villages and therefore that different management strategies would be needed to address them.

Economic motives were not prominent in the remaining three villages. However in terms of non-economic motives, almost all hunters in all five villages mentioned pleasure as an important reason for hunting. One hunter from village C, when asked why he hunts, answered simply: *"I don't know, I really don't have an answer for this question, I just love to hunt, I am just eager to hunt."* He also spoke of hunting in terms of tradition and talked of his wish to show his sons how to hunt. Almost all of the hunters claimed that hunting in the area that is now Bamu National Park is a traditional activity for the local people and that therefore hunting should not be banned. Several people also said that having a rifle is part of the 'traditional legacy' of living adjacent to an area full of game.

Single hunters frequently gave multiple reasons for hunting. For example the 32-year-old from village A quoted above, who justified his hunting as fulfilling his need for clothes and a motorbike, explained later in the same interview: *"You know ... hunting is a sophisticated activity...the thrill of it cannot be compared with anything you have experienced...when you shoot the game and it rolls down the mountain, we enjoy seeing this happen just like an addict with his drug..."*. Clearly motivations are multilayered and complex, even for individual hunters.

An additional factor that came across strongly was the deep hostility between local people and the provincial Department of Environment (DOE), which is responsible for protected area management. The hostility was related not only to specific conflicts over hunting but also to perceived injustices dating back to the creation of the park. For example according to a hunter from village A, over the years the DOE has restricted access successively to different wells, other water sources and areas of land that were important for livestock. He claimed that at least one of the wells where this had happened was not even located in the park. It became apparent in conversations with park staff that some borders of the protected area are not delineated clearly and there is disagreement between the park and the people about which wells and springs are within the park's boundaries, which has caused additional conflict.

More generally, almost all of the interviewees who stated that poverty and unemployment drove them to hunt blamed the DOE directly or implicitly for this problem. A local hunter from village A stated that: "*There have been times in my life that I had to hunt to survive, because DOE would not let our livestock to graze. If someone wants to help us and establish a factory in this area, the DOE would interfere and so unemployment goes on".*

The actions of the DOE in the Bamu National Park are perceived by local communities not only to have affected their access to resources and their livelihoods but also to show a lack of respect. One local hunter from village A said: *"Just imagine this old respectful shepherd with his herd wants to graze his livestock and he gets captured and insulted by a young warden."* The majority of local hunters expressed their dissatisfaction with the DOE. It was explained from different perspectives by different people but the main point was more or less the same. As one hunter put it, *"Our major problem is with the DOE, we do not like them and they do not like us"*.

At its most extreme, the enmity between local people and the park has acted as an extra incentive for hunting: "*If there is no game in the mountain* [National Park] *there would be no game-wardens, no DOE and no one to protect this area...life can be much easier for us without them and their interventions in the park...so the best thing to do is to hunt and to get rid of everything...and that is not hard to achieve, there are 6-7 leopards left and if they don't have enough prey, they will die and the whole story of the park will end... "*. (Hunter from village C). Thus strong enforcement measures may actually be motivating people to increase their hunting further, thus leading to further escalations of conflict.

However, people's accounts of different stages in the park's history revealed that in spite of the ongoing conflicts between people and the park since its creation, the level of tension has not always been so high. From 2006 to 2009 there was a Head of the park who was highly respected and had a good relationship with local people, and this was reported by hunters in all five villages to have made them reduce hunting. For example one hunter from village A stated: *"I would have been ashamed of him and of our friendly relationship with him if he would be informed that I was at a hunting trip...he came to our village...to our homes...he had tea with us and he pleaded for help to save the park, how could I continue hunting ignoring him..."*.

One hunter from village C believed that the park head tolerated low levels of hunting (even though this would be against the principles and regulations of the national park): *"He always said to locals that: "the park is yours, I am not telling you to stop hunting but do not exceed your needs, help me and let us keep the park together"*. Hunting did not cease altogether but people believed it had decreased considerably: *"I am not saying that people were not hunting those years, but if they normally hunted 60 game animals a month, they have reduced that to 20 per month, and that was just because he respected them and they respected him". (Member of park staff).*

Thus hunting in Bamu National Park may serve as a way for local people to demonstrate hostility or compliance with the park authorities in addition to its economic and cultural drivers. There are no systematic data on wildlife populations but both hunters and park staff believed that game populations had increased during the period when there were good relations with the park manager.

IMPLICATIONS FOR MANAGEMENT STRATEGIES

Because of the high level of conflict in Bamu over hunting, this study was based on a relatively small number of interviews with a non-representative sample of hunters. However a high degree of consensus in what people said suggests robustness in the findings. Motives for hunting included poverty-related subsistence needs, market-related profit, pleasure and revenge. Poverty and profit were each associated with a single village whereas the recreational and cultural value attached to hunting and the deep-seated resentment of the park was common to all villages.

These findings have important implications for management. Currently, the main management strategy for combating illegal hunting is strict enforcement through checkpoints and patrolling. Park staff believed that commercial hunting was having the greatest impact on wildlife populations and that enforcement was the best way to combat commercial hunting. However enforcement alone is unlikely to be effective, for several reasons. First, enforcement on the ground is likely to have only limited success unless market demand is also addressed (Duffy, 2010) – something that was recognized by protected area staff but that they felt they were not in a position to do anything about. Second, strict enforcement is unlikely to be effective where meat is an 'essential good', which appears to have been the case for at least one village, where hunting was driven by extreme poverty. Here, a more appropriate strategy would be the development of alternative sources of livelihoods. It was beyond the scope of this study to investigate livelihood options but it was apparent that local people believed that the park had the opposite policy and was consistently undermining livelihood opportunities.

Third, strict enforcement does not address cultural drivers of hunting, and can thus create deep-seated resentment. However the moral concept of shogoun,

Bamu National Park © Nosrat Dehghan

according to which commercial hunting is perceived as immoral and likely to bring bad luck, may offer common ground from which protected area staff can build on cultural values to counter the worst excesses of hunting. In spite of changing economic conditions and social values, the concept of 'shogoun' appears to remain powerful, although management strategies using this approach would need to take care to address the changing perspectives of the youth.

Finally, strict enforcement has led to acute resentment, to a point where it appears to be acting as a motive for hunting in its own right. Protected area staff are perceived as disrespectful both of traditional practices and of local people, and this has built upon a deep-seated sense of injustice related both to local people's perception of hunting as a traditional activity, with the implication of associated rights, and to broader loss of access to their lands and natural resources since the creation of the park. There is a danger of an ever-escalating conflict as the protected area authorities respond to increased hunting by implementing ever-stricter enforcement measures, which simply spur people to hunt even more in revenge. However hostility and hunting are both reported to have decreased when there was a park manager who had good relations with hunters, suggesting that it may be possible to improve the situation over a relatively short time through a change in behaviour of the protected area staff and an emphasis on positive personal engagement with local people.

CONCLUSIONS

The situation in Bamu National Park presents a particularly graphic example of what is probably the biggest controversy in protected areas conservation – the balance between a 'fences and fines' approach based on strict enforcement and a more inclusive approach that aims to gain the support and involvement of local communities. The 'fences and fines' approach, dominant in protected areas conservation at least until the 1970s, lost ground to more conciliatory approaches precisely because of evidence that it led to ever-escalating conflict that was both economically and politically unsustainable (Mulder & Coppolillo, 2005; Russell & Harshbarger, 2003). Community-based approaches have met with limited success and been criticised in their turn (Oates, 1999; Terborgh, 1999), and current management

strategies often combine some level of enforcement with more conciliatory approaches. In the case of Bamu National Park it is clear that enforcement is a necessary part of management, but that it is unlikely to be successful on its own. In relation to commercial hunting, measures are needed to reduce market demand as well as supply. Subsistence hunting driven by extreme need will only be reduced if alternative sources of livelihood are developed. In many countries limited hunting is permitted in protected areas for subsistence and cultural purposes – an approach that would be consistent with the perceptions of Bamu park managers that it is only commercial hunting that is a major threat to wildlife populations. However Iranian law does not currently allow for this option. Nonetheless two alternative approaches may be useful in reducing hunting levels. First, the concept of shogoun may offer a basis from which to work with local people to counter the worst excesses of hunting. Second, the degree to which hostility and hunting are reported to have decreased when there was a park manager who had good relations with hunters suggests that it may be possible to improve the situation over a relatively short time through a change in behaviour of the protected area staff and an emphasis on positive personal engagement with local people. Once the level of conflict has decreased it should be possible to gather more systematic quantitative data on hunting activities, their impacts, and the relative significance of the different motivating factors that drive them.

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RESUMEN

En este análisis se utiliza una metodología cualitativa informal para determinar las motivaciones para la caza en el Parque Nacional Bamu en la provincia de Fars, Irán. El parque tiene, con toda seguridad, el nivel más alto de conflictos relacionados con la cacería en cualquier área protegida de Irán. Dos funcionarios de alto rango del parque y catorce cazadores fueron entrevistados individualmente y otros seis cazadores fueron entrevistados en grupo. Entre las motivaciones para la caza se mencionaron la pobreza, los beneficios comerciales, el placer (la devoción por la caza y su valor tradicional) y la venganza, en cuanto a que el resentimiento hacia la zona protegida fue citado como una razón para cazar. Se concluye que es poco probable que una aplicación estricta pueda disminuir la cacería por sí sola, pudiendo más bien aumentarla a medida que crece el resentimiento contra el parque. La gestión sostenible de la caza no está permitida bajo la ley iraní, pero la presencia de un concepto moral tradicional (shogoun) de que la caza comercial está mal, podría ofrecer una base para un enfoque más colaborativo, y hay evidencia de que un énfasis en la colaboración positiva entre el personal del parque y los pobladores locales podría mejorar la situación con bastante rapidez.

RÉSUMÉ

Dans cette étude, une méthodologie informelle et qualitative est utilisée pour analyser les motivations des chasseurs du Parc national de Bamu, dans la province iranienne de Fars. C'est en effet dans ce parc que l'on trouve probablement le niveau de conflits le plus élevé parmi toutes les aires protégées d'Iran. Deux cadres supérieurs du parc et quatorze chasseurs ont été interrogés individuellement, et six autres chasseurs interrogés en groupe. Les raisons mises en avant par les chasseurs sont la pauvreté, le profit commercial, le plaisir (l'amour de la chasse et sa valeur traditionnelle) et la revanche (le ressentiment envers l'aire protégée a été cité en soi comme une raison). L'étude conclut en affirmant qu'une application stricte de la loi a peu de chances de faire diminuer les pratiques de chasse, mais qu'au contraire le ressentiment et donc la chasse pourraient augmenter parallèlement au développement du parc. La chasse durable et gérée n'est pas autorisée dans le cadre de la loi iranienne, cependant l'importance d'un concept moral traditionnel (*shogoun*), qui insiste sur le caractère néfaste de la chasse commerciale, pourrait offrir la base d'une approche plus collaborative. Enfin, il est avéré qu'une implication positive entre le personnel du parc et les communautés locales améliorerait rapidement la situation.