

PARKS

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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.

- la 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.
- lb 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 organisations (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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PARKS: THE INTERNATIONAL JOURNAL OF PROTECTED AREAS AND CONSERVATION

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PARKS is published to strengthen international collaboration in protected area development and management by:

- exchanging information on practical management issues, especially learning from case studies of applied ideas;
- serving as a global forum for discussing new and emerging issues that relate to protected areas;
- promoting understanding of the values and benefits derived from protected areas to communities, visitors, business etc;
- ensuring that protected areas fulfill their primary role in nature conservation while addressing critical issues such as ecologically sustainable development, social justice and climate change adaptation and mitigation;
- changing and improving protected area support and behaviour through use of information provided in the journal; and
- **promoting IUCN's work on protected areas.**

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EDITORIAL: RESPONDING TO DISASTERS - THE ROLE OF PROTECTED AREAS

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ABSTRACT

The costs of storms, floods, earthquakes, landslides, ocean surge and desertification are increasing; and with each event natural capital is also lost in terms of healthy ecosystems, species and ecosystem services. Despite increased spending on disaster risk reduction (DRR) strategies, well over a million people died as a result of natural hazards in the last decade. We need to rethink how to manage DRR. One strategy poorly recognised and under-exploited to date is the role of natural ecosystems in protecting against and mitigating from disasters and the role of protected areas in maintaining these ecosystem services. This editorial reviews how protected areas can support DRR and draws specifically on responses to the Great East Japan Earthquake in 2011.

KEYWORDS: disaster risk reduction, protected areas, Great East Japan Earthquake

Humanity is fighting a losing battle against the impact of natural hazards. Despite spending ever larger amounts of money on disaster risk reduction (DRR) strategies, the costs of storms, floods, earthquakes, landslides, ocean surge and desertification are increasing. Well over a million people have died as a result of natural hazards in the last decade (Vinck, 2013); far more than died in armed conflict during the same period. At the same time, the economic costs of disasters are escalating. The 2013 edition of the *Global Assessment Report on Disaster Risk* (UNISDR, 2013) reports that over a trillion dollars in economic losses have been recorded for the first decade of the 21st century, but even this is admitted to be a substantial under-estimate, for instance missing uninsured losses from recurrent, small-scale disasters in low and middle income countries. Total expected annual losses from earthquakes and cyclone wind damage alone amount to US\$180 billion a year; and global annual losses from wild-land fires in the tropics will potentially reach US\$190 billion a year. The UN International Strategy for Disaster Reduction believes that direct disaster losses are at least 50 per cent higher than **internationally reported and its 'wake-up call' for 2013 is** that disasters are even costlier than we thought (UNISDR, 2013).

It has long been accepted that poor people in poor countries are the most likely to experience an extreme **weather event as a 'disaster', due to poor infrastructure**, overloaded health and emergency services, existing environmental degradation and the land shortages that often force the poorest people to live in hazardous, disaster-prone places (Abramovitz, 2001). But the old poor-rich distinctions are starting to break down as disasters hit some of the richest countries in the world: the Japanese tsunami, Hurricane Katrina in the United States and escalating, catastrophic fires in Australia have proven to be no respecters of socio-economic privilege. The Japanese Toyota company lost US\$1.2 billion in product revenue after the 2011 earthquake and tsunami. Losses can be long-term or permanent; prior to the 1995 **earthquake in Japan, Kobe was the world's sixth largest** port, but despite massive investment to repair damage it never recovered its previous regional dominance and had fallen to 47th place in the world by 2010 (UNISDR, 2013).

Disaster risks include the loss of natural capital in terms of healthy ecosystems, species and benefits foregone. Many countries are caught in a vicious cycle: environmental degradation reduces the ability of

ecosystems to withstand natural hazards, which in turn causes further environmental degradation, and so on. The slow slide into large-scale desertification is a prime example, but damage to coastal vegetation and reefs, losses of riparian forests and disruption of natural floodplains are all too common in many countries, rich and poor.

Responding to disasters requires a fundamental rethinking of priorities, both amongst those at risk and from governments and industry charged with the responsibility of minimising both the risks of disasters and the likely scale of the consequences. Here we are concerned with one element that we consider to have been poorly recognised and under-exploited to date: the value of natural ecosystems in protecting against and mitigating from disasters and the role of protected areas in maintaining these ecosystem services.

While many communities have traditionally used natural ecosystems such as forests, coral reefs and natural dryland vegetation to protect themselves against the impacts of natural hazards from climate extremes and earth movements, larger numbers of people are now left exposed because environmental degradation has exposed people to increased levels of risk. Reversing these trends is now recognised as an urgent priority. Protected areas **provide one of the world's most effective mechanisms for** maintaining natural habitats and ecosystem functions. After decades in which engineering solutions were automatically the first choice for minimising the risk of disasters such as flooding and avalanches, the importance of protecting ecosystems is increasingly being recognised.

Protected areas provide four main benefits:

- Maintaining natural ecosystems that buffer against hazards such as tidal surge (coastal mangroves, coral reefs); flash floods (wetlands, floodplains); landslides (forests and other native vegetation); and dust storms and desertification (natural vegetation cover in drylands).
- Maintaining traditional cultural ecosystems and crops in protected landscapes (IUCN category V protected areas) that have an important role in mitigating extreme weather events, such as agroforestry systems, terraced crop-growing and fruit tree forests in arid lands that can prevent desertification.
- Providing a controlled environment for active or natural restoration of degraded ecosystems, such as reforestation of steep slopes or restoring flood plains, providing both benefits to biodiversity and disaster mitigation benefits.
- Providing emergency sources of food, freshwater, building materials and living space following disasters, from protected areas where some level of sustainable off-take is allowed (e.g., IUCN protected area category VI sustainable use areas) (Stolton et al, 2008).

These benefits are increasingly being recognised, although resistance from more traditional agencies **hampers progress. In 2011, UNISDR wrote “the monetary undervaluation of ecosystem services remains an important obstacle to the adoption of ecosystem-based DRM. As a consequence, relatively few countries are taking advantage of tools such as ‘payments for ecosystem services’.** When politicians consider adaptation to challenges such as climate change they often still instinctively look to dams and levees for water storage and flood control and more investment in coastal defences such as sea walls, rather than restoration of natural floodplains and planting of mangrove forests in coastal regions. Civil servants making decisions about DRR may well belong to different ministries than those working on nature protection and the former may not understand the potential of ecosystem services. They will also be lobbied by powerful business interests who would profit from engineering solutions. Natural conservatism probably plays a role too. After the devastating effects of Hurricane Katrina in New Orleans in 2005, the need for restoration of floodplain forests and wetlands was widely recognised, but still had to compete with pressures to continue developing the bayous.

The role of protected areas can also be strengthened by integrating them more thoroughly into existing DRR planning, for example by:

- Rigorous economic, engineering and environmental analyses: of proposed infrastructure projects to determine when and where there are benefits of incorporating green infrastructure versus hard infrastructure into disaster reduction plans.
- Broad-scale spatial planning: cooperation by disaster relief agencies at a national and regional/transboundary scale to identify places where natural ecosystems could prevent and mitigate disasters and to develop associated ecosystem protection strategies. This can include where appropriate the establishment of new protected areas to safeguard ecosystem services that buffer communities.
- Management plans: some protected area authorities may consider revising management objectives and management plans in order to maximise benefits in terms of disaster mitigation and

to increase awareness of these values among the general public. Such revisions should not be at the expense of the biodiversity and ecosystems functions for which the protected area was established.

- Payment for ecosystem services and financing strategies: disaster risk reduction institutions could work with protected area managers to develop innovative financing strategies for protected areas, which recognise payment for ecosystem services. (DRR funds should in some cases be used to establish or manage protected areas in places where these provide cost effective DRR.)
- Restoration: in some cases it may be useful to protect and restore degraded ecosystems specifically to improve their role in disaster mitigation; in such situations some level of active management may be required, e.g. removal of invasive alien species to allow natural regeneration or planting of native species to restore natural processes.
- Training: protected area managers and rangers are often some of the few government officials in remote areas; additional training specifically on DRR issues allows them to help communities both through management options within the protected area and relief management if an extreme event takes place.



Local people contributed ideas for the new Sanriku Fukko National Park in Japan © Ministry of the Environment

DDR IN ASIA

The Asia Parks Congress in late 2013 is probably the first protected area conference to focus attention particularly on the role of protected areas in DRR, building consciously on experience during the 2011 tsunami. Coasts protected by natural ecosystems suffered less damage than those without such barriers and the government has reacted by highlighting the role of ecosystem services and developing a new national park in the region of the disaster, which serves both as a protection against future events and a memorial for those who lost their lives (see box).

BOX: THE NEW SANRIKU FUKKO NATIONAL PARK

The Great East Japan Earthquake had a substantial impact on the natural environment along the coast, and did extensive damage to facilities (paths, toilets, campsites, etc.) in the Rikuchu Kaigan National Park and many other natural parks. This coastline is known as the Sanriku coast, and includes many areas that have been designated natural parks because of their wonderful scenery.

Working on the principle of using reconstruction to restore connections between forests, satoyama (protected landscapes), rivers, and sea, the Ministry of the Environment decided to restructure this series of parks into a single park—the Sanriku Fukko National Park—and use it as a basis for green reconstruction, thereby stimulating local tourism, agriculture, forestry and fisheries (**'Fukko' is a Japanese word for reconstruction**).

An integral part of this plan was to incorporate the Tanesashi Kaigan Hashikamidake Prefectural Natural Park into the Rikuchu Kaigan National Park. The former includes Kabushima, famed as a breeding ground for black-tailed gulls (*Larus crassirostris*), and the Tanesashi coast with its beautiful coastal grassland scenery. The parks were officially joined in May 2013,

and redesignated the Sanriku Fukko National Park (see Figure 1 and Figure 2 overleaf).



Monitors walked the whole proposed Michinoku Coastal trail © Ministry of the Environment



Figure 1: Map of the reorganization of natural parks. Source: Ministry of the Environment

RECONSTRUCTION ACTIVITIES

Initial management activities have included:

- Michinoku Coastal Trail - a path bringing north and south together: The Ministry of the Environment has been working with local municipalities on preparations for the Michinoku Coastal Trail. This is a long-distance path that is expected to become a symbol of reconstruction through the various connections that it makes, linking **the local natural environment and people's lives**, traces of disaster, the people who use the trail, and the people who live along it. To survey the best course for the trail, monitors walked the envisaged routes and discovered the attractions of each locality.
- Repair and reconstruction of damaged facilities: Repair and reconstruction of damaged facilities at some of the most-used parts of the Sanriku Fukko National Park, such as Jodogahama (a beach in Miyako, Iwate) and Kesennuma Oshima (an island in Kesennuma, Miyagi) are proceeding in collaboration with the local authority, contributing to reconstruction of the area. At Anegasaki cape (Miyako, Iwate), there are plans to preserve part of the damaged park facilities unrepaired, creating a venue for learning about how dangerous nature can be.

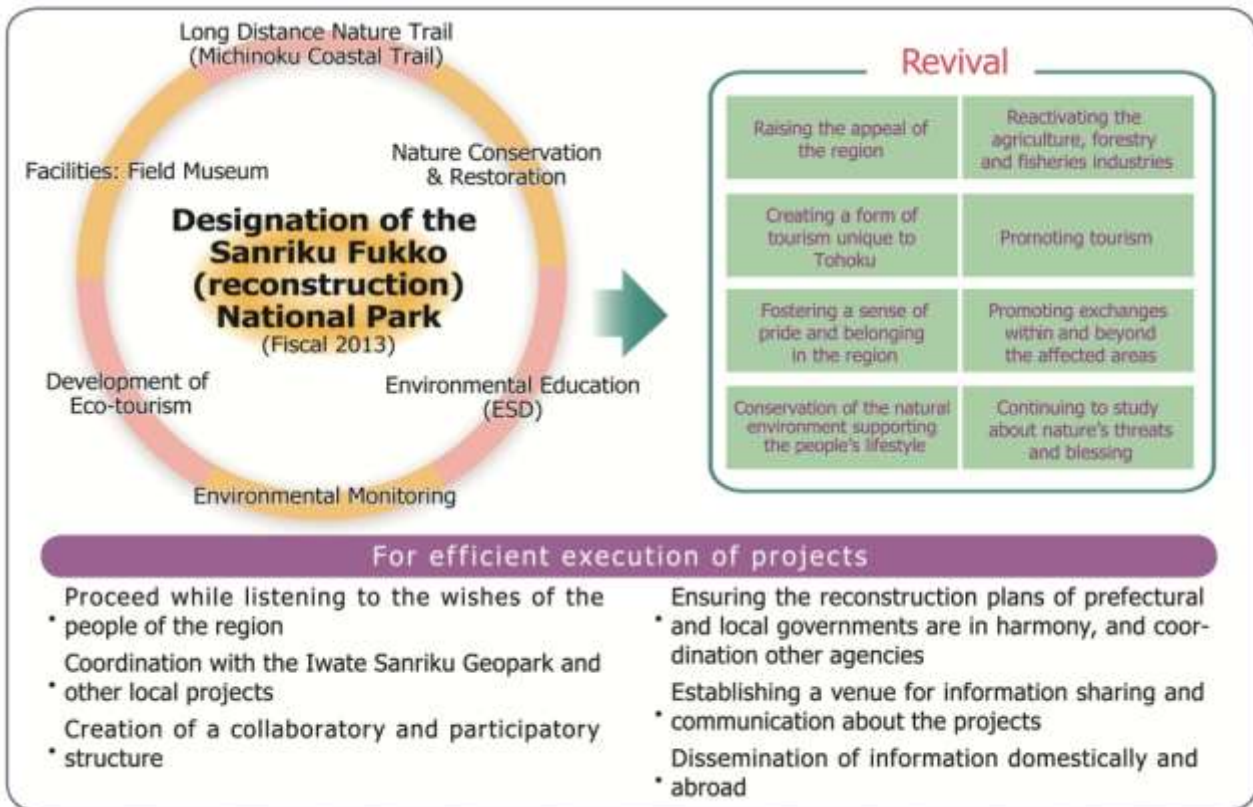


Figure 2: Green reconstruction centered on creating the Sanriku Fukko National Park. Source: Ministry of the Environment



Sanriku Fukko National Park, Japan © Ministry of the Environment

COMMUNICATING TO AN INTERNATIONAL AUDIENCE

The Sanriku Fukko National Park idea has attracted substantial international attention when introduced at international venues such as the Preliminary Asia Parks Congress in Tokyo in November 2011 and the IUCN World Conservation Congress, Jeju, Korea in September 2012.

Further presentations and updates are planned for the first Asia Parks Congress in Sendai, Japan in November 2013. By broadcasting this information internationally, we hope that the initiative will become an international model for the role that conservation policies have to play in recovery from a disaster.

In 2014, the World Parks Congress will also have a particular theme on protected areas and DRR. Then in 2015, the global community will be agreeing its next ten year strategy for international disaster risk reduction at the 3rd UN World Conference on Disaster Risk Reduction in Sendai, Japan. These sequence of events provide an opportunity to raise the profile of protected areas as tools for disaster risk reduction and provide more complete guidance to park managers, governments and other stakeholders about how such benefits can be maximised.

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Nakanohama Campsite which will be utilized as a venue for learning how dangerous nature can be © Ministry of the Environment

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Radhika Murti is the Programme Coordinator for nature based solutions to disaster risk reduction (DRR) at IUCN's headquarters. Radhika works with IUCN offices and members around the world to implement pilot projects in ecosystem based DRR, develop national and local capacities for policy makers and collaborates with universities/research institutes to collate scientific evidence on the role of nature in DRR. Additionally, Radhika also acts as the focal point for IUCN's engagement with Hyogo Framework for Action processes and works with relevant thematic programmes to promote integration of DRR and climate change adaptation strategies.

RESUMEN

Los costos de las tormentas, inundaciones, terremotos, deslizamientos de tierra, marejadas y la desertificación están aumentando; y con cada evento también se pierde capital natural en términos de ecosistemas saludables, especies y servicios de los ecosistemas. A pesar del aumento de la inversión en estrategias para la reducción del riesgo de desastres (RRD), más de un millón de personas murieron en la última década como resultado de desastres naturales. Es preciso replantearnos cómo debemos gestionar la RRD. Una estrategia poco reconocida y desaprovechada hasta la fecha es la función de los ecosistemas naturales en la protección contra los desastres y la mitigación de sus efectos y el papel de las áreas protegidas en el mantenimiento de estos servicios de los ecosistemas. Este editorial analiza cómo pueden las áreas protegidas apoyar la RRD y se basa específicamente en las reacciones al gran terremoto que sacudió el este de Japón en 2011.

RÉSUMÉ

Les coûts économiques associés aux tempêtes, inondations, tremblements de terre, glissements de terrain, à la montée des océans et à la désertification sont en augmentation, et à chaque événement le capital naturel est également perdu en termes de santé des écosystèmes, des espèces et des services écosystémiques. Malgré l'augmentation des dépenses liées à la réduction des risques de catastrophe (RRC), plus d'un million de personnes ont péri à la suite de catastrophes naturelles au cours de la dernière décennie. Nous devons **repenser la manière de gérer la RRC. L'un des stratégies mal reconnues et sous-exploitées à ce jour est le rôle des écosystèmes naturels dans la protection contre les catastrophes et pour leur atténuation, et l'implication des aires protégées dans le maintien de ces services écosystémiques. L'éditorial suivant examine comment les aires protégées peuvent soutenir la RRC, et s'appuie notamment sur les réponses au violent séisme et tsunami de 2011 dans l'est du Japon.**



NATURE NEEDS HALF: A NECESSARY AND HOPEFUL NEW AGENDA FOR PROTECTED AREAS

Harvey Locke

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ABSTRACT

Conservation targets should be based on what is necessary to protect nature in all its expressions. When in **1988 the Brundtland report called for tripling the world's protected area estate (which was then at 3 to 4 per cent of the land area)** there was a strong belief that sustainable development would ensure the proper care for nature on the rest of the unprotected earth. This has proven wrong. We therefore must materially shift our protected areas target to protect at least half of the world, land and water, in an interconnected way to conform with what conservation biologists have learned about the needs of nature. Instead we have set goals that are politically determined, with arbitrary percentages that rest on an unarticulated hope that such non-scientific goals are a good first step towards some undefined better future outcome. This has been a destructive form of self-censorship. It is time for conservationists to reset the debate based on scientific **findings and assert nature's needs fearlessly.**

KEYWORDS: protected area targets, expansion, coverage,

INTRODUCTION

It is well settled scientifically that humanity's relationship with the natural world is in trouble. The Intergovernmental Panel on Climate Change (Parry et al, **2007**) stated bluntly: "The resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change, associated disturbances (e.g., flooding, drought, wildfire, insects, ocean acidification), and other global change drivers (e.g., land use change, pollution, overexploitation of resources)". The human species has become so dominant that some argue we have entered a new geological age dominated not by the chemical and physical workings of the earth as they exist under their own motion from time to time but by us humans and they propose we call this new period the Anthropocene (Zalasiewicz et al., 2011).

This is not new. Our species' troubled relationship with nature has been widely understood for 25 years. In 1988 the United Nations published *Our Common Future*, known widely as the *Brundtland Report* (World Commission on Environment and Development, 1987). It stated "As the century closes, not only do vastly increased human numbers and their activities have that power [to alter planetary systems], but major unintended changes

are occurring in the atmosphere, in soils, in waters, among plants and animals and in the relationships among all these."

A few years later the "World Scientists' Warning to Humanity", which was signed by the majority of the living Nobel Prize winners in science at the time, said starkly: "Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources. If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about" (Union of Concerned Scientists, 1992).

The concerned scientists identified the need to bring environmentally damaging activities under control in order: "to restore and protect the integrity of the earth's systems we depend on" and stated that "We must halt deforestation, injury to and loss of agricultural land, and the loss of terrestrial and marine plant and animal species."



Galapagos National Park, Ecuador © Nigel Dudley

THE FIRST GLOBAL CONSERVATION TARGETS FOR PROTECTED AREAS: 10 OR 12%

Protected areas were identified by the authors of the Brundtland Report as a critical response to the troubled relationship between humanity and the rest of nature. **They called them “areas managed explicitly to conserve species and ecosystems” and stated: “Conservation of living natural resources - plants, animals, and micro-organisms, and the non-living elements of the environment on which they depend - is crucial for development. Today the conservation of wild living resources is on the agenda of governments: nearly 4 per cent of the Earth’s land area is managed explicitly to conserve species and ecosystems, and all but a small handful of countries have national parks.”**The chapter concluded **“a consensus of professional opinion suggests that the total expanse of protected areas needs to be at least tripled if it is to constitute a representative sample of Earth’s ecosystems” (World Commission on Environment and Development, 1987).** This led to the first widely accepted goals for protected areas. Depending on who did the math it became the 10 per cent goal or the 12 per cent goal for global protected areas. Note that the goal spoke to representation of ecosystems.

A GLOBAL TARGET EMERGES FROM THE CONVENTION ON BIOLOGICAL DIVERSITY

The urgency of the scientific declarations in the late **1980s and early 1990s about humanity’s failing** relationship with nature led to the Earth Summit in Rio di Janeiro in **1992. Many of the world’s political leaders** attended. They signed two conventions intended to confront the integrated problems: the Framework Convention on Climate Change and the Convention on Biological Diversity (UN, 2013). The objective of **The Convention on Biological Diversity (CBD) is “the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources”. Biological diversity was defined as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.”**

The CBD’s provisions institutionalized protected areas as a key strategy to protect biodiversity. The CBD defines a protected area as “a geographically defined area which is designated or regulated and managed to achieve specific

conservation objectives". It provides at Article 8 for In-Situ conservation and the first five items speak directly to **protected areas**: **"Each Contracting Party shall, as far as possible and as appropriate:**

- (a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;
- (b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;
- (c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;
- (d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;
- (e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a **view to furthering protection of these areas; ...**".

In 2002 the parties to the CBD did a strange thing. They set a non-numerical goal that was designed to slow down the bleeding of life from the Earth but did not seek **expressly to conserve biodiversity. The goal was "to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth."** (SCBD, 2002).

In the Foreword to the *2010 Global Biodiversity Outlook 3*, an assessment of the state and trends of biodiversity in the world, UN Secretary General Ban-Ki Moon summarizes how ineffective this slow the bleeding **approach was: "In 2002, the world's leaders agreed to achieve a significant reduction in the rate of biodiversity loss by 2010. Having reviewed all available evidence, including national reports submitted by Parties, this third edition of the Global Biodiversity Outlook concludes that the target has not been met."** (SCBD, 2010a).

In 2012 at Nagoya, Japan the failure of this approach was recognized by the parties to the CBD and a more specific **Target 11 for protected areas was set: "By 2020, 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, are conserved through effectively and equitably managed, ecologically representative and well connected (sic) systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes."** (SCBD, 2010b).

While these references to protected areas in the broader landscape and connectivity are important new developments, no scientific rationale is given for the protected area targets of 17 per cent land and 10 per cent marine. Nor was a longer term target set against which these might be considered mileposts.

In 1998, one of the fathers of conservation biology, Michael Soule, and his then student, Sanjayan, published a **provocative paper 'Conservation Targets: Do they help?'** in which they demonstrated protecting only 10 per cent of the Earth would not protect biodiversity (Soule and Sanjayan, 1998). No other paper has scientifically defended such low numerical targets.

WHAT SCIENTIFIC ANALYSIS SUGGESTS PROTECTED AREA TARGETS OUGHT TO BE

In a world where humans were just one species interacting among many we would not need protected areas. This was the case for most of human history. Now we need them.

It is clear from a plain reading of its text that the goal of the CBD (and by extension of the 193 state parties to it) is to preserve nature, defined as biodiversity, with protected areas as an essential tool. It should follow that all the work done in furtherance of that Convention should be based on the best scientific answer to the **question 'what does nature need in order to conserve biodiversity and how do we get there given the desires of humans?'** **Strangely that is not what has happened. Instead, the focus has been 'what are humans willing to spare'. This of course is political, not scientific, and suffers from the basic flaw that it does not seek an effective solution to the problem the CBD was created to address. So what is the best scientific information on how much we should protect?**

Noss and Cooperrider (1994) concluded that in most regions 25 per cent to 75 cent (or on average 50 per cent) of an area will need protection to maintain biodiversity and ecological processes. In 2000 a poetic suggestion for the amount of protected areas needed came from biologist and author E. O. Wilson (2003) who called for **"Half the world for humanity, half for the rest of life, to make a planet both self-sustaining and pleasant."** Tropical ecologist John Terborgh (2006) noted half the world was degraded and called for the protection of the **other half. Pressey et al. (2003) noted that "recent comprehensive conservation plans have delineated around 50% or more of regions for nature conservation"**. Svancara et al. (2005) reviewed 159 articles reporting or proposing 222 conservation targets and assessed

differences between policy-driven and evidence-based approaches. By evidence-based approaches they meant an adequate understanding and mapping of the distribution and viability of the conservation requirements of individual biodiversity features such as species and vegetation types and found that the average percentages of area recommended for evidence-based targets were nearly three times as high as those recommended in policy-driven approaches.

Co-ordinated by the Canadian Boreal Initiative (borealbirds, 2007), 1500 scientists from over 50 countries around the world came together to write to **Canadian governments to urge protection of “in the range of half” of that country’s vast boreal forests. Their letter included the following succinct summary of the widely known conservation science: “The relatively intact state of Canada’s northern Boreal region provides an opportunity to implement conservation strategies to protect the region’s ecological integrity. The field of conservation biology identifies four objectives that must be achieved to ensure the long term viability of an ecosystem: 1) all native ecosystem types must be represented in protected areas; 2) populations of all native species must be maintained in natural patterns of abundance and distribution; 3) ecological processes such as hydrological processes must be maintained; and 4) the resilience to short-term and long-term environmental change must be maintained. Achieving these objectives requires an extensive interconnected network of protected areas and sustainable management of the surrounding areas. Reviews of previous conservation planning initiatives provide further direction by indicating that protected areas should cover in the range of half of the landscape to achieve the objectives listed above.” Note that representation, the basis of the 10 per cent or 12 per cent goal that began with the Brundtland Report, remains fundamentally important but is only one of four elements needed to sustain ecosystems over time.**

Rodriguez and Gaston (2001) considered the needs of species and found the minimum percentage of area needed to represent all species within a region increases with the number of targeted species, the size of selection units, and the level of species’ endemism and stated that **“the 10% target proposed by the IUCN is likely to be wholly insufficient, and that much larger fractions of area are estimated to be needed, especially in tropical regions.” In 2004 the Nature Conservancy, the Nature Conservancy of Canada and other partners concluded their multi-expert driven assessment of an area of mountains and valleys that straddles the Canada-US border. The goal of the conservation assessment was to**

identify the suite of conservation sites and strategies that ensure the long-term survival of all native plant and animal species and natural communities in the region. They assessed with a coarse filter 40 terrestrial systems and 77 aquatic systems and with a fine filter 75 rare plant communities, 95 rare plants and 56 animals. They combined target plant and mammal species (both terrestrial and aquatic) in a SITES optimization model. They concluded that 49.7 per cent of the region should be in conservation areas but noted this did not address connectivity needs for wide ranging mammals (Nature Conservancy of Canada, 2004).

Traditional ecological knowledge combined with western science has reached the same conclusion on at least one occasion. Grand Chief Herb Norwegian (2005) described a process in which elders were consulted about their traditional use of the boreal forests and mountains along **the Mackenzie River in Canada’s Northwest Territories** and developed a land use plan that called for the conservation of more than half of the Dehcho region in an interconnected network of protected areas.

In a 2012 editorial in *Conservation Biology*, Noss et al. (2012) surveyed several studies of the percentage of area needed and compared those results with politically derived targets. They noted that current political and convention targets tended to be much lower than those based on scientific assessment, review and expert opinion where the mid-point of the range of evidence-based assessments was slightly below 50 per cent and called for a precautionary target of 50 per cent. They **concluded “Nature needs at least 50% and it is time we said so”.**

THE MEANING OF PROTECTED AREA

The CBD definition of protected area noted above is “a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives.” **This definition does not provide specific guidance about the range of protected area types that could be adapted to different situations. In the mid-2000s IUCN’s World Commission on Protected Areas engaged in a multi-national expert consultation process to update its guidelines for protected areas that culminated in a summit in Almeria, Spain in 2007 (Dudley and Stolton, 2008). That process came up with a useful definition of protected area that is adopted for the purposes of this paper: “A specifically delineated area designated and managed to achieve the conservation of nature and the maintenance of associated ecosystem services and cultural values through legal or other effective means.” (Dudley, 2008). This includes the six**



Nahanni National Park Reserve, Canada © Nigel Dudley

categories of protected area recognized by IUCN for some time: strict nature reserve/wilderness area, national park, natural monument, habitat/species management area, protected landscape/seascape and managed resource protected area. While some of these categories allow some resource extraction for local use, industrial activity is not included. This can be described as the difference between tapping sap from a maple or rubber tree and cutting trees down to feed to a pulp mill. Notably, the governance framework of these protected areas can range from international, national, provincial, regional, municipal, indigenous, community, NGO or individual as long as the area is managed and dedicated by legal or other effective means.

PROTECTING HALF OF THE EARTH'S LANDS AND WATERS

Conservation targets expressed in percentages can be misleading and will not be effective to protect the full range of life on earth if they are rotely numerical or area-based. In other words, protecting all of Antarctica is an excellent idea and would materially enhance the percentage of the world protected and do great things for life there but would do nothing for tigers, toucans, lions or grizzly bears. To halt and eventually reverse the **terrible trend demonstrated in IUCN's Red List of Endangered Species** we ought to apply across all ecoregions of the world the four broadly accepted conservation planning principles adopted by the 1500 **signatories to the Boreal Scientists' Letter**. To recap, those are: represent all native ecosystem types in

protected areas as well as protect sufficient area to maintain populations of all native species in natural patterns of abundance and distribution, ecological processes such as fire and flooding, and resilience to short-term and long-term environmental change.

The idea of protecting half gives a better sense of the **order of magnitude of protected areas required than "50 per cent" which might imply a mathematical formula of universal application**. What is required is principled study and conservation planning based on each **ecoregion's unique characteristics followed by determined implementation of the results**. When such rigorous study occurs it usually results in a finding that we should protect about half of any given ecoregion. Some noted conservation biologists have expressed private opinions to the author that that may well be too low a figure. Thus it would be most accurate and precautionary to say nature needs at least half.

CONNECTIVITY AMONG PROTECTED AREAS

In addition to the question of how much is needed in protected areas is the now widespread scientific understanding that these areas must not only be protected but also connected to each other to allow for gene flow and to adapt to climate change (Dudley, 2008; Locke and Mackey, 2009; Heller and Zavaleta, 2009; Worboys et al., 2009; Nature, 2011; Noss et al., 2012). Hodgson et al. (2009) issued an important reminder that connectivity is a supplement to and not a substitute for core protected areas.

NATURE ON THE OTHER HALF

Lands outside of protected areas can be valuable for some species and are worthy of attention. They can provide connectivity between habitat patches and support migratory processes for birds and insects. Some species even thrive in landscapes fragmented by humans (e.g. the white-tailed deer - *Odocoileus virginianus*) and a few even thrive in high urban concentrations of humans (e.g. Norwegian rats - *Rattus norvegicus* and rock doves - *Columba livia*). But many species are habitat specialists and human-altered habitats do not support them. Intensely cultivated lands on which chemically supported agriculture is practised have very low value for biodiversity. Humans on pasture lands outside of protected areas tend to have very low tolerance of species that compete with us for meat or forage for domestic animals. Thus we kill them or erect impermeable fences to exclude them that also have the effect of fragmenting the landscape, which can terminate critically important seasonal migrations of large mammals. Humans outside protected areas often make large efforts to suppress inconvenient natural processes like fire and flooding that are vital to the ecosystem dynamics on which many species depend. So while lands intensely used by humans support some threads of nature (and more nature friendly practises should be encouraged on them) they cannot support the full tapestry of life. Simply put, we need to share the world with nature.

SELF-CENSORSHIP IN THE CONSERVATION COMMUNITY WHEN IT COMES TO TARGETS

The closing session at the World Wilderness Congress, WILD 9 in Merida, Mexico (2009) called for the protection of at least half the world in an interconnected way (Natureneedshalf.org). Many delegates from many countries were wildly enthused (e.g. Harman, 2009). Some of them sought to carry that idea into the negotiations at the CBD. When those enthusiasts returned to other settings censorship set in along these **lines 'Of course that is correct, but we will not be taken seriously' or 'We must be realistic about what is politically achievable and that is not'. This self-censorship raises important questions about the role and function of ideas in society and of park professionals as social participants.**

Ideas clearly expressed have the most power. We in the parks community have the best product in the world to sell - intact nature with its myriad benefits for our species. We have a rational foundation for our passions. The science is that nature needs about half. Some of our caution can no doubt be explained by the fact that many

park professionals work for governments who set the policy context for their work. There is no mandate to **state one's own preferences and goals in such an institutional setting.** That is entirely true and right. But this rationale does not apply to non-government organizations whose role in civil society is to say the things that governments ought to do and to help find ways to bring that about.

The explanation for NGO caution could be found in the concern that the expression of ideas too radical will result in exclusion from participating in certain *fora* to **the detriment of one's institution's work or one's own career.** The concern is that it is better to be there in a less than perfect process than it is to be excluded or humiliated. Fear of the loss of such status or access is the motivation for self-censorship. **This is a loser's game.**

A different but cynical explanation for self-censorship could be that NGOs are very invested in their programmes and priorities and fear that their donor relations require them to keep inconvenient new ideas away. This would be shameful conduct and requires no further comment than that.

The basic problem with self-censorship in an NGO setting is that it focuses on the actors not the outcome. The agreed outcome sought by the CBD should drive **behaviour. Its purpose is 'the conservation of biodiversity'. If no one brings forward the best scientific knowledge of what is needed to achieve the CBD's central goal then we are doomed to fail.** AIDS advocates cannot back down when sexual transmission of disease is denied by politicians nor can doctors back down when the health effects of tobacco are denied, for to do so would fundamentally impair their cause. So it is with advocates for nature conservation - we should insist on that which is necessary to keep nature healthy. We can do it politely and thoughtfully but do it we must.

Another possible explanation that does not involve self-censorship is that after assessment, NGOs conclude that there is no possible way that such a goal as nature needs half could be met and therefore it should be discarded. The thinking could be that in some places with huge human populations and vast intensive agriculture such a goal seems so fanciful as to be absurd. Though lower targets are known not to be sufficient they are better than nothing and their deficiencies are better left unsaid. This approach is rooted in pessimism but is called realism by **its proponents. The problem is that such 'realism' denies possibilities that are real without first taking the chance to bring them about.** Hope is suspended and a dark future guaranteed.



Serengeti National Park, Tanzania © Sue Stolton

PROTECTING AT LEAST HALF OF THE EARTH IS A VIABLE GOAL

There are several examples from around the world in which the nature needs half goal has already been realized through public policy. In western North America, there are several examples of governmental action to protect at least half of a region. On Haida Gwaii, British Columbia (previously known as the Queen Charlotte Islands) a mix of national park, provincial park and First Nations conservation has resulted on over 50 per cent protection of the terrestrial system and an initial marine conservation area. In Boulder County, Colorado, **located in that state's heavily populated Front Range, a combination of national park, federal wilderness areas, city and county parks, and private land conservation has protected over 50 per cent of the County** ([natureneedshalf.org/case studies](http://natureneedshalf.org/case-studies)). The Capital Regional District of Victoria, British Columbia has set a goal of protecting at least 50 per cent of its lands and waters **after a public process that saw it explicitly “subscribing to the idea that nature needs half”** (Capital Regional District, 2012). Note the varied forms of governance types that have achieved the nature needs half goal.

On the Indian subcontinent, the ancient kingdom of Bhutan recently announced that it has achieved 50 per cent protection by putting over 42 per cent of its land in protected areas and over 8 per cent in biological corridors (Bhutan; [natureneedshalf.org/case studies/Bhutan](http://natureneedshalf.org/case-studies/Bhutan)). The Seychelles archipelago is over 50 per cent

protected “as a contribution to fulfilling its obligations under the Convention on Biological Diversity” (IUCN, 2013). The Galapagos Islands of Ecuador are much more than 50 per cent protected.

The Serengeti ecosystem in Tanzania and Kenya is over 50 per cent protected. The Canadian Rockies biome in Alberta, Canada is about 65 per cent protected through a mix of national parks, and provincial parks and wilderness areas. The American portion of the Crown of the Continent Ecosystem in Montana is over 50 per cent protected by national park and wilderness designation and a similarly high percentage of park and wilderness areas is present in the core of the Greater Yellowstone Ecosystem. It is no coincidence that these areas in the Yellowstone to Yukon region and East Africa still support all their native species.

An obvious retort to these examples is that they are areas that have received special attention and are far way from large population centres. As to receiving special attention, yes they have and they should be taken as examples of how we should treat the whole world. As to their distance from population centres, this raises a different concern. Is it impossible to do something like this in the crowded areas of places like Europe, India, China or the east coast of North America? We are unlikely ever to protect half of the best agricultural land that has been in production for centuries. We may not even want to because we like the food it produces. But so

much marginal land has been brought into cultivation in the last 250 years that we could make enormous inroads in restoring it.

In eastern North America most of western **Massachusetts, Vermont, New Hampshire and Quebec's** Eastern Townships were denuded of forests by farmers, sheep grazers, loggers and charcoal makers. But the land was marginal and largely abandoned as other lands became available. Today there is extensive forest cover across the region and significant species recovery. In upstate New York the 2 million ha Adirondack Park was created in 1895 to recover cut-over lands whose degradation threatened downstream water quality. Today over half it is managed as Forever Wild under the New York State constitution.

The rewilding of Europe has occurred at a remarkable rate as marginal hill and mountain farms are being abandoned by a declining population. The corresponding recovery of large mammals, including brown bears (*Ursus arctos*) western Europe is remarkable. Natura 2000 (www.natura.org) was a deliberate pan-European **policy that increased Europe's protected areas to 20 per cent** and some jurisdictions like Germany are seeking formally to protect wilderness.

The short term feasibility of an idea does not invalidate the idea. It simply shifts to becoming an aspirational goal.

A PHILOSOPHICAL MOMENT FOR THE PROTECTED AREAS MOVEMENT

We in the nature conservation community are at a philosophical crossroads. No one who studies the global state of nature could be satisfied. Indeed things are bad and getting worse with a few happy exceptions (IUCN Red List, 2013). We are not meeting the goals of the CBD.

At moments of philosophical crisis there are two ways one can turn. One is in the direction of deeper determination, higher aspiration and courageous commitment to clear ideals. This is what the persecuted Christians did during the Roman Empire and ultimately converted its rulers to their way. This is what the US Civil Rights movement has done and continues to do and that country now has a second term black president. This is what the Nature Needs Half movement seeks to do: collectively assert a vision in which humanity returns to being one species among many that is humble enough to understand that we must protect all life and the processes it depends on for own well-being and because it is ethically the right thing to do. It is about fixing the

human relationship with nature by recognizing that any relationship needs mutuality to be healthy (Martin, 2010). **This is called 'radical hope' because though the idea is clear the course of action that will make it possible is not yet fully clear** (Lear, 2006).

The other road to follow is to decide that the goal of biodiversity conservation as set out in the CBD is impossible and to set a new agenda. Thus some post-modern conservationists consider this a time of defeat and that now is the moment to abandon traditional conservation goals based on parks and wilderness areas. Instead the Green Postmodernists would have us embrace the idea that we should convert the Earth to a garden that serves the interests of local people and urban dwellers (Marvier et al., 2012). This of course would mean the end of inconvenient and difficult to conserve species like grizzly bears, tigers, lions and elephants. It would also mean concerted efforts to prevent the natural and necessary but deeply disruptive processes of renewal such as fire and flooding (Locke, in press).

The death of the wild in favour of the garden with *homo sapiens* triumphant is no vision for those who proclaim to love nature. It will also inevitably be disastrous for the human species. We do not know how to run the world. It is time for our species to become humble and wise and to stop being greedy and clever (Locke, 2013).

Philosopher Immanuel Kant summed up the human dilemma with two questions: *What can I know?* and *What ought I to do?*. These are appropriate questions for conservationists in the 21st century. And we can answer them. We know that nature needs at least half. We ought to assert it even if it is not clear that we will succeed. Our failure to do so will likely guarantee failure of the conditions that support life on earth.

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continuous corridor for wildlife from Yellowstone National Park in the United States to the Yukon in Northern Canada and of the global Nature Needs Half **movement**. **In 1999 Locke was named one of Canada's** leaders for the 21st century by *Time Magazine Canada*.

RESUMEN

Los objetivos de conservación se deben fundar en lo que sea necesario para proteger la naturaleza en todas sus expresiones. Cuando en 1988 el informe Brundtland pidió triplicar el patrimonio de áreas protegidas del mundo (que entonces representaba entre el 3 y el 4 por ciento de la superficie terrestre), existía el firme convencimiento de que el desarrollo sostenible garantizaría la protección de la naturaleza en el resto de la tierra desprotegida. Esta apreciación demostró ser errónea. De ahí que debemos cambiar sustancialmente nuestros objetivos en materia de áreas protegidas a efectos de proteger al menos y de manera interconectada la mitad de la tierra y el agua del mundo, para adecuarnos a lo que los biólogos conservacionistas han aprendido acerca de las necesidades de la naturaleza. En lugar de esto, hemos establecido objetivos definidos políticamente, con porcentajes arbitrarios que se apoyan en una expectativa desarticulada de que tales objetivos carentes de una base científica son un buen primer paso hacia un mejor aunque indefinido resultado futuro. Esta ha sido una forma destructiva de autocensura. Es hora de que los conservacionistas reanuden el debate fundado en conclusiones científicas e impongan sin temor alguno las necesidades de la naturaleza.

RÉSUMÉ

Les objectifs de la conservation doivent être établis en fonction de ce qui est indispensable pour protéger la nature, dans toutes ses dimensions. Lorsque les rédacteurs du rapport Brundtland préconisaient, en 1988, **de tripler la superficie mondiale des aires protégées (qui était à l'époque de 3 à 4 pour cent de la surface terrestre)**, ils étaient persuadés que le développement durable aidera à maintenir la nature sur les terres **non protégées restantes. Les bénéfices prévues du développement durable n'ont pas été réalisées. Nous** devons donc matériellement modifier notre objectif concernant les aires protégées et protéger au moins la moitié du monde, terre et mer, de façon interconnectée, afin de prendre en compte les dernières découvertes des biologistes de la conservation sur les besoins de la nature. Cependant, plutôt que de suivre cette voie, nous établissons des objectifs politiquement déterminés et dénués de fondement scientifique, avec des pourcentages arbitraires basés sur le vague espoir selon lequel ces objectifs seraient un premier pas satisfaisant vers un meilleur futur – **qui n'est jamais précisé . Cette forme d'autocensure est destructive. Il est temps que les conservationnistes rouvrent le débat en se basant sur les études scientifiques et qu'ils** affirment clairement les besoins de la nature.



THE SERENGETI OF ASIA: CONSERVATION IN TWO MAJOR PROTECTED AREAS OF THE EASTERN PLAINS LANDSCAPE PROTECTED AREA COMPLEX, CAMBODIA

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ABSTRACT

The Eastern Plains landscape of Cambodia still has extremely good forest cover over a large area but wildlife populations remain low after many years of civil unrest and hunting pressure. Over the past decade concerted conservation efforts of WWF in collaboration with the Royal Government of Cambodia in the Mondulkiri Protected Forest and Phnom Prich Wildlife Sanctuary, the two major protected areas in the landscape, have demonstrated modest successes in curbing illegal activities and gaining community support for forest protection. These conservation efforts include rigorous and regular monitoring of biological diversity, effective law enforcement monitoring using latest tools, gaining community support for forest protection through awareness and livelihood interventions. This programme shows the different aspects of management which need to be considered for protected areas to be effective and at the same time reflects the need for long-term investment in conservation in order to see progress and the requirement to address policy, social, economic in addition to biological factors to ensure sustainability.

KEYWORDS: monitoring, tigers, law enforcement, Mondulkiri Protected Forest, Phnom Prich Wildlife Sanctuary, Eastern Plains Cambodia, protected area management

INTRODUCTION

Heralded in the 1950s as the ‘Serengeti of Asia’, the dry forests of Eastern Cambodia once supported some of the greatest aggregations of large mammals in South-East Asia (Wharton, 1957). This area, known as the Eastern Plains Landscape, saw considerable turmoil over the last four decades of the 20th century as Cambodia struggled through civil war, the Pol Pot regime and invasion by Vietnam. During this dark period, biodiversity and natural resources declined at a frightening rate (Global Witness, 2007). Though protected areas were unofficially designated before forest protection legislation came into existence in early 2000, easy availability of guns, absence of any environmental law enforcement and civil unrest resulted in the widespread hunting of wildlife for food and trade, and large-scale logging of many forests (Loucks et al., 2008). The first protection legislation, the Forestry Law, was approved in 2002 to protect the

Kingdom’s forests and wildlife. Shortly after, the Protected Area Law (2003) came into force, to provide a means of legally designating and protecting land for biodiversity, such as National Parks and Wildlife Sanctuaries. After a decade of concerted efforts from a range of government agencies and conservation partners, some wildlife populations now appear to be recovering in parts of Cambodia, including in the Eastern Plains.

The Eastern Plains spreads over approximately 1.6 million hectares at the core of the Lower Mekong Dry Forest Ecoregion in Mondulkiri, Ratanakiri and Kratie Provinces in Cambodia, and Dak Lak Province in Vietnam. The Lower Mekong Dry Forest is considered one of the 200 most important Ecoregions for global biodiversity by WWF (Olson & Dinerstein, 1998; Wikramnyake et al., 2002). The Eastern Plains Landscape is a complex of five protected areas—

Table 1: Details of the protected areas in the Eastern Plains Landscape

Protected Area	Size (ha)
Mondulkiri Protected Forest	372,971
Seima Protected Forest	301,867
Phnom Prich Wildlife Sanctuary	222,500
Lumphat Wildlife Sanctuary	252,525
Yok Don National Park	115,545

Mondulkiri Protected Forest, Phnom Prich Wildlife Sanctuary, Lumphat Wildlife Sanctuary, Seima Protected Forest, in Cambodia, and Yok Don National Park in Vietnam (Table 1; Figures 1 and 2). It supports the largest extant of lowland dry deciduous forest in Southeast Asia (Tordoff et al., 2005).

The Eastern Plains Landscape is home to many globally endangered and critically endangered mammals including Asian elephant (*Elephas maximus*), banteng (*Bos javanicus*), wild water buffalo (*Bulalus arnee*), Siamese crocodile (*Crocodylus siamensis*) and Eld's deer (*Cervus eldi*); critically endangered water birds like the giant ibis (*Thaumatibis gigantea*), white-shouldered ibis (*Pseudibis davisoni*) and white winged duck (*Cairina scutulata*) and three critically endangered vulture species - the red headed vulture (*Sarcogyps calvus*), slender-billed vulture (*Gyps tenuirostris*) and white-rumped vulture (*Gyps bengalensis*).

Around 50,000 people of multiple ethnic groups live in Mondulkiri Province with 59 per cent of them living below the poverty line (WWF, 2008). Many of these communities depend directly or indirectly on natural resources to support their livelihoods and subsistence needs.

While some conservation gains have been made over the last ten years, the rich biodiversity of the landscape remains under threat due to illegal logging, hunting, land clearing and other unsustainable uses of natural resources. On-going protection is thus vital. Continued granting of large economic land concessions within and around the protected areas, as well as mining and hydropower development create additional large-scale and serious threats to both forest and wildlife. The kouprey (*Bos sauveli*), **Cambodia's national animal**, and the Indochinese tiger (*Panthera tigris corbetti*) which

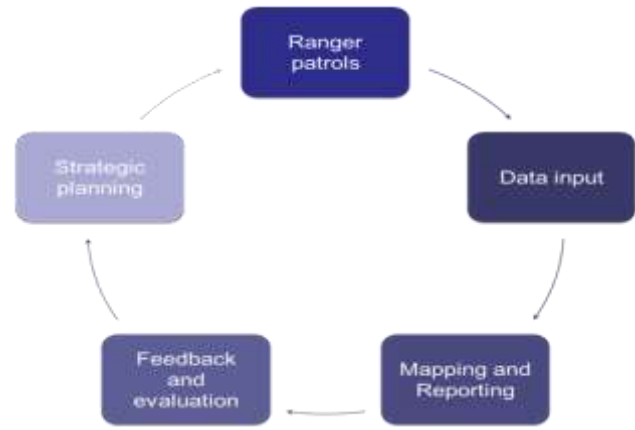


Figure 1: Basic adaptive feedback management model of law enforcement monitoring used in the EPL

once thrived in this landscape are almost certainly extirpated (Timmins et al., 2008; Gray et al., 2012) and the status and immediate future of many other species is uncertain unless immediate action is taken to reduce these threats.

INITIATIVES TO SUPPORT THE BIODIVERSITY

This paper focuses on two protected areas in the Eastern Plains Landscape, Mondulkiri Protected Forest (MPF) and Phnom Prich Wildlife Sanctuary (PPWS), where WWF works in collaboration with the Cambodian government for the protection of wildlife and their habitat. MPF is of particular national significance as it is the only Tiger priority source site identified in the National Tiger Recovery Plan of Cambodia (MAFF, 2010). Based on early biodiversity survey work, the areas were identified as priority sites for biodiversity conservation. WWF is providing both financial and technical support to the Ministry of Environment, Ministry of Agriculture, Forestry and Fisheries and the Provincial Government. Conservation actions are directed through a landscape strategic plan (see Lessons Learned, below), developed by those working in the area. The conservation strategy focuses around law enforcement, governance and policy development, community engagement, and biodiversity monitoring.

BIODIVERSITY MONITORING

WWF carried out the first biological survey in MPF and PPWS in 2000 and then regular biological surveys were conducted between 2000-2008 (Timmins & Ou, 2001; Claassen & Ou, 2006). A detailed baseline survey was conducted in 2009 as a basis for regular monitoring for priority species including large carnivores and their prey, Asian elephants and yellow-cheeked crested gibbons (*Nomascus gabriellae*) in the MPF and PPWS (Gray & Phan, 2011; Gray & Prum, 2011; Gray et al., 2011a; 2011b;

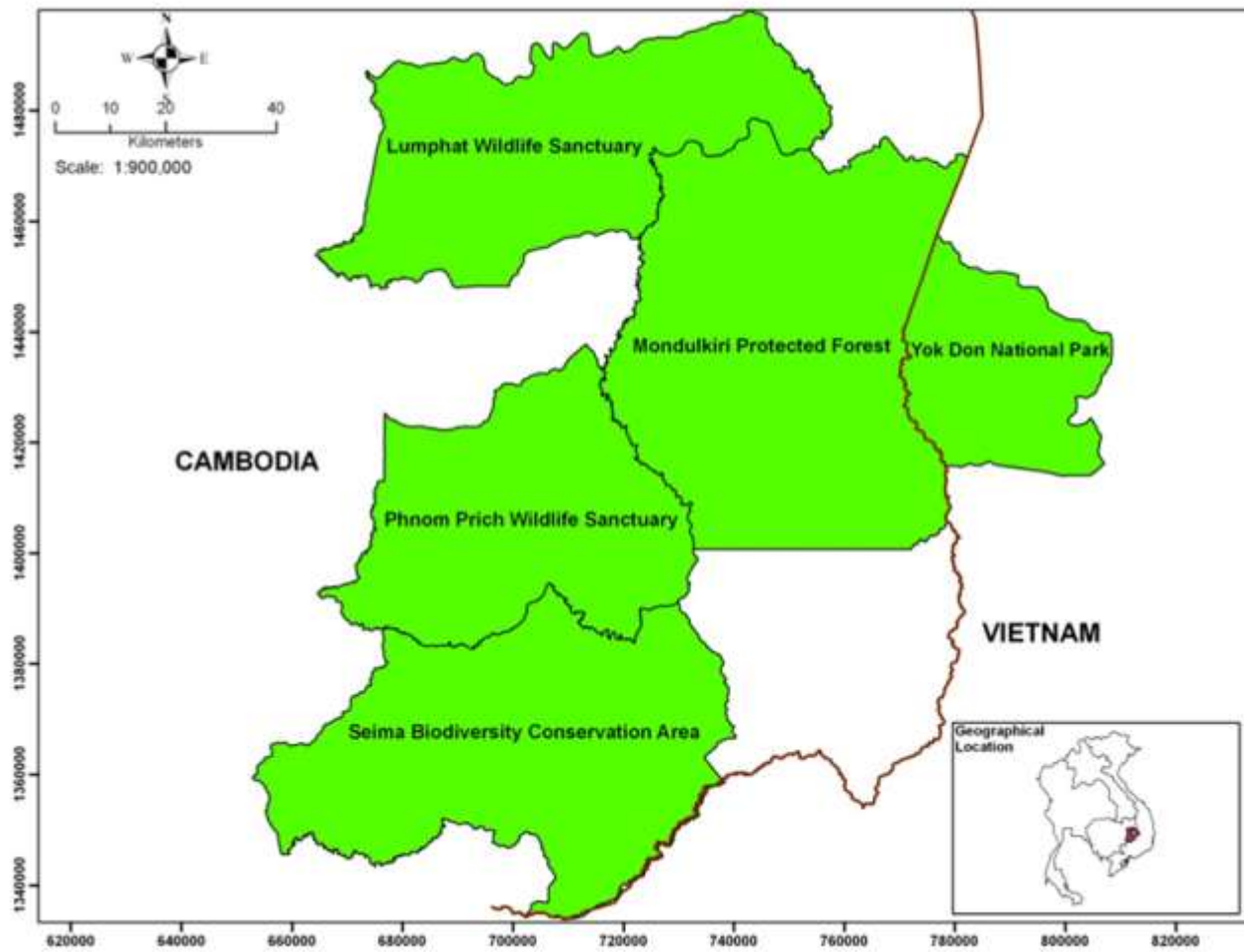


Figure 2: Protected area complex in the Eastern Plains Landscape, inset – mainland South-East Asia

Phan & Gray, 2009). Standard distance-based line transect sampling and camera trapping are used for monitoring ungulates and a range of other species, whilst new innovative techniques such as the use of scat detection dogs and DNA identification from faeces have been used to survey low density species such as Indochinese Tiger and Asian elephant (WWF-internal unpublished data; Gray et al., 2011b). Similar studies have also been conducted in the Seima Biodiversity Conservation Area (SBCA), an adjacent protected area in the landscape (WCS/FA internal data). Populations of large ungulates remain in the landscape, including **Banteng, Eld's deer, sambar (*Cervus unicolor*), gaur (*Bos gaurus*), red muntjac (*Muntiacus muntjac*) and wild pig (*Sus scrofa*).** Surveys suggest that these populations may be slowly recovering from earlier hunting pressure (Gray et al., 2011a) and the landscape is now home to globally significant populations of some species. For example, it **supports world's largest banteng population (Gray et al., 2012), and is an important regional stronghold for Eld's deer, Asian elephant, yellow-cheeked crested gibbon, giant ibis and white-shouldered ibis (*Pseudibis davisoni*).**

The presence of the landscape's arguably most charismatic species, the tiger, remains doubtful. A camera trap photograph from the MPF taken in November 2007 is the most recent confirmed evidence of tiger presence in Cambodia (Lynam, 2010). Despite extensive targeted camera trapping in PPWS and MPF and surveys using tiger scat detection dogs there has been no further concrete evidence of tigers in MPF and PPWS since then (WWF internal unpublished data). Similar studies have been conducted in Seima Protected Forest (WCS/FA internal data) with the same result. There have been reports of tiger footprints in MPF and PPWS respectively in 2008 and 2010 (unpublished ranger reports) but this evidence is inconclusive. This suggests that, if tigers persist in the landscape, there may be only one or two individuals.

Another globally important species, the Asian elephant, still remains in reasonable numbers in the landscape. The faecal-DNA based capture-mark-recapture method was used to establish a base line for the Asian elephant populations in MPF and PPWS. The results indicate



A herd of banteng in the core zone of Mondulkiri Protected Forest © Fletcher & Baylis

between 101 to 175 (mean 154) individuals in PPWS and a minimum of 21 individuals in MPF (Gray et al., 2011b). Movement of elephants between the two protected areas was observed over the 2009 dry season (Gray et al., 2011b), demonstrating the importance of a landscape approach and the need to maintain biological corridors for conserving viable populations of large, wide-ranging species such as elephant.

Biodiversity monitoring has demonstrated that the landscape has huge potential for wildlife conservation, and if adequately protected, wildlife populations can recover; however further research is required to determine the carrying capacity of the landscape.

LAW ENFORCEMENT

Law enforcement is the single most critical conservation action needed to protect the biodiversity of the landscape. Uncontrolled hunting, logging, land clearing and other unsustainable uses of natural resources **threaten the landscape's rich biodiversity. WWF has been** actively supporting enforcement activities in the landscape since 2006. Currently three major enforcement teams work in the landscape; ranger teams in MPF and PPWS for enforcement within the protected areas and a Mobile Enforcement Unit (MEU). The protected area teams conduct regular enforcement

patrols within the park boundaries and gather basic but vital information on key species. The MEU is responsible for monitoring international border transit points, checking markets and restaurants for wildlife products as well as gathering intelligence on wildlife and forest crime. It has been highly effective in responding to tip offs of wildlife crime and illegal logging activity within the province. A total of 64 rangers make up these three teams although, for two protected areas of this size, at least 90 would be more appropriate. Rangers patrol on foot, and by motorbike, elephant and boat. During the dry season, the majority of the patrols are done on motorbikes, however during the monsoon elephants are used as they provide greater access to remote areas. MIST—Management Information System—is an electronically based system used to monitor the patrol **efforts and to gather information on key species'** distribution and habitat quality (Stokes, 2010). Other monitoring tools are used for the systematic recording of enforcement data are the Informant Monitoring Tool and Wildlife Crime Database (WWF, 2012a). The Informant Monitoring Tool is designed to store all the information gathered by informants as a means of measuring their effectiveness. The tool has details of all informants, their target areas, information received from them and incentive provided to them. It also records the outcomes of the actions taken by law enforcement agencies, based

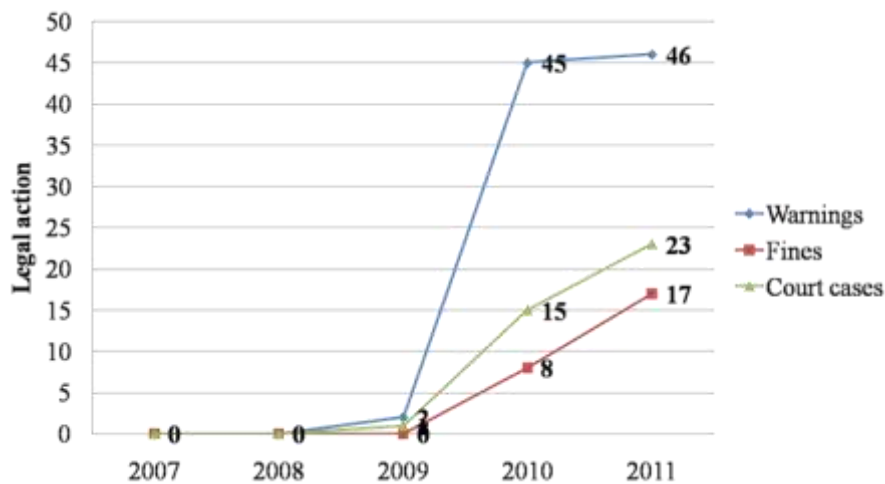


Figure 3. Legal action taken against forest and wildlife crime in the Eastern Plains Landscape, 2007–2011, including warning letters (blue), fines (red), and court cases (green)

on the information provided. The Protected Area Law and Forestry Law of Cambodia offer three types of legal action against forest and wildlife offences i.e. written warning, fines and court cases. The law also allows sanctions to become stronger for repeat offenders. However, in the past, neither the Provincial level Forestry Administration (FA) nor the Department of Environment (DoE) had a system for recording crimes and repeat offenders which made it difficult to track what legal action had been taken, and against whom, for forest and wildlife crime offences. To address this issue the Wildlife Crime Database was created in 2011 to manage the information on legal actions taken by FA and DoE against offenders in the Mondulkiri Province. The database is now managed by the provincial FA and DoE.

The protected area teams conduct monthly patrol planning to ensure effective patrolling and adapt strategies as appropriate. Patrol planning meetings are held in the forest at the ranger stations and are led by the protected area managers. A variety of information sources are used for patrol planning purpose, e.g. reviewing patrol block coverage and patrol routes, as well as information received from the communities or informants to ensure that, within a given time, the whole of the respective protected area has been patrolled and that hotspots of illegal activity are prioritized. Every enforcement ranger spends 16 days patrolling the forest, as well as seven days at their ranger outposts each month.

Between 2006 and 2011, the enforcement teams undertook 8,848 day patrols and 3,062 night patrols. Teams have confiscated a huge amount of wildlife articles and luxury timber. Around 359 m³ of luxury timber and 133 chainsaws were confiscated by the enforcement teams over this period (WWF, 2012a). Notable species seizures include wild water buffalo, leopard (*Prionailurus pardus*), sun bear (*Ursus*

malayanus), Eld's deer (*Cervus eldi eldi*), Asian elephant (*Elephas maximus*) and pangolin (*Manis javanica*), mostly hunted for wild meat, trophies or medicinal purposes. A few wildlife species that have been confiscated were destined for the pet trade or were being kept in captivity, including leopard cats (*Prionailurus bengalensis*) and green peafowl (*Pavo munticus*), but this is not common. According to the Forestry and Protected Area Law, only common species can be kept as pets and only with due approval from the concerned Ministries. The MEU is responsible for curbing such illegal activities. Over 250 animals that were fit for release were returned to the wild, while 10 in poor condition were sent to the Forestry Administration's Phnom Tamao wildlife rescue centre near Phnom Penh.

During any enforcement work, it is important that proper legal action is taken against the offenders. In the Cambodian context, legal action is especially important because sanctions under the law become more severe if the wildlife offender repeats their crime. Previously, very few court cases were filed by the enforcement agencies. Since 2010, however, due to the improvement in knowledge of the legal procedures by the enforcement teams, there has been a significant increase in legal action concerning wildlife and forest offences; 40 court cases were filed, 93 warning letters were issued and 25 offenders have been charged fines (Figure 3).

COMMUNITY ENGAGEMENT

There is broad recognition that community engagement is a key element of conservation management. In least developed countries such as Cambodia (UNCTAD, 2012), support for livelihoods is critical to help offset the restricted access to natural resources that can come with the designation of protected areas. Without these interventions it can be difficult to maintain community support for conservation. In the Eastern Plains, there



A tiger photographed in the core zone of Mondulkiri Protected Forest in 2007. This photograph is the most recent unequivocal evidence of Tigers in Cambodia ©FA-WWF-Cambodia

have been four major foci: awareness and education, community forestry, improving livelihoods through sustainable harvesting of non-timber forest products (NTFP) and ecotourism (WWF, 2012b). A socio-economic survey was conducted in 2007 and 2008 to target and better understand those communities depending on forest resources such as hunters, resin collectors and honey collectors (Mailing, 2007; WWF, 2008). Working in the area since then, the first three years of the project focused on building relationships with communities living in and around the MPF; with the same model being replicated later for PPWS. A key aim of the project was to improve the capacity of the local communities as de facto resource managers.

Under a parallel initiative, six Community Protected Areas, three Community Conservation Forests and two Community Fisheries have been established over the past six years (Figure 4). These areas are managed and monitored by the communities, with legal mandates under the Protected Areas, Forestry and Fishery Laws, respectively. Thirty-four patrol teams, consisting of local community members, cover 22,931 ha of forests in these areas (as of September 2012). Community patrol teams use MOMS (Management Oriented Monitoring System) to record information on illegal activities and wildlife in their area (Diggle, 2006; WWF, 2012b) which is then shared with relevant authorities for them to take action. Communities are allowed to manage and extract NTFPs in a sustainable manner within these areas, however hunting, land clearing and illegal fishing is banned. In community fisheries areas communities are allowed to

harvest fish sustainably for their own subsistence needs while protecting their areas from illegal fishing. Another activity initiated is sustainable harvesting of honey and supporting the communities in processing and marketing. Fifty-four of the poorest forest-dependent families have benefited through the programme and their annual income has increased on average from US\$ 150 in 2008 to US\$ 400 per family in 2012.

Ecotourism is another means of improving community livelihoods and strengthening the link between local communities and the forests. A community-based ecotourism feasibility study was done in the year 2007 (Bauld, 2007) and an ecotourism initiative was started in early 2009, resulting in the establishment of a community home stay at Dei Ey in the MPF. The homestay is a purpose-built building, managed by the community. In addition to providing income to the community, part of the resources earned from the tourism activities are used for supporting community patrol teams. Beside this, regular awareness programmes are conducted in villages as well in the schools. WWF also played an important role in building ecoclubs in local schools.

GOVERNMENT ENGAGEMENT

It is very important to engage with concerned government agencies from all levels to achieve the **protected area management and landscape goals**. WWF's strategy to achieve this includes; a full-time person for government liaison both at national and provincial level, monthly meetings and annual workshops with all stakeholders, and involvement in land use planning activities.

LESSONS LEARNED

As a result of a long-term engagement in these two protected areas in the Eastern Plains Landscape it is possible to draw out some key elements that helped to foster success.

1. Clear conservation strategy: a clear overall conservation strategy with constituent goals based on assessments of threats to the key biodiversity values of the landscape helps define and frame the work programme. Ideally, this should be reviewed throughout the project lifetime. In the Eastern Plains Landscape this was achieved through following the WWF Global Programme Standards Framework in MIRADI (Conservation Measures Partnership, 2009).
2. Identification of all stakeholders: it is important to identify the full spectrum of stakeholders right at the beginning of the project including those likely to be for or against some or all project activities. The role



Mondulkiri Protected Forest enforcement team © WWF

and impact of stakeholders needs to be reviewed on a regular basis and new stakeholders may need to be engaged as the situation develops. This was done early through social-economic surveys, threat analysis for both the protected areas and through government engagement. Based on the role of different stakeholders and threats the first landscape strategy was developed in 2007. As the situation may change rapidly in the landscape, it is beneficial to repeat this exercise intermittently. In the Eastern Plains Landscape the exercise was repeated in 2012 (WWF, 2012c).

3. Full government engagement from the start: it is very important to engage all the concerned government agencies continually from the beginning of **the project. This includes 'target' ministries such as** Ministry of the Environment but should also include other departments such as Roads and Transportation, Industry and Mines which may not be directly involved with conservation and protected area management but whose activities and plans impact on conservation.

This also improves the protected area management through participatory discussion as well as strengthening links between government and NGOs. In the Eastern Plains Landscape project a position titled government liaison officer is supported to ensure this work.

4. Commit for the long term: protected area management needs committed long-term intervention and support particularly in developing countries like Cambodia. This includes both financial and technical support. WWF has been supporting conservation in the Eastern Plains Landscape since 2000 and will need to continue to do so for the foreseeable future. However it is equally important for NGOs to have a clear exit strategy in place to ensure that protected area management can continue once this support is withdrawn.

5. Work at the right scale: this may be especially true for community and livelihoods engagement where benefits have to be sufficiently widespread and fit within the broader socio-economic context of the community in order for true conservation buy-in to be achieved.

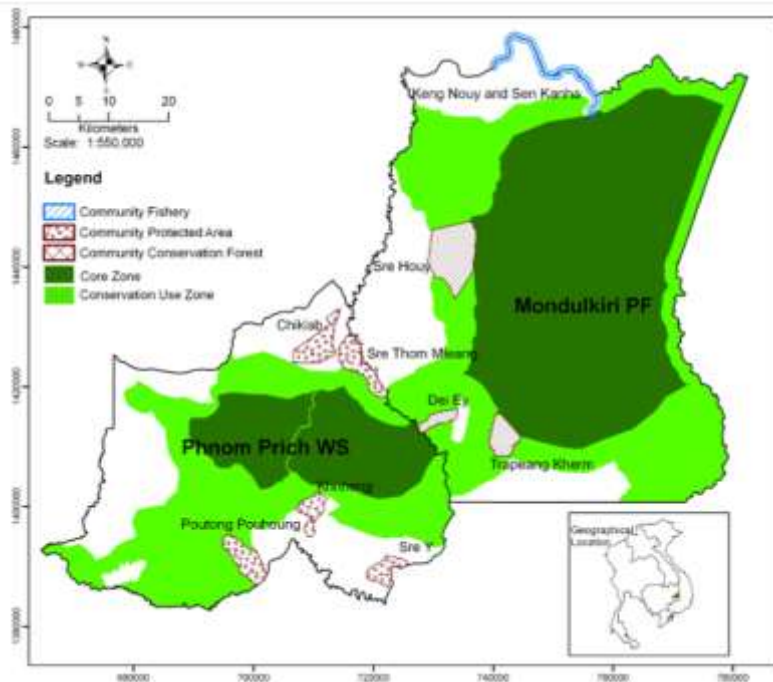


Figure 4: Community Conservation Forests, Community Protected Areas and Community Fisheries in Monduliri Protected Forest and Phnom Prich Wildlife Sanctuary

6. Need to engage with the political framework and understand the political context: it is as important to understand and address the political framework as it is to understand the biological elements within a protected area as regards its impact on management. The same is also true of understanding the socio-economic context of communities who impact the protected area – directly or indirectly and the **motivations underlying people's decision making.**

7. Be selective in fundraising: it is very easy to **'chase the money', which can result in shifting objectives,** not necessarily related to good protected area management or protection. It is important for both government and NGOs to prioritize actions source funding accordingly.

8. Basic biological and enforcement monitoring tools: in any protected areas it is necessary to have a system in place to monitor the effectiveness of the law enforcement activities. These tools provide regular information on magnitude of threats and their distribution which is very important for developing enforcement strategies. The project has been using the MIST system for past six years and has recently started using the Spatial Monitoring And Reporting Tool—SMART (Conservation Software, 2013). Biodiversity monitoring is also important; however it requires sufficiently trained personnel and can be expensive. Ensuring a proportion of all funding goes to monitoring is critical to assess impact and measure success.

9. Nurture and retain the right skills base: identify skill and knowledge gaps, and ensure complementarity of technical skills across the landscape is an important contribution to effective management.

Regular training need assessments and capacity building programmes have been conducted in the Eastern Plains Landscape to ensure the correct skill base in the protected areas.

10. Raise the profile of the area through awareness: it is very important to keep the profile of the protected areas high to help get, and maintain, both financial and especially political support.

11. Communication plan: establish how the work – and the importance of the protected area – will be communicated and through which medium. Understand **how best to 'sell' the landscape or the wildlife it contains** to maximize external interest.

12. Balance land use: there is the need to balance the requirements of local communities and emerging business with that of the natural world. This is best captured through appropriate allocation of land for development and formalizing ownership of land through land titles.

THE FUTURE OF THE EASTERN PLAINS

In keeping with many protected areas in the tropics, those in the Eastern Plains of Cambodia suffer from very limited management resources, low levels of funding and little systematic planning. Protected areas are inherently complex and, to be effective, have to address simultaneously biological, economic and social issues whilst prioritizing resource uses to where they are most needed. Conservation efforts in the two protected areas of Eastern Plains discussed here give one example of where this is being put in to practice. The work is still at a relatively early stage but lessons can be learned from the experiences to date. Enforcement activities are critical to

protecting protected areas and their natural resources but these must be coupled with strong laws and a legal system that offers true deterrents to illegal activity. The policy environment must recognize the full value of the protected areas (financial and non-financial) and the contribution they make at local, national and international levels. This must be reflected in appropriate large scale land-use planning that designates areas primarily for conservation. It is also reflected in fostering a greater understanding of the range and importance of ecosystem services and the development of sustainable harvesting systems for natural products. Science and research is helping underpin much of the decision making, for example around quota setting for NTFPs and fisheries, identifying core conservation areas and indicating how resilient a given habitat is likely to be to change. However, research findings alone cannot provide the whole answer and decisions about land use must also incorporate social and traditional land use considerations.

In Cambodia all these requirements have not yet been fully met, but significant progress and some success has been achieved. With long-term commitment from the responsible government agencies and, for now, the donor community there is no reason why all of these requirements for ensuring truly effective protected areas should not be realized. Many stakeholders will need to be involved and many competing and conflicting demands will need to be considered. It is impossible that every interest group will be satisfied with the outcome and a key role of government will be to ensure that decisions lead to the protection of these globally important forests. With strong leadership and real commitment to **protecting Cambodia's natural heritage there is room for optimism** that this landscape can once again become the Serengeti of Asia.

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RESUMEN

El paisaje de los Llanos Orientales de Camboya aún tiene una buena cobertura forestal en una área extensa, pero el nivel de las poblaciones silvestres continúa siendo bajo tras tantos años de guerra civil y la presión de la cacería. Durante la última década, los esfuerzos de conservación de WWF en colaboración con el Gobierno Real de Camboya en el Bosque Protegido Mondulhiri y el Santuario de Vida Silvestre Phnom Prich, las dos principales áreas protegidas en el paisaje, han demostrado éxitos modestos en la reducción de actividades ilegales y la obtención de apoyo comunitario para la protección de los bosques. Estos esfuerzos de conservación incluyen el monitoreo riguroso y periódico de la biodiversidad, la vigilancia efectiva de la aplicación de la ley mediante el uso de modernas herramientas, y la obtención de apoyo comunitario para la protección de los bosques a través de campañas de sensibilización e intervenciones para asegurar los medios de subsistencia. Este programa muestra los diferentes aspectos en materia de gestión que deben tenerse en cuenta para asegurar la eficacia de las áreas protegidas, al tiempo que refleja la necesidad de inversión a largo plazo en la conservación para avanzar en este sentido y la necesidad de abordar factores de carácter político, social, económico y biológico para garantizar la sostenibilidad.

RÉSUMÉ

Le paysage des plaines orientales au Cambodge possède encore un excellent couvert forestier sur une vaste superficie, **mais les années de chasse et les troubles civils ont drastiquement réduit les populations à l'état sauvage. Depuis dix ans**, les efforts de conservation concertés du WWF et du gouvernement royal du Cambodge, dans la forêt protégée de Mondulhiri et le sanctuaire de vie sauvage de Phnom Prich, les deux principales aires protégées du paysage, connaissent un succès modeste et sont parvenus à réduire les activités illégales et à gagner le soutien des communautés pour améliorer la protection des forêts. Ces efforts de conservation incluent un suivi rigoureux et régulier de la diversité biologique ; **un suivi efficace de l'application de la loi grâce aux outils les plus modernes** ; et un soutien aux communautés pour protéger les forêts grâce à des campagnes de prise de conscience et à une amélioration des moyens d'existence. **Ce programme montre les différents aspects de la gestion devant être pris en compte pour optimiser l'efficacité des aires protégées, et reflète parallèlement le besoin d'investissement à long terme dans le secteur de la conservation**, afin de voir les progrès et les exigences des questions politiques, sociales, économiques et biologiques pour garantir la durabilité.



THE VULNERABILITY OF COMMUNITIES AROUND THE MARINE PROTECTED AREAS OF BAMBOUNG, CAYAR AND JOAL-FADIOUTH IN SENEGAL: PLACES OF ADAPTATION TO CLIMATE CHANGE

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ABSTRACT

Climate change accelerates the vulnerability of resources that are of great importance to the lives of communities in many parts of the world. This study aims to analyze the vulnerability and adaptation to climate change of local populations in and around marine protected areas (MPAs) in Senegal. The methodology is based on Participatory Rural Appraisal (PRA) and the CRISTAL tool used to assess the vulnerability of communities and adaptation strategies. The Climate Information Portal (CIP) has been **used to make projections of rainfall and temperature; allowing projections to be 'downscaled' to local areas.** The results show that the riparian communities of three MPAs (Bamboung, Joal-Fadiouth and Cayar) are facing climate and non-climate vulnerabilities. Strategies for current and potential adaptation options have been identified to overcome the various hazards and these are outlined. Strategies are designed to contribute to the sustainable improvement of the living conditions of communities around the MPAs.

KEYWORDS: climate change, adaptation, marine protected areas, Bamboung, Joal-Fadiouth, Cayar, Senegal

BACKGROUND

It is becoming increasingly clear that the social aspects and ecology of protected areas are not totally independent and that simultaneously protected areas today are increasingly expected to deliver social and economic benefits in addition to conserving biodiversity (Dudley and Stolton, 2008). Achieving these dual aims is however far from easy; the impacts of climate change will make this an even more challenging goal for many protected areas.

Fisheries contribute 30 per cent of Senegal's exports and nearly 600,000 jobs are directly or indirectly created by fisheries and related activities. Approximately 80 per cent of the catch in Senegal (about 400,000 t / year) is from the local artisanal fisheries. Much of the country's population derives its income from fisheries. However, in recent years the fishery resources have decreased drastically. This is seen particularly in demersals species, which have high commercial value. The increase of foreign demand has, for example, contributed to the

collapse of the *Epinephelus aeneus* group on a large scale (Thiao et al., 2012).

This paper focuses on three of five Marine Protected Areas (MPAs) in Senegal, Bamboung, Cayar and Joal-Fadiouth. They were created by the Decree N° 2004-1408 in November 2004, aim to address the declines in fish stocks and cover a total surface area of 82,500 ha. The populations of all three MPAs (38,632 in Joal-Fadiouth, 15,772 in the 14 villages around Bamboung and 22,000 in Cayar in 2009) are vulnerable to climatic and non-climatic events. The consequences of climate change manifest themselves in the degradation of the quality of life, reduced natural resources, and a decrease in revenues. Implementation of adaptation strategies is therefore a necessity for any prospect of local sustainable development.

There are few studies on MPAs in Senegal, and almost none of the studies addresses their vulnerability to climate change and the influence of this vulnerability on



Local fisherman, Cayar village, Senegal © Hartmut Jungius / WWF-Canon

the livelihoods of surrounding communities. This does not facilitate the consideration of local concerns in climate change adaptation projects. This paper is one of the first to look at the issues of development, biodiversity conservation and the vulnerability of communities to climate change in the coastal area of Senegal where fishing is vital for the local economy and sustenance.

INTRODUCTION

Conventions on biodiversity, desertification and climate change are major steps in the governance of the global environment; and are closely linked to many development goals (OCDE, 2005). Populations of non-Annex 1 countries of the United Nations Framework Convention on Climate Change (UNFCCC), which are predominantly developing countries, are already subject to numerous obstacles to sustainable growth including poverty, disease and lack of economic development. The impacts of climate change make them even more vulnerable. Parties to the convention are invited to protect the climate system for present and future generations (Article 3) and to take full account of the specific needs and circumstances of developing country Parties, especially those that are particularly vulnerable to the adverse effects climate change (Article 4).

The conclusions of the Intergovernmental Panel on Climate Change (IPCC, 2007) show that during the 20th century temperatures in Africa rose at a rate of about 0.05°C each decade. An increase in temperature of about 0.1°C per decade is expected for the next two decades. The projected impacts of climate change in West Africa include periods of increased heat and more frequent heavy precipitation, an increase of drought and of arid and semi-arid areas, and exacerbated water stress in some countries. In Senegal the average annual temperature has increased by 0.9°C since 1960 and southern regions saw a significant decrease in rainfall, of 10-15 mm per decade, during the rainy seasons between 1960 and 2006 (the lack of data on daily rainfall does not allow assessment of changes in rainfall intensity) (UNDP / Oxford, 2008). The anticipated rise in sea level is expected to affect low-lying coastal areas with large populations (UNDP, 2008) as well as coastal wetlands, including salt marshes and mangroves, especially when these coastal areas are subject to constraints or they lack sediment (IPCC WGII, 2007). Dennis et al. (1995) compared four scenarios of sea level rise (rises of 0.2, 0.5, 1 and 2 m by 2100) before 2100. On the Senegalese coast the results projected the amount of surface area that could be lost, populations and economic value at risk and the cost of protection. The projections were that between 55 and 86 km² of beach will disappear, due to increased coastal erosion phenomena.

The major environmental problems facing the Senegalese coast are more or less directly related to climatic parameters, the most important being floods, coastal erosion, salinization of soil and water, degradation of mangroves and changes in fish resources (MEPN, 2006). A common observation is the need to better link climate issues to local development issues through the management of ecosystems for the most vulnerable populations – human and wildlife (ENDA, 2009). In Senegal, fishing is of vital importance to the people not only in economic terms but also for employment and food security (PRCM, 2003).

The landmark Stern report argues that adaptation is the only possible response to the impacts that will occur in the coming decades before mitigation measures take effect (Stern, 2006). National adaptation programmes of action (NAPAs) address priorities for adaptation under the UNFCCC; however implementation requires resources that are not always available. In addition, these strategies are sometime inadequate when people are faced with a variety of pressing needs. People living around MPAs for example are constrained in the exploitation of natural resources important for their livelihoods and thus need alternative livelihood strategies.

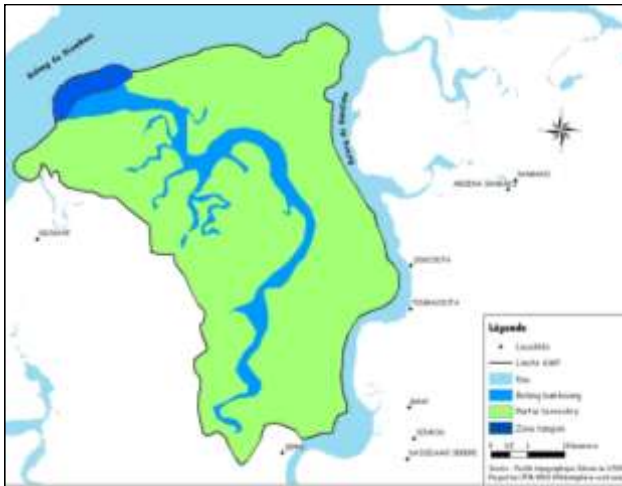


Figure 1 and 2: Map of the MPA of Bamboung (above) and Cayar MPA (right)

The five MPAs (St. Louis, Cayar, Joal-Fadiouth, Bamboung and Abene) that have been established in Senegal are an important step towards the establishment of a representative network of MPAs. They aim to promote sustainable management of fishing areas by protecting nursery and breeding areas. Despite these aims, however, research has revealed the difficult living conditions of people around MPAs – for example the challenges faced by communities in the vicinity of the Bamboung MPA – may be related to its mode of management (Drame, 2008). As the impacts of climate change have become apparent it is increasingly clear that the current management of MPAs is not facilitating the development of socio-economic, cultural and environmental activities to mitigate impacts. The study reported here thus aimed to better understand the vulnerability of communities to climate change in the coastal area of Senegal and highlight on-going and new strategies to be incorporated in the management of the MPAs to help communities mitigate and adapt to climate change.

STUDY SITE: BAMBOUNG, JOAL-FADIOUTH AND CAYAR

Bamboung MPA is in the western part of central Senegal, in the region of Fatick in the district of Toubacouta; it has an area of 70 km². The MPA is divided into a central marine area, a buffer zone and an area of land. The central area consists essentially of the Bamboung bolong (small river) and its tributaries (Figure 1). With a length of 15 km (from the confluence with the Diomboss River to the mudflats of Kole forest), its width varies from 50 to 500 metres and its depth varies from 0 to 15 meters. A buffer zone is located at the confluence of the bolong, at



the confluence of the Diomboss and Bamboung. Fishing is prohibited in the MPA. Twenty -three new species of fish have been recorded between 2003 and 2007 according the results of a survey conducted by the Institute of Research for Development (IRD) (IRD, 2007).

Cayar (Kayar) MPA includes the maritime dependencies of the commune and the marine depression of Cayar; it covers 171 km² (Figure 2). There are no zones strictly prohibiting fishing operations however at certain periods of the year fisheries are subject to a temporary closure to promote reproduction, increase species and allow regeneration of resources.

Joal-Fadiouth MPA includes the maritime dependencies of the commune, small rivers and mangroves; it covers 174 km² (Figure 3). It is part of a new generation of protected areas in Senegal where the concept of community co-management of resources is applied. The zoning was participatory and was defined as the core area, a multipurpose zone and a mangrove area. Fishing is completely banned from core area which extends over 4.5 km from the coast to the sea. This area covers fish spawning and nursery areas, the habitat of manatees and areas important for sea turtle nesting. The multipurpose zone extends from the edge of the core area (4.5 km from the coast) to 8 km from the sea. In this part of the MPA, sustainable fishing is allowed using equipment that abides by legal standards. The mangrove and bolong area are places where conservation and development activities are practiced. This area includes seeding zones for molluscs (*Anadara senilis*) and oyster farming areas. Ecotourism is authorized within the mangrove area if natural resources are not extracted.

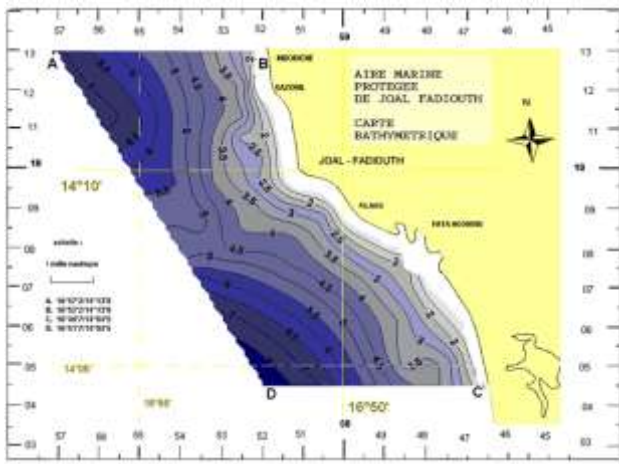


Figure 3: Bathymetry of Joal-Fadiouth MPA (Source: WWF WAMER, 2006)

SOCIAL ORGANIZATION

The Bamboung area belongs to the Saloum Delta, one of the most populated regions of Senegal. Population growth in the region was higher than the national average between 1904 and 1958, i.e. 2.2 per cent compared to 1.3 per cent. This could be explained by the attractiveness of the region due to favourable growing conditions for groundnut production during this period (Sarr, 2005). Traditional social organization is characterized by the presence of family households subject to the authority of the head of the compound, generally the elder.

In Joal-Fadiouth, the Fadiouth inhabitants are 99 per cent Serere ethnic group while in Joal the population is heterogeneous with Wolof, the Serer and other ethnic groups from the sub-region (Mali, Burkina Faso, etc.). The society is matrilineal. Several traditional authorities in Joal-Fadiouth exercise various governance functions.

The population of Cayar was just under 17,000 in 2005. It is spread over nine districts of which five official district form the former core of Cayar. The original population of Cayar is Lebu (an ethnic group), but as fishing activity developed there was an intermingling of populations. The main ethnic groups are essentially the Wolof (80 per cent) and Fulani (10 per cent). There is also small presence of Serere and Diola ethnic groups. The society is patrilineal supported by a caste system strongly influenced by the Muslim religion.

An increase in the population of all these areas has led to pressures on the resource base as the need to satisfy local consumption and markets needs to generate increased income. In addition a drought between 1970 and 2000 led many farmers to turn to fishing, which contributed to the acceleration of overfishing and conflicts between

Table 1: The three main risks identified in each site

Study area	Identified risks
Joal-Fadiouth	1- Coastal erosion 2- Flooding 3- Strong winds
Cayar	1- Strong winds 2- Rainfall variability 3- Sea level rise
Bamboung	1- High temperature 2- Drought 3- Strong winds

indigenous and non-native fishermen. Fishermen have had to go far from their traditional fishing grounds due to scarcity of fish. Fish processing, which was done only **by fishermen’s wives, is now carried out by a variety of** national and sub-regional operators; who increasingly employ men. This disrupts the social organization and division of labour between men and women.

METHODOLOGY

The study aimed to contribute to a better understanding of the types of vulnerabilities that people face around MPAs in Senegal. It analysed the forms of local adaptation and limitations on adaptive strategies so that appropriate measures can be taken to improve the livelihoods of local populations.

The approach is both qualitative and quantitative. Participatory Rural Appraisal (PRA) was used to develop the profile of a focus group through the use of semi structured interviews. PRA tools were complemented by the Community-based Risk Screening Tool – Adaptation and Livelihoods (CRISTAL) (IISD, 2012) to assess the vulnerability of communities and identify adaptation strategies. In addition to qualitative techniques, quantitative techniques were used through the Climate Information Portal (CIP) (cip.csag.uct.ac.za) to make projections of rainfall and temperature. This approach allowed researchers to downscale data from climate data sources and analyze future climate in the three MPAs studied.

Site selection was based on geographical criteria and socio-economic activities. The five MPAs were divided into three types of environments (small coastal areas, large coastal areas and estuary/Casamance – an area south of Gambia including the Casamance River). An MPA was chosen in each environment. The MPAs were also representative of variable levels of implementation and regulation. Bamboung (an estuarine area) was the

first functioning MPA in Senegal. Cayar (Kayar) is in the **'large coast environment' and is one of the most diverse** and economically important fishing zones in the world. The MPA boundaries are not yet marked out, but the indigenous peoples have a culture of conservation of fishery resources. In Joal- **Fadiouth, located in the 'small coast' and a very important breeding area for sea turtles,** the indigenous populations were farmers before being fishermen and do not have the same type of conservation approach to fisheries.

Cayar and Joal-Fadiouth are district communes whilst Bamboung is surrounded by fourteen neighbouring villages. In Bamboung, the technique of rational choice was used for the selection of target villages based on the following criteria:

- The involvement of the village in the process of creating the MPA.
- The involvement of the village in the management activities of fisheries resources.
- The location / position of the village in regard to the MPA.
- Presence or not in Bamboung before it was protected.
- The villages selected for the survey around Bamboung were thus Toubacouta Soukouta, Sipo, Diogaye and Nema Bah.

Resource persons from various socio-professional categories operating in fisheries and agriculture were the main targets for the collection of information. The research included documentary research, the collection of field data, data processing and reporting.

CURRENT VULNERABILITY OF COMMUNITIES AROUND MPA

Table 1 summarises the three main vulnerabilities assessed by the communities in the three MPAs studied. These include climate and non-climatic risks that increase vulnerability; all risks have an impact on the communities and resources.

Current climate vulnerability is closely linked to climatic factors and is summarised below.

Wind: Wind determines ocean circulation off the Senegal coast. There are two types of wind circulation: the cold north equatorial current (toward the west) and the hot and salty equatorial counter-current (toward the east). These currents change direction before reaching the continental plateau, resulting in a southerly current with cold and salt water, which prevails from January to

May; and a northerly current, with warm, salty waters from June to October. The transition between the two periods is between November and December, with the onset of coastal upwelling. There exists a variability of speeds and wind directions during the dry season (Roy, 1989, cited by Niang Diop, 1994).

The winds have become more frequent and are accompanied by dust. They cause murky water and strong waves. Winds often prevent the fishermen of Cayar, Joal-Fadiouth and Bamboung from going to sea. The wind also causes damage to property including the destruction of boats, sinking of canoes and can cause damage to fish habitats. Women working in fish processing are impacted as their work depends on the availability of fish. In addition, they must take more stringent hygiene measures when there is a lot of dust; and the dust is also linked with the increased frequency of coughs and other lung ailments.

Coastal erosion: Coastal erosion is a major environmental problem and affects nearly 10 per cent of the Senegalese coast (ANDS, 2011). The rate of decline of the shoreline is between 1.25 to 1.30 m per year according to studies conducted in Senegal's first national communication to the UNFCCC. These rates may seem low at first glance, but they are responsible for habitat and infrastructure destruction mainly in highly urbanized areas such as St. Louis, Rufisque and Joal.

Coastal erosion has the greatest impact in Joal. During the application of the CRISTAL tool in focus group interviews the population of Joal-Fadiouth spoke of the coastal erosion hazard as having a high-impact on their livelihoods. Major damage was noted to infrastructure and livelihoods through the loss of trees and the displacement of several houses that were not far from the beach. Turtle nests have been washed away and the île des mouettes and several islets have disappeared.

Rising sea level: In Senegal, a 1 m rise in sea level could cause flooding and erosion of more than 6,000 km² of land, most of which are wetlands (Dennis et al., 1995). In general, floods are responsible for more than 95 per cent of land losses, whichever sea level rise scenario is considered. Dennis et al., (1995) showed that for a 1 m rise, buildings with a total market value of at least US\$499-707,000,000 would be at risk. In this scenario, tourist facilities across the country represent 20 to 30 per cent of the total value at risk. It estimated that at least 110,000 to 180,000 people, between 1.4 and 2.3 per cent of the population of Senegal in 1990, would be at risk (Dennis et al., 1995).

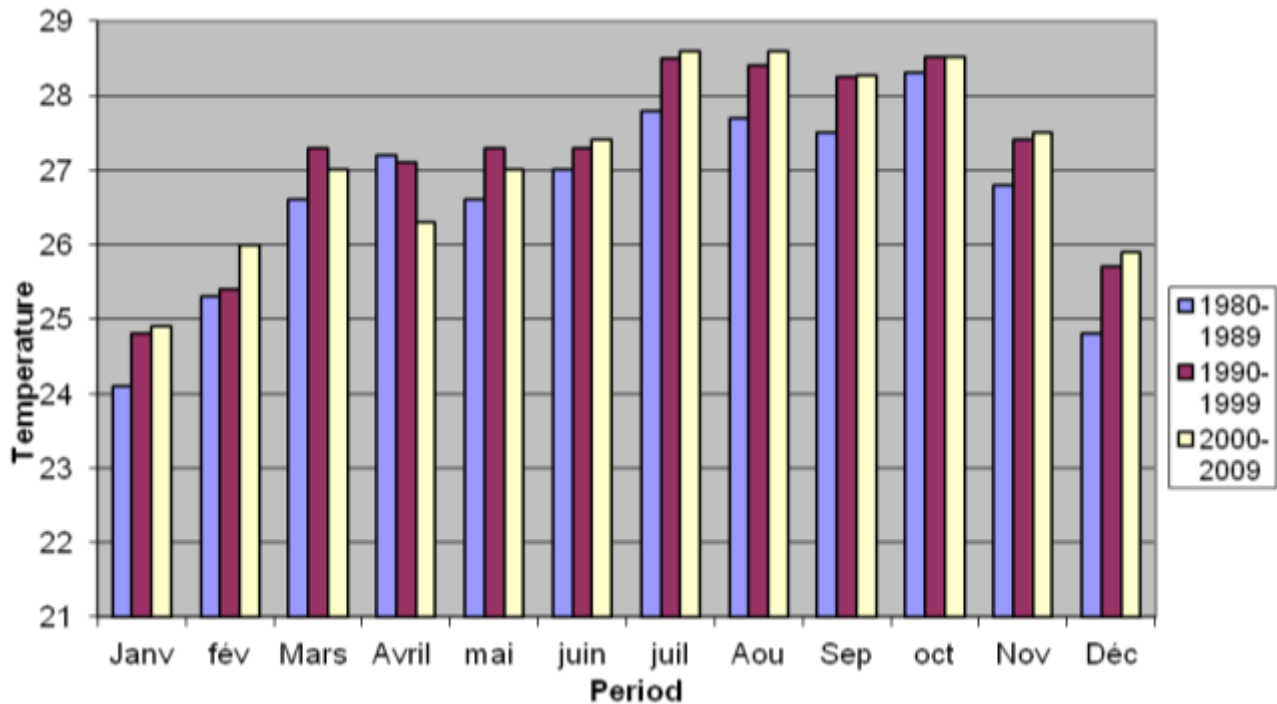


Figure 4: Mbou decadal temperature from 1980-2009

Local populations living near the three MPAs signalled a rise in sea level in the focus group discussions. It was among the three major risks cited in Cayar. Sea level rise causes the displacement of the local population to more distant sites as homes are damaged and demolished and infrastructure such as fishing piers is lost.

High temperature: Marine species are less constrained than terrestrial species by physical barriers of transportation and migration, so their distribution is mainly determined by environmental factors (e.g. temperature, oxygen, light, salinity, etc.) There are many examples of plankton (Beaugrand et al., 2002) and fish species (Brander et al., 2003) which are rapidly extending their range as the environment changes. Because many marine organisms are already living near their upper thermal tolerance limits, increases in temperature can adversely affect the performance and survival (Amara, 2003). Carpenter (1992) speaks of the vulnerability of fisheries to climate change and notes that impacts depend on the nature of climate changes, the type of fishery, fish species and their habitats. Changes in climatic conditions such as air temperature and precipitation affect fisheries by altering the availability or quality of the habitat. Specifically, fish habitat may be affected by changes in water temperature, time and duration of extreme temperature conditions, the size and curve of annual flows, and sea-level rise affecting surface water and the shores of lakes, reservoirs and coastal marine environments.

Decadal average temperatures have increased from 1980 to 2009 at Mbou in the Thies Region of Senegal (Figure 4). Data from this station was used to represent the situation in Joal-Fadiouth and Cayar as it is the nearest station with complete information for the selected period. In the focus group discussions people gave examples of the different species captured during high and low temperatures. The general observation from the communities in the MPAs is the disappearance of fish **species, especially what are called “noble species”**. These species have a high market value which previously allowed the fishermen to make good profits.

Drought: Desertification and land degradation in arid, semi-arid and dry sub-humid areas results from various factors including climatic variations and human activities.

Data from the National Weather Service of Senegal helped plot the development of rainfall patterns over a 40 year period. The findings showed drought conditions over three decades followed by a relatively wet period over the last ten years. This trend was the same in all three study areas with only slight variability. Communities reported that drought has an environmental and socio-economic impact. Soils, vegetation, water and livestock were all affected. For example, soil erosion is accelerating, salinization is ongoing, soil is drying out and deteriorating and land abandonment is increasing. There is a decline in

productivity and yields, problems with pests, and some crops, such as rice, are no longer being cultivated. The decline in revenues is a reality.

Rainfall variability: Rainfall amounts show a downward trend from 1970 to 2000. Since 2000, there has been a recovery in rainfall. Water stress strongly impacts fishing, agriculture and gardening.

The changing dates of the onset of the rains are well recognised by the communities of fishermen and farmers. Periods without rain are becoming longer than **in the past. Ponds, groundwater, 'céanes' (small ponds in Wolof) and backwaters** are greatly reduced. The rivers are drying up. The lowering of the water table increases well depths. There is less water available for livestock and as a consequence the livestock decreases. The vegetation has suffered a sharp decline. The populations in the three study areas noted that rainfall is not only important for soil and agricultural activities, but is also of great importance for marine and river resources. Normally a good rainy season is also advantageous for fisheries. More species of fish appear when the rainy season is good.

Flood: The west coast of Africa is often battered by storm surge and is currently threatened by erosion, flooding and exceptional weather events. Increased flooding could be of particular concern in the future according to many studies (Awosika et al., 1992; Dennis et al., 1995; Jallow et al., 1996).

Flooding is a major problem for communities and is a major concern in Joal. Several neighbourhoods suffer from flooding and people are often forced to move. Floods cause great disruption and some areas become **inaccessible, e.g. the women's fish processing site in Joal**, leading to a decline in income during these periods. Overall, the decline in trade during the rainy season and the subsequent reduction in mobility affects all sectors of the economy.

FUTURE VULNERABILITY

The Intergovernmental Panel on Climate Change (IPCC 2007) report notes that by 2020, between 75 and 250 million people are expected to suffer from water stress due to climate change in Africa. The cost of adaptation to climate could amount to 5-10 per cent or more of the GDP in most African countries.

The climate models developed with the CIP make projections of temperature and rainfall for Senegal. Projections for the three MPAs are based on Kaolack



Local fish market, Cayar village, Senegal © Hartmut Jungius / WWF-Canon

(which borders The Gambia) and Thiès stations (60 km east of Dakar), as these weather stations provide the most comprehensive data (available for over forty years). Data of daily temperatures are available. Trends show an increase in temperature and a decrease in rainfall between July and September, with a high variability during the start and the end of the season, i.e. May and October. The projections indicate a shift in the rainy season, which tends to stretch to November, and thus a longer season with lower rain volumes which inevitably leads to dry spells and drought. Thus, the vulnerability of the agriculture sector, which depends on the rainy season, is expected to increase with resulting food insecurity, declining incomes in the agriculture sector and increased poverty. The fishing industry is also not immune from the vulnerabilities that are developing. Farmers who are not making a living from their activity are turning to fishing. This has had an impact on the overexploitation of resources, declining stocks of fishery resources and loss of jobs.



Artisanal pirogue with local fishermen passing Spanish trawler in their fishing grounds, Senegal © Jo Benn / WWF-Canon

CONSEQUENCE OF HAZARDS ON THE LIVELIHOODS OF COMMUNITIES

By affecting different natural resources, climate related risks are causing an array of impacts on the livelihoods of communities.

Overall, the reduction and degradation of resources results in a slowdown in the development of socio-economic activities. The results of the surveys conducted in the three MPAs shows the relatively strong influence of climatic conditions on natural, physical, financial and human resources. Thus, we can conclude that people are very vulnerable to climate risks, and this is exacerbating non-climate vulnerability (e.g. poverty, population growth, overuse of resources, fisheries agreements, abandonment of seasonal fisheries closures and insufficient infrastructure for conservation of fishery products) which are discussed in more detail below.

Poverty and population growth: The population of Joal-Fadiouthin in 2003 was estimated at 17,292 men and 15,699 women giving a total of 32,991 inhabitants. The population growth in Thiès is 2.85 per cent (ANDS, 2010). Thus the population on the basis of this projection rate was 38,632 inhabitants in 2009. The population of the 14 villages around Bamboung in 1988 was 9,775; in

2009 this had risen to 15,772. The Cayar population was 16,148 in 2002 according to the census of that year. Current estimates suggest a population of about 22,000 inhabitants. These figures may be the result of natural increase, but can also be explained by the migration of people both to the capital Dakar and between communities. Cayar, for example, sees seasonal migration of fishermen from other areas from November to June, the most cited migrants are those coming from the district of GuethNdar St. Louis and fishermen from Fass boy and Joal. There are 2,500 to 5,000 migrant fishermen during the fishing period (Drame, 2011). This means about 550 canoes are active during the fishing season against only 300 in the off-season. During focus group discussions with fishermen, young men revealed involvement in illegal migration activities (e.g. using boats to take people to Spain) due to the number of people working in the fisheries and the high cost of fuel. Such activities involve many risks and are thus indicative of the difficult living conditions experienced by many young men in these communities.

The overexploitation of fisheries resources and fisheries agreements: The overexploitation of fisheries resources is a concern for the authorities and for households who are no longer able to eat high quality fish. As a result there is the need to enforce biological

recovery areas, regulations on fishing equipment and the creation of MPAs in order to reduce the unsustainable exploitation of resources.

Overfishing is a reality in Senegal. Senegalese people are great consumers of fish. Fisheries agreements aim to control access and maintain resources, however the proposed financial compensation is not enough to visibly improve the living conditions of local populations reliant on fisheries. Senegal has had a negotiated agreement with the European Union on fisheries since 1979; an agreement that has been renewed 17 times. But these renewals are not free of difficulties. Parties to the agreement often fail to renew the protocol, and as a consequence most Senegalese people question the value of these agreements and their impact on future livelihoods. In the various focus group discussions with fishermen there was a strong recognition of the large number of nationals involved in fishing but also the increasing role of foreign vessels, which were seen as plundering the resources. Chinese and European boats were most often cited.

IDENTIFICATION OF CURRENT AND POSSIBLE STRATEGIES FOR ADAPTATION TO RISKS

To overcome the risks posed by climate change and improve the lives of local communities living in and around the MPAs a number of current and potential mitigation strategies were discussed. Options can be technological, based on better management of natural resources, or focused on the creation of legal and institutional frameworks. The section below provides an analysis of these strategies according to the risks identified above.

Wind: Windbreaks are used for soil conservation purposes. The practice is to install linear windbreaks, often (living) hedges, composed of woody species, and sometimes herbaceous plants. A windbreak has two parts: a windward (exposed to prevailing winds) and leeward side (UICN, 2011). Windbreaks can become essential components of the production system, for instance by protecting fruit crops from wind damage. Other strategies are based on the need to restore soils affected by the impacts of wind erosion and raising local awareness of hygiene, as windy periods often trigger increased respiratory diseases.

It is necessary to use “all possible means of communication to make weather and climate information accessible to all users” (Anams, 2011). Information provided by the meteorology service in Senegal, often broadcast by community radio stations,

plays an important role in educating fishermen. In Cayar announcements are made via the mosque to inform fishermen of weather conditions. People are also building more solid houses because the winds sweep away insubstantial structures and in particular roofs.

Coastal Erosion: In Joal-Fadiouth adaptation funding is focused on solving the problem of coastal erosion. A dam is being constructed (see below) and the fishing pier in Joal is being protected. Other activities involve the installation of modern ovens to improve the working conditions of female processors at the Kèlkom, which is the most important fish processing site in Joal. Other project activities include:

- Monitoring of nesting turtles.
- Reforestation using casuarina trees, cactus, eucalyptus and Prosopis sp outside the MPA and natural regeneration within the MPA.
- Relocation of people and infrastructures, such as fishing piers, away from areas suffering from erosion. This strategy is however insufficient and not sustainable as the cause of the problems is not being addressed. The local population has advocated alternative strategies such as banning the use of the marine sand to help stabilize the shore.

Rise in sea level: To mitigate land salinization, flooding and the destruction of infrastructure an anti-salt dam has been established to fight against salinization. It holds rainwaters and prevents salty waters from invading rice fields. The dam in Joal is being built over a distance of 3,300m with a north bank dam of 1,550m, a south bank dam of 1,800m; it has an average height of 0.60m and width of 3m. It is being built under the supervision of the Centre for Ecological Monitoring, Directorate of Environment and Classified Areas, and is a joint project with other agencies such as the NGO Green Senegal and the Association of Dynamic Women of Joal.

High temperature: To cope with the impact of temperature increases, a number of activities are suggested:

- Development of rainy season ponds to fight against the rapid depletion of temporary streams.
- Reforestation with plant species adapted to each zone and monitoring to reduce losses.
- Improved techniques for drying and salting fish to ensure that products do not rot quickly in the heat.

Activities underway include the creation of workplace **shelters to limit exposure to the sun’s heat for the female processors** in Joal and Cayar. Also in Cayar growers are



Sorting out fresh-landed fish, Cayar © Olivier Van Bogaert / WWF-Canon

starting to plant more heat tolerant varieties, because they are facing scarcity of food crops such as cauliflower, which are failing due to increased temperatures.

Drought: Drought has led to the degradation of plant cover and to water deficits. Anti- salt dams in Bamboung are helping some people access fresh water and practice gardening. Other useful mitigation strategies include the establishment of mini dams and development of irrigation; sinking wells; more effective harvesting of rainwater; use of local / indigenous knowledge such as **'Bawnane' sessions (a traditional ceremony organized by local people in order to have a good rainy season)** at delays in the start of the rainy season or during dry spells; reforestation and protection of plants to reverse the degradation of the vegetation cover; bush fires management including the erection of firewalls; and production of fruit crops more resistant to drought.

Drought also has a negative impact on fisheries, so strategy developments required include good MPA management and stopping the introduction of fishing vessels in areas reserved for artisanal fishing. This latter strategy is beginning to be implemented and in April

2012, the Government of Senegal cancelled 29 fishing authorizations that were granted to foreign trawlers chartered by two Senegalese and Moroccan ship-owners. Other strategies include information and raising awareness on sustainable fishing and fishing techniques such as the prohibition of dormant nets.

Flood: Relocation of populations living in *non-aedificandi* (areas where the local population are not allowed to build because of the topography or geomorphology issue) towards more favourable sites is the most cited strategy by communities.

Rainfall variability: There is a need for research institutions to work with farmers to recommend species that are resilient to changing conditions and allow the farmers to cope with more difficult and unpredictable conditions.

DISCUSSION

The threat of overfishing combined with the impacts of climate change have resulted in increased regulation of the fisheries sector in Senegal through the establishment



Bringing fresh-landed fish from the beach into trucks, Cayar © Olivier Van Bogaert / WWF-Canon

of MPAs and fisheries agreements. These measures are necessary in order to ensure sustainable fisheries resources into the future.

However the development of MPAs can also increase the vulnerability of local communities. Many actors such as beach seine fishermen (fishing using a seine or dragnet **deployed from the shore**), the 'Kilieur' (fishermen using drag nets for fishing shrimps), and sellers of sea turtles have been affected by the designation of the Fadiouth-Joal MPA. The conversion to MPA management is not easy and cases of poaching are noted in Joal. In Bamboung female processors saw a decrease in their income as those household bordering the MPA could no longer collect oysters. In Cayar there are conflicts between indigenous and non-indigenous populations over the management of resources.

The research reported above however confirms the additional vulnerability of fisheries and local communities to climatic factors (drought, high winds, high temperatures, rising sea levels and coastal erosion). There is clearly therefore an opportunity for MPA managers to further develop common solutions which

link climate vulnerabilities and local livelihoods. For climate vulnerabilities it is especially urgent that coping strategies are implemented. Responses to non-climate vulnerabilities cannot be the sole responsibility of the MPA manager; and need policy input at the highest level as well as a range of involvement from other sectors of society.

Local populations have a level of awareness of the degradation of marine and coastal resources; indicating their close relationship with and reliance on natural resources. They must be involved in the management of the resources of their area. The co-management approach to MPA governance is perhaps the best way to ensure sustainability and conservation. In particular the co-management of MPAs can improve sustainable management of fisheries resources.

Finally, the existence of a project to adapt to climate change in Joal-Fadiouth shows that in some places MPAs need to be accompanied by specific plans to reduce the vulnerability of communities especially as the MPA approach entails prohibitions of exploitation of some resources.

CONCLUSION

Fishing is a very important activity in the socio-economic lives of many communities around the world. However, fishing is not immune to the problems of climate change noted in other sectors; and the phenomena of desertification, drought and loss of biodiversity are not only characteristics of terrestrial systems. Moreover climate change has intensified in recent years leaving many communities in catastrophic situations. In Senegal discussions with local people show that they are becoming increasingly aware of the need to cope with the impacts of climate change. The effects of coastal erosion, rainfall variability and high temperatures are having adverse effects on activities and community life. Coping strategies to overcome various types of vulnerabilities often require financial and technical resources. Knowledge of future vulnerability should allow a better planning of selected adaptation options.

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Traditional fish market, Dakar, Senegal © Seamus Murphy / WWF-Canon

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RESUMEN

El cambio climático acelera la vulnerabilidad de los recursos que son de gran importancia para la vida de las comunidades en muchas partes del mundo. Este estudio pretende analizar la vulnerabilidad de las poblaciones locales y su capacidad de adaptación al cambio climático en y alrededor de las áreas marinas protegidas (AMP) en Senegal. La metodología se basa en la Evaluación Rural Participativa (PRA) y la herramienta CRISTAL que se utiliza para evaluar la vulnerabilidad de las comunidades y las estrategias de adaptación. Se ha utilizado el portal sobre el cambio climático (CIP) para hacer proyecciones sobre precipitaciones y temperatura, lo que permite hacer proyecciones a escala local. Los resultados muestran que las comunidades ribereñas de tres áreas marinas protegidas (Bamboung, Joal-Fadiouth y Cayar) se enfrentan a vulnerabilidades climáticas y de otra naturaleza. Se ha identificado estrategias sobre opciones de adaptación actuales y potenciales para superar las diversas amenazas. Las estrategias están diseñadas para contribuir a la mejora sostenible de las condiciones de vida de las comunidades alrededor de las áreas marinas protegidas.

RÉSUMÉ

Les changements climatiques contribuent à l'accélération de la vulnérabilité des ressources qui sont d'une grande importance pour l'existence de nombreuses communautés dans le monde. Cette étude se propose d'analyser la vulnérabilité et l'adaptation aux changements climatiques des populations locales habitant dans et autour des aires marines protégées du Sénégal. La méthodologie utilisée est basée sur l'évaluation rurale participative et l'outil CRISTAL a permis d'évaluer la vulnérabilité des communautés et les stratégies d'adaptation. Le Portail d'information sur le climat a permis de faire des projections de pluviométrie et de température. Les prévisions ont ainsi pu être faites à échelle réduite pour les zones locales. Les résultats obtenus à travers cette méthodologie montrent que les communautés riveraines des trois aires marines protégées (Bamboung, Joal-Fadiouth et Cayar) font face à des vulnérabilités climatiques et non climatiques. **Des stratégies d'adaptation actuelles et possibles ont été décelées pour venir à bout des différents aléas, qui sont présentés. Les stratégies sont destinées à contribuer à l'amélioration notable des conditions de vie des communautés autour des aires marines protégées.**



IMPROVING THE SUSTAINABLE OPERATION OF A WORLD HERITAGE SITE: INCREASING ENERGY EFFICIENCY AND IMPLEMENTING A RENEWABLE ENERGY SYSTEM ON ALDABRA ATOLL, SEYCHELLES

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ABSTRACT

The UNESCO World Heritage Site of Aldabra Atoll is an important conservation and research area but its remoteness makes management a major logistical challenge. Using diesel generators for electricity resulted in high fuel and transport costs, and was environmentally unsustainable. In 2008, the Seychelles Islands Foundation started investigating ways to increase energy efficiency, and developing a renewable energy system; aiming to reduce operational costs. Following an energy audit, renewable energy options and their applicability were assessed, alongside research into energy efficient measures. Findings were subsequently implemented, and a 25 kW_p hybrid photovoltaic-diesel energy system was set up. Demand reductions were a prerequisite for successful implementation of the renewable energy system. Energy efficient measures reduced electricity demand by 57 per cent. 38,171 kWh of solar electricity was generated in the first year of **operation, covering 94 per cent of the station's new demand. This has avoided a total of 97,523 kg CO₂** per year. Since implementation of the photovoltaic system, diesel demand has decreased by 97 per cent and operational savings of up to €68,000 are projected, resulting in system payback in only three years. Investments into both energy efficiency and renewable energies are required for environmental and financial sustainability.

KEYWORDS: energy audit, renewable energy, efficient, Aldabra Atoll, Seychelles, hybrid photovoltaic-diesel

INTRODUCTION

Seychelles, an island nation in the south western Indian Ocean (figure 1) belongs to the group of Small Island **Developing States (SIDS). The country's dependence on fossil fuels** makes the fragile economy particularly vulnerable to increasing oil prices. Seychelles has a negligible impact on global CO₂ emissions but, as an island nation, is hugely vulnerable to the effects of climate change. Even without legal obligation under UNFCCC and its Kyoto protocol to reduce CO₂ emissions, Seychelles has a clear objective to decrease its dependency on fossil fuels and minimize CO₂ emissions (Energy and Environment Partnership - Southern and East Africa, 2012). Implementation of renewable energy projects to achieve a 15 per cent share of renewable energies in electricity production is the national target for 2030 (van Vreden et al., 2010).

Aldabra Atoll, part of the Seychelles archipelago, is one of the largest raised atolls in the world and considered part

of a global biodiversity hotspot (Conservation International, 2013). Aldabra hosts many threatened and endemic species and is a valuable scientific research area of high international reputation for marine, coastal and terrestrial ecosystems.

Historically, Aldabra's ecosystems were threatened both locally by overexploitation and internationally by a proposal for a military base. Aldabra was nationally designated as a Special Reserve in the late 1960s and inscribed on the UNESCO World Heritage list in 1982. These designations facilitated the preservation of Aldabra as an undisturbed natural treasure. Since 1979, the atoll has been managed and protected by a public trust, the Seychelles Islands Foundation (SIF). With the exception of a small research station (ca. 15 people) established for monitoring, research and protection, the **atoll is uninhabited. Aldabra's ecosystem remains fragile** and requires continuous protection. Since the establishment of the research station in the 1960s all

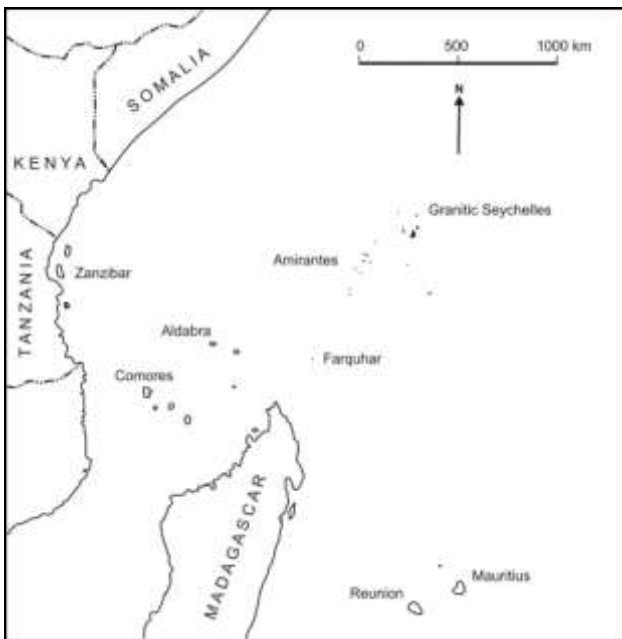


Figure 1: Seychelles island archipelago in the Western Indian Ocean (modified after Hill & Currie, 2007, p.5)

electricity for the station was produced by diesel generators. Aldabra is 1,100 km away from the **Seychelles' main island of Mahé and ensuring that the atoll was supplied with sufficient fuel for up to several months was a major logistical and financial challenge.** High operational expenses resulting from increasing **diesel and transport costs were making the atoll's operation financially unsustainable.** Aldabra's income sources have always been limited to small-scale but high-end tourism. The situation worsened in 2009, when the piracy threat in the Western Indian Ocean restricted yachting tourism and trips to the outer islands were severely curtailed. The operation of the atoll is heavily **subsidised by income from the Vallée de Mai, Seychelles' second UNESCO World Heritage Site** which is also managed by SIF. Due to these financial and logistical difficulties, and to ensure long-term conservation of the atoll, it became a priority for SIF to reduce the energy demand of the station and to replace the inefficient, unsustainable and outdated energy system with an environmentally and financially viable solution.

In 2008, a project was launched with the overall objectives of increasing the environmental and financial sustainability of Aldabra station, minimising CO₂ emissions and reducing dependency on fossil fuels. To achieve these aims, the following specific objectives were to:

1. increase energy efficiency of the station;
2. identify the most feasible and sustainable renewable energy source for Aldabra's conditions; and
3. plan and implement a reliable renewable energy system.

METHODS

A holistic approach comprising several preparatory steps was required to address the diverse issues involved in **improving the sustainability of Aldabra's operations.** The different stages were conducted in sequence as follows:

1. *Comprehensive energy audit* - to serve as a baseline study evaluating energy demand and electricity costs.
2. *Workshop with local energy experts* – to ensure involvement of local capacity and applicability of the work.
3. *Energy efficiency assessment* - Including a scenario analysis considering opportunities to streamline future electricity consumption and costs.
4. *Cost-benefit and SWOT analysis* – based on the results of the energy audit to assess operational costs. As well as a literature review and other research into renewable energy systems to assess different options (Quanz, 2009).

1. Energy audit

Aldabra is an off-grid location so baseline data on energy consumption was collected by making a detailed inventory of all electrical appliances and measuring electricity consumption for key consumption groups such as air-conditioning (AC) units, household appliances and computer equipment. The total consumption was calculated to be 95,664 kWh per annum with an average 15 people on the atoll. The biggest share was from the AC systems (52 per cent), followed by office equipment (16 per cent), and chilling facilities (fridges and deep freezers, 13 per cent) (figure 2, Quanz 2009). With an average annual consumption of 6,300 kWh per head the demand was more than twice as high on Aldabra than on Seychelles main islands (3,100 kWh per head) (National Statistics Bureau (ed.), 2012).

The costs of electricity on Aldabra were determined by the price of fuel, transportation costs and the efficiency of the generators (produced kWh per litre diesel). Fuel costs only resulted in an electricity price of €0.43 per kWh. However, high transportation costs, including hiring a supply boat, purchasing and filling fuel drums, loading and unloading fuel drums increased the electricity price to €0.61 per kWh. It should be noted that the supply boat also delivers food supplies and therefore only 50 per cent of the cost was included in the transport cost calculation (Quanz, 2009).

These energy calculations were based on 2008 figures. In the following years, both transportation and fuel costs increased substantially on the global market which immediately affected fuel costs in Seychelles, making the economic gains from renewable energy investment even more pressing.

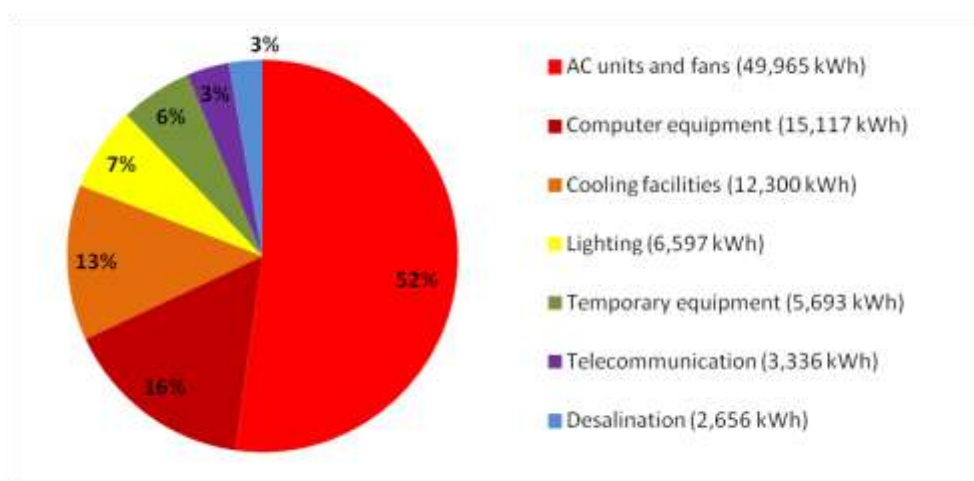


Figure 2: Shares of different energy consumer groups in Aldabra's energy consumption 2008 (Quanz, 2009)

2. Workshop with local energy experts

The baseline energy study culminated with a workshop on Mahé attended by local experts in renewable energies, electricity generation and island operation. The workshop aimed to verify the initial energy calculations and generate ideas on implementation of the renewable energy system. A key recommendation was the need to renovate the single phase overhead electrical distribution system with three-phase underground cables, to facilitate the efficient operation of the future energy system.

In addition, site visits were undertaken to other protected areas in Seychelles that had attempted to meet their electricity demands with a PV system, but had encountered critical problems. Experiences were shared to avoid similar problems on Aldabra. These exchanges allowed for a realistic analysis of costs, such as allocated budget for spare parts and rewiring.

3. Energy efficiency assessment

Energy demand is an important factor to determine the optimal size of a renewable energy system and decisive for the required investment costs. During the last few decades the market has been revolutionized with increased options for energy efficient appliances. Replacing existing equipment with the latest technology makes it possible to realise remarkable savings in electricity consumption, lower peak load demand and reduced CO₂ emissions. Opportunities included low consumption or alternative powered AC units, energy efficient certified household appliances, energy star labelled office equipment, compact fluorescent (CFL) or light emitting diode (LED) lights. Table 1 compares

energy consumption, percentage of total energy demand and electricity expenses for the respective consumer groups for 2008 and a future energy efficient scenario. For example, the introduction of the most efficient AC units reduced the energy demand of this consumer group from 52 to 7 per cent of the total energy demand. By maximising energy efficiency measures, energy demand could potentially be reduced by 74 per cent to only 25,021 kWh per year (Quanz 2009).

Investment costs to implement energy efficiency measures were estimated at €36,000 (including transport). Energy efficient appliances were sourced directly from overseas as they were not available in Seychelles. With annual electricity savings of 74 per cent, equalling €40,850, the investment was projected to be recouped within one year. Applying energy efficiency measures was a prerequisite for increasing financial sustainability by reducing Aldabra's operational costs.

A protocol was developed to complement the energy efficient infrastructure by ensuring prudent use of electricity by the staff. The overall project success depended on the support and cooperation of all, therefore it was vital that staff were an integral part of the project and felt ownership of the new system. Staff benefits helped to achieve this; for example, the reduced energy consumption of energy-efficient fridges made it possible to equip all houses with a fridge. In contrast, however, inefficient appliances, such as electric rice cookers, toasters and cookers were removed from the island, which had to be explained to all staff.

	2008			Energy efficient scenario		
	kWh/a	%	€	kWh/a	%*	€
Electricity consumer						
Air-conditioning & fans	49,965	52	30,479	7,000	7	4,270
Computer equipment	15,117	16	9,221	3,370	4	2,056
Cooling facilities	12,300	13	7,503	3,135	3	1,912
Lighting	6,597	7	4,024	1,487	2	907
Temporary equipment	5,693	6	3,473	5,693	6	3,473
Telecommunication	3,336	3	2,035	3,336	3	2,035
Desalination	2,656	3	1,620	1,000	1	610
Total	95,662	100	58,355	25,021	26	15,263

Table 1: Estimated potential energy (kWh/per annum) and financial (€) costs application (energy efficient scenario) of energy efficiency measures for different energy consumer groups used on Aldabra Atoll.

* Percentages of the consumer groups for the future scenario are displayed as percentages of the original figures for 2008

4. Cost-benefit and SWOT analysis

An in-depth literature review and cost-benefit analysis of all available renewable energy sources was undertaken, to allow an informed decision as to the most appropriate **system on which to base Aldabra's power production**. Through integrating external and internal factors, a holistic strategy can be realized (Fuerst & Scholles (ed.), 2008: 505). A SWOT analysis was applied to potential renewable energy sources, namely photovoltaic (PV), concentrated solar power (CSP), wind power, ocean energies (e.g. tidal power, ocean thermal energy conversion) and biomass (Table 2 shows the SWOT analysis undertaken for PV power; Quanz, 2009).

Key considerations, when identifying the most suitable **energy source to cover or partly cover Aldabra's** electricity demand, were its reliance, the energy output, operation and maintenance costs, the system lifespan and the start-up investment. Due to the remote location and logistical challenges a low maintenance solution was considered more important than low investment costs. The climate of Aldabra is harsh, particularly the problem of corrosion from significant exposure to the marine

environment. Logistics are expensive and complicated, thus flying in technicians for regular maintenance or troubleshooting is not possible, especially during the south-east (SE) monsoon season (April-October), when no transport to the atoll is available. Therefore, a proven and reliable technology was needed, ideally with an option to remotely monitor and trouble-shoot the system. In addition, the lack of heavy construction equipment (crane, excavator etc.) limited the scale of the construction work that could be undertaken on the atoll. Aldabra is the most strictly protected area in Seychelles and limiting the environmental impact of the project was of paramount importance.

The initial SWOT analysis indicated that a hybrid wind-PV system would be the best option; PV because it is a proven technology with comparably low maintenance requirements, reliable output predictions throughout the year, readily transportable and easy to install, and with limited construction requirements. A vertical micro wind turbine was proposed, because of the relatively low start-up wind speeds required, lower noise level compared to larger horizontal wind turbines, smaller size making installation easier and their reputation of negligible

Table 2: SWOT analysis of photovoltaic power for Aldabra

SWOT	Helpful to achieve the objective	Harmful to achieve the objective
Photovoltaic		
Internal analysis (attributes of the energy sources)	Strengths: <ul style="list-style-type: none"> - modularity - higher irradiation increases efficiency - favourable for stand alone application - environmentally-friendly technology - long lifetime makes high investment costs worthwhile - commercially proofed technology - hybrid system possible 	Weaknesses: <ul style="list-style-type: none"> - efficiency 10-18 % - with increasing operation temperatures efficiency decreases - increasing costs with higher efficiency - fluctuations in availability - storage facilities required - high investment costs
External analysis (attributes of the environment)	Opportunities: <ul style="list-style-type: none"> - harmless for environment - increased efficiency due to higher solar irradiation on Aldabra 	Threats: <ul style="list-style-type: none"> - basic maintenance required for successful operation and full life-span



Unloading of construction materials on Aldabra © Michal Sur (December 2011)

impact on birds. There was, however, inadequate wind speed data for Aldabra, which was limited to a few years in the 1970s recorded at an unknown location and height. The old data ranged from 3 m per second during the north-west monsoon to 6 m per second during the south-east monsoon. With possibly insufficient year-round wind speeds being a concern, prior to investment in wind technology it was decided to obtain accurate wind speed data at an appropriate location and height. Further consideration of wind technology was put on hold until sufficient baseline wind data was collected to assess the suitability of this technology. The results from the wind study so far confirm that investment into a vertical wind turbine would not be an economically viable option.

IMPLEMENTATION

At the end of 2010, following the findings of the SWOT analysis and the data available, the decision was taken to implement a hybrid PV-diesel system. A hybrid system was opted for because it ensures reliable and efficient system operation, since PV power only would have had weather related fluctuations. The company, IBC solar, based in Germany, was selected on the basis of relevant experience, especially with off-grid systems in remote locations that have difficult logistics, and the professional services they offered including post installation service.

Initially SIF planned to phase the change from the conventional energy system to a PV-powered system. Following receipt of the initial quotations and planning, however, it was identified that costs for a phased conversion to the new power system would be substantially higher due to transportation, labour, construction and commissioning costs. It was ultimately more economical to design a completely new system, covering all power requirements, including the complete renovation of the electrical distribution system. Thus, instead of starting with a 10 kW_p system that would supply part of the station and be expanded later on, the plan was upgraded to the installation of a 25 kW_p system to meet all energy demands immediately. A battery backup system was incorporated to supply the research station at night. A new backup diesel generator was also included to ensure system reliability during bad weather periods and to enhance the life time of the battery system.

A web-based monitoring system was integrated, allowing online system control, thus supporting the smooth running of the system over its lifespan. The system allowed for possible future PV extensions and eventual integration of a small-scale wind turbine. By August 2011 the system design was finalised.



SIF staff on Aldabra assembling solar modules on mounting frame © Christina Quanz (March 2012)

The most challenging element of the project was the construction phase. The construction plans were produced by IBC solar and implemented by a local contractor in Seychelles. The delivery of construction materials was particularly demanding as all supplies had to be ferried from the supply boat using a smaller boat and then manually unloaded onshore. It finally required three supply boat trips before all construction materials were on Aldabra (see picture on previous page). The renovation of the electrical distribution system of the whole station with three-phase underground cables was undertaken by local electricians.

By early 2012, 22 t of solar equipment, accessories and efficient household appliances were delivered by IBC Solar and finally unloaded on Aldabra. Aldabra staff then assembled the mounting structure, placed the PV modules (see picture above), inverters, communication and energy control devices and connected the batteries and modules. At the end of March 2012 two engineers from the solar supplier arrived for the final commissioning of the system and staff training.

DISCUSSION: RESULTS AFTER FIRST YEAR OF OPERATION

Increased energy efficiency

Initially increased energy efficiency was achieved by changing from outdated inefficient office equipment (e.g. cathode ray screens) to energy star labelled laptops, changing the lighting system to CFL bulbs and implementing a protocol for conservative use of electricity on the atoll. The first results were visible in 2010, when it was confirmed that the daily energy consumption had fallen by 20 per cent to 76,650 kWh per annum. Since early 2012 the new energy-certified fridges and freezers, combined with implementation of other energy efficient measures, have so far reduced Aldabra's electricity consumption by 57 per cent (from 95,664 to 40,867 kWh per year) compared to pre-project levels. In addition the required peak load demand has dropped from 25 kW to 5 kW and electricity costs have been reduced by 85 per cent (figure 3). Further reductions in electricity demand will be achieved with the installation of the new inverter-type AC system which

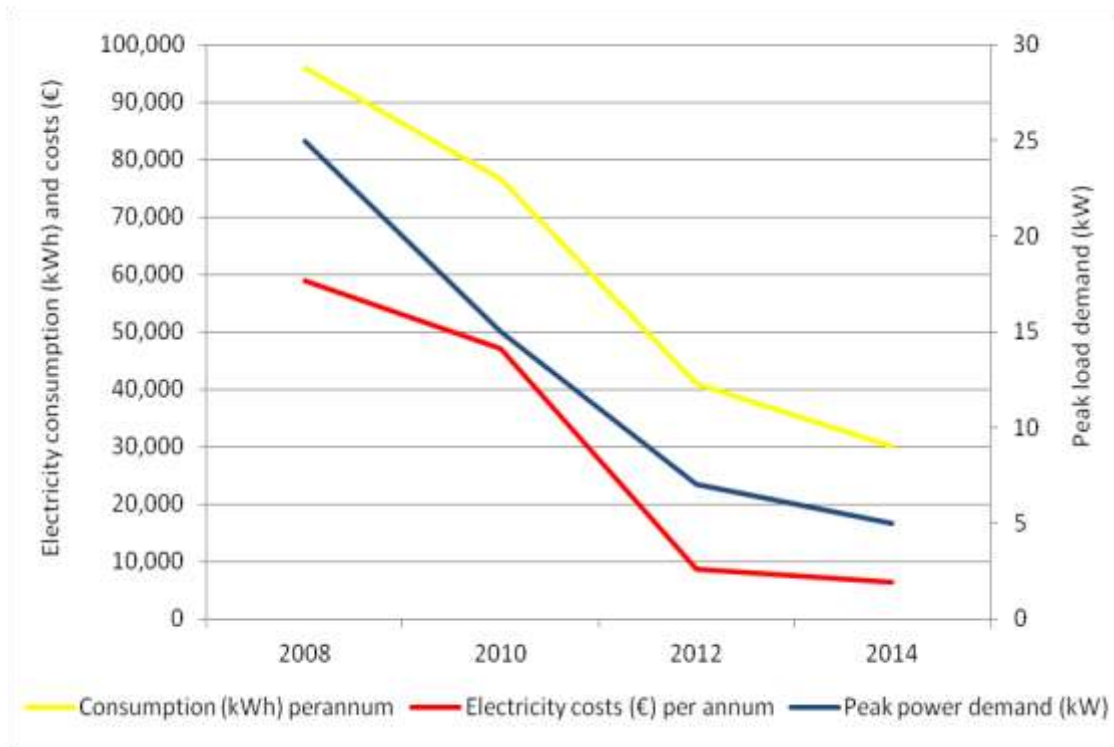


Figure 3: Decrease in energy demand, electricity costs and peak load demand

has the highest available efficiency rates (expected to be completed by the end of 2013). This should help to approach the 74 per cent reduction in energy demand which was projected at the start of the project.

Successful implementation of renewable energy system

At the time of writing, the new PV system has been functioning effectively on Aldabra for 18 months. During the day, the entire research station runs on solar power (12 staff houses, offices – including six AC units, shop, library, laboratory, research facilities, as well as the desalination plant and water pumps). Overnight, a battery backup system (charged by the solar panels **during the day**) **supplies the research station's energy needs**, and the new diesel generator is only required occasionally (ca. 15 hours per month). Successful operation of the conventional AC system on PV power was previously considered impossible due to its high power demands but has now been achieved on Aldabra.

During the first 12 months the PV system produced 38,171 kWh of solar electricity, supplying 94 per cent of **the station's energy demand with solar power**. Diesel consumption decreased by 97 per cent to only 87 l per month. Savings in operational costs (fuel and transport costs) of up to €68,000 annually increase the financial sustainability of Aldabra's operation.

Avoided CO₂ emissions contributing to climate change mitigation measures

CO₂ avoidance (in kg) is calculated using the generated electricity (kWh) multiplied with the specific CO₂ factor (kg/kWh). The CO₂ factor indicates how much CO₂ is produced for every kWh of electricity generated in the country (SMA Solar Technology AG, 2012). To determine the exact CO₂ factor for Aldabra, the CO₂ emissions prior to the project start were calculated using the emission factor of 2.67 kg CO₂ per litre diesel consumption. Based on the former diesel consumption of 37,600 l per year, CO₂ emissions equalled 100,392 kg per year. To obtain the specific CO₂ factor for Aldabra the CO₂ emissions are divided by the produced electricity (95,664 kWh per year) resulting in 1.049 kg CO₂/kWh as specific CO₂ factor.

By increasing energy efficiency the electricity demand was reduced by 54,797 kWh per year (Table 3), resulting in 57,482 kg of CO₂ avoided. In addition, the annual PV production of 38,171 kWh avoids a further 40,041 kg of CO₂ per year. The combination of energy efficiency measures and use of renewable energies avoids a total of 97,523 kg of CO₂ per annum. An investment of €36,000 increased energy efficiency, reduced the electricity demand by 57 per cent and avoided 57,482 kg CO₂ emissions in the first year of operation at a cost of €0.63 per saved kg CO₂. The installation of the PV system

	Electricity demand	CO ₂ avoidance*
Pre-project (2008)	95,664 kWh	0
After energy efficiency measures and implementation of Renewable Energy system (2012)	40,867 kWh	
Avoided	54,797 kWh	57,482 kg
Annual PV production	38,171 kWh	40,041 kg
Total		97,523 kg

Table 3: CO₂ avoidance by increased energy efficiency and implementation of renewable energy system on Aldabra Atoll

*Calculation based on specific CO₂ factor of 1.049 kg CO₂/kWh

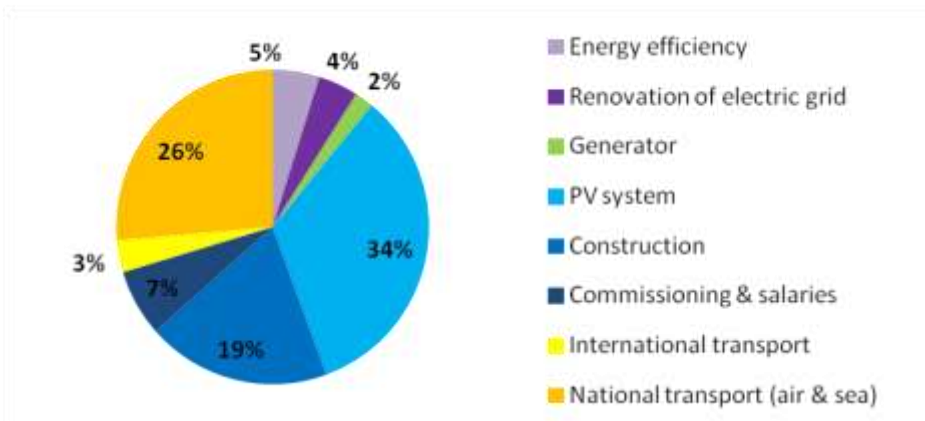


Figure 4: Breakdown of project costs

reduces the CO₂ emissions by further 40,041 kg at a cost of €160,000 (€4 per saved kg CO₂). Investment into energy efficiency is therefore extremely important to consider as the most economical way to reduce CO₂ emissions. Energy demand reductions in this case were six times more cost effective than PV-system installation and should always be considered as the first step in a sustainable energy project.

FINANCIAL ANALYSIS OF THE PROJECT COMPONENTS

The PV system has a predicted life expectancy of 20 years and the investment (€160,000) is predicted to be paid back in only three years of operation. The most expensive part of the PV system was the battery backup system (36 per cent), followed by the modules (21 per cent). Inverters accounted for 15 per cent of the costs followed by additional equipment (cables, electric control and distribution boxes, tools, etc). It should be considered that the lifetime of the battery system is 8-12 years, depending on environmental conditions, which is considerably lower than the remaining system parts. Therefore it would be wise to include battery replacement in the future budget. Together with PV system components, testing and commissioning, overall project costs, including investment into energy efficiency measures, rewiring, diesel generator, transport to and within Seychelles, construction work and materials, labour and tools, amounted to €500,000. The PV system constituted the greatest investment, at 34 per cent of

costs, followed by local transport, illustrating the difficulty in accessing Aldabra (figure 4). The current projected return of investment for the whole project is 8 years, which is expected to drop due to rising oil and transportation prices.

LESSONS LEARNED

Lessons learned which are applicable to other protected areas that are considering setting up renewable energy systems are:

- Include a comprehensive energy audit as a preparatory step.
- Consider and plan energy efficiency measures to reduce energy consumption. Demand reductions are more cost effective than investments into PV power and should be fully explored first.
- When defining your energy demand consider the implementation of energy efficient measures for an economical system size since the system size dictates your investment costs.
- Do not underestimate the resources and work indirectly required to install your system (e.g. construction work in terms of labour, material and logistics and expenses).
- Be prepared for the unexpected.
- Plan in as much detail as possible, and if not possible, be prepared to make alterations.
- Integrate the local community for long-term success of the project.



A historic moment: The Aldabra team, SIF CEO Dr Fleischer-Dogley and IBC Solar technicians after the commissioning of the PV system © Richard Baxter (April 2012)

- Build ownership into project implementation.
- Secure the majority of your investment prior to the start of the project.
- Investments into energy efficiency and renewable energies can increase sustainability of financing your operations.
- Consider the long-term maintenance of the system and select a reliable supplier who has a proven track record of implementation of similar projects and is able to offer post installation service.
- Remote monitoring options for systems in isolated places can substantially reduce maintenance costs.
- Publicity is vital to enlist support, disseminate information and galvanise efforts to initiate similar projects elsewhere – include presentations, posters, flyers, press releases.

The staff of Aldabra were integrated into the project from the beginning, with frequent presentations as well as being consulted on relevant issues. Through their involvement in assembling the system the staff gained

invaluable experience and skills, which are still rare in Seychelles. In addition working with the local staff reduced installation costs since there was no need to fly in additional technicians. To ensure long-term successful operation, despite the high staff turnover, training in energy efficiency and PV-system maintenance will be mainstreamed in the new Aldabra Management Plan.

CONCLUSIONS

Bringing renewable energy to a site as remote and logistically challenging as Aldabra was viewed as unattainable for a long time. The outcome of this project demonstrates that it is not only possible but even more successful than predicted. The project showcases a highly effective environmental management solution in a protected area with economic benefits via substantial reductions in operation costs, thereby increasing financial sustainability.

The benefits of this project are not limited to a single protected area; other nature reserves in the country, as well as government agencies have shown considerable



Lagoon Island, Aldabra Atoll © Nancy Bunbury

interest in renewable energy systems. Successful project implementation has strengthened national and international collaboration by the integration of local experts in the planning process, such as the Seychelles Public Utility Company as well as linkages with international companies importing their expertise to Seychelles. Aldabra, as the first successful stand alone and largest off-grid PV system in Seychelles, encourages others to follow.

Recently a 6 MW wind farm became operational on Mahé, with a predicted output of 8 million kWh per annum covering 2.5 per cent of Seychelles electricity demand (Public Utility Cooperation (ed.), 2013). Other small nature reserves, e.g. Aride Island, have already followed Aldabra's example by installing PV power systems (Seychelles Nation (ed.), 2013). Many more projects are planned and needed to achieve the national target in terms of renewable energies. To facilitate this plan and to make renewable energies more cost effective, efforts are needed on a national level to promote the use of energy efficient appliances and general conservative use of electricity. SIF leads by example by importing equipment with highest energy efficiency ratings (EER) without existing legal obligations. The implementation of energy efficiency policies and a legislative framework to

ensure import of highly energy efficient equipment would prevent Seychelles, like other African countries, from becoming a target for export of inefficient appliances (van Vreden et al., 2010).

The partnerships built through this project are likely to facilitate future ventures. SIF is currently planning the creation of a remote access visitor centre for Aldabra on Mahé, which will bring this unique site closer to the people of Seychelles and its visitors. Following the success of the renewable energy project on Aldabra, it is planned that this building will be state of the art in sustainable architecture and powered entirely by renewable energies.

The set up and operation of a renewable energy system on Aldabra is a successful example and inspiration for other islands within and outside Seychelles. The Aldabra energy story demonstrates that, with good planning and in combination with increased energy efficiency, the switch to sustainable energy can be achieved even on the most remote and inaccessible of islands. It is hoped that the success of this project will assist with galvanising efforts and the wider application of the most available and easy to harness renewable energy source, the sun.

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Nancy Bunbury is a conservation biologist and was **recruited by SIF in 2008. She is currently SIF's Science and Projects Programme Coordinator** and has developed and managed a range of research, conservation, education and management projects for the organisation. She holds a PhD in avian conservation biology and a BSc in Zoology from the University of East Anglia, UK. Nancy

was previously employed for five years with the Mauritian Wildlife Foundation as a project coordinator and fieldworker. Her main interests are in protected area management, particularly endangered species conservation and invasive species management.

Frauke Fleischer-Dogley is a trained conservation biologist with a PhD in the sustainable management of the Coco de Mer, from the University of Reading, UK and a diploma in plant conservation techniques from the Royal Botanic Gardens Kew. She has 15 years of experience in protected area management and is responsible for the management and protection of the **Seychelles' UNESCO World Heritage Sites, the Vallée de Mai and Aldabra**. She has a keen interest in environmental management practices and initiated the development of the Seychelles Sustainable Tourism Label. The implementation of the renewable energy system was led by her from inception to operation.

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RESUMEN

El atolón de Aldabra, sitio del Patrimonio Mundial de la UNESCO, es una importante zona de conservación e investigación, pero su lejanía hace de la gestión un gran desafío logístico. La utilización de generadores diesel para proveer energía eléctrica resultó en costos elevados de combustible y transporte, además de ser ambientalmente insostenible. En 2008, la Fundación de las Islas Seychelles comenzó a investigar formas para aumentar la eficiencia energética y desarrollar un sistema de energía renovable para reducir los costos operativos. A raíz de una auditoría energética, se evaluaron diversas opciones de energía renovable y su aplicación y se realizaron investigaciones sobre medidas de eficiencia energética. Los resultados fueron puestos en práctica, y se estableció un sistema híbrido fotovoltaico-diesel de 25 kW. La reducción de la demanda de electricidad era un requisito previo para la implementación exitosa del sistema de energía renovable. Las medidas de eficiencia energética redujeron la demanda de electricidad en un 57%. En el primer año de operación se generó 38.171 kWh de electricidad solar, equivalente al 94% de la nueva demanda de la estación. Esto ha evitado un total de 97.523 kg de CO₂ al año. **Desde la implementación del sistema fotovoltaico, la demanda de diesel se ha reducido en un 97% y se proyectan ahorros operativos de hasta €68.000, con lo que la inversión en el sistema se recupera en tan solo tres años. Se requieren inversiones en eficiencia energética y energías renovables para asegurar la sostenibilidad ambiental y financiera.**

RÉSUMÉ

Le site d'Aldabra Atoll, classé sur la Liste du patrimoine mondial de l'UNESCO, est une zone importante pour la conservation et la recherche, mais du fait de son éloignement, sa gestion est un défi majeur en termes de logistique. L'utilisation de groupes électrogènes à base de diesel pour alimenter l'île en électricité a entraîné des coûts élevés de combustible et de transport, sans parler du coût écologique. En 2008, la Fondation des îles Seychelles a commencé à s'interroger sur les façons d'améliorer son efficacité énergétique et de développer un système d'énergie renouvelable, dans l'optique de réduire ses coûts d'exploitation. Un audit énergétique a été mené, où les options en termes d'énergie renouvelable et leur applicabilité ont été évaluées, et les mesures d'économie d'énergie étudiées. Les résultats ont ensuite été appliqués, et un système énergétique hybride photovoltaïque-diesel de 25 kW_p a été installé. La réduction de la demande était une condition préalable pour une mise en œuvre réussie du système d'énergie renouvelable. Des mesures d'économie d'énergie ont permis de réduire la demande d'électricité de 57 pour cent. 38 171 kWh d'électricité solaire ont été produits pendant la première année d'exploitation, couvrant 94 pour cent de la nouvelle demande de la station. Au total, cela a permis d'éviter 97 523 kg d'émissions de CO₂ par an. Depuis l'installation du système photovoltaïque, la demande en diesel a diminué de 97 pour cent et on s'attend à économiser 68 000 euros sur les dépenses d'exploitation, ce qui permettra de rembourser l'installation en seulement trois ans. Il en ressort donc que des investissements dans l'efficacité énergétique et les énergies renouvelables sont nécessaires pour améliorer la durabilité environnementale et financière.



MULTI-LEVEL CO-MANAGEMENT IN GOVERNMENT-DESIGNATED PROTECTED AREAS – OPPORTUNITIES TO LEARN FROM MODELS IN MAINLAND SOUTHEAST ASIA

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ABSTRACT

There is broad consensus that the ecological-social landscapes for government-designated protected areas should comprise core areas and their surrounding buffer zones and that the essential tasks for managing these landscapes should comprise: (i) ecological research and monitoring, (ii) law enforcement, (iii) community outreach and awareness raising, (iv) community livelihoods development and engagement with community managed lands, (v) ecotourism, and (vi) habitat management. This paper proposes that these tasks should not necessarily be undertaken by the protected area agency alone. Instead, it recommends investigation into the development of protected area management working groups in the different fields of management, whereby these networks create institutional linkages between the grassroots communities, other local stakeholders and a protected area co-management committee. The paper draws from the authors' experiences and briefly describes models for such local networks already being implemented in northern Vietnam and Laos for protected areas with high biodiversity values. While many of the approaches described are still too young to draw conclusive evidence of their efficacy, their implementation demonstrates that local interest for innovative approaches to co-management can be generated.

KEYWORDS: co-management, protected areas, Vietnam, Laos, local communities, management

INTRODUCTION

There are now more than 177,547 protected areas worldwide, covering more than 12.7 per cent of the Earth's land surface (Bertzky et al., 2012). But designation is only the first step. If protected areas are to be effective in fulfilling their role in biodiversity conservation, they must be well managed (WWF, 2004). During the last four decades there has been a rapid development of protected area management approaches moving away from the traditional "fortress" approach to take greater account of the needs of communities and

stakeholders within the broader social-ecological landscape. Buffer zone management (Wells et al., 1992; Ebregt & De Greve, 2000), integrated conservation and development (Hughes & Flintan, 2001) and collaborative management (Borrini-Feyerabend et al., 2004b) all focus on local communities while aiming to preserve biodiversity within reserves. However, during the same period the threats to protected areas have increased (Dudley & Stolton, 1999), particularly from habitat disruption, hunting and forest-product exploitation (Lawrence et al., 2012), as well as climate change



View of the Trung Khanh District, Cao Bang Province, Vietnam © Nguyen The Cuong

(Hannah, 2003; Hannah et al., 2007; IPPC, 2002). One key issue to have received scant conservation attention is how to organize protected area staff optimally to engage with other stakeholders in the protected area landscape.

Collaborative management, or co-management, has been promoted as a means to bridge the gap between the protected area and local stakeholders. It has been **defined in different ways, e.g. 'the sharing of power and responsibility between the government and local resource users'** (Berkes et al., 1991), or **'governance systems that combine state control with local, decentralized decision making and accountability and which, ideally, combine the strengths and mitigate the weaknesses of each'** (Singleton, 1998). Co-management is a continuous problem-solving process, rather than a fixed state, involving extensive deliberation, negotiation and joint learning within problem-solving networks (Carlsson & Berkes, 2005). This presumption implies that co-management research should focus on how different management tasks are organized and distributed concentrating on the function, rather than the structure, of the system. Such an approach has the effect of highlighting that power sharing is the result, and not the starting point, of the process.

Carlsson and Berkes (2005) recommend that the co-management approach might include (1) defining the social-ecological system under focus; (2) mapping the

essential management tasks and problems to be solved; (3) clarifying the participants in the problem-solving processes; (4) analyzing linkages in the system, in particular across levels of organization and across geographical space; (5) evaluating capacity-building needs for enhancing the skills and capabilities of people and institutions at various levels; and (6) prescribing ways to improve policy making and problem-solving. Bloomquist (2009) proposes that multiple and polycentric institutional arrangements operating (imperfectly) may offer prospects for improved sustainable management of natural resources. Berkes (2002) suggests there is a need to design and support management institutions at more than one level, with attention to interactions across scale from the local level up.

Landscape-level protected area management in Southeast Asia has made advances in engaging local communities through co-management in recent decades. Through this paper the authors are drawing both from their own experiences and other referenced experiences to describe how different components of multi-layer co-management are being implemented and are strongly aligned with the approach proposed by Carlsson and Berkes (2005). This paper reviews the co-management systems field-trialed at sites in northern Vietnam **protecting some of the world's most endangered primate species**, an ecotourism initiative also in northern

Vietnam and a community outreach network established in central Lao P.D.R. By examining this group of case studies, the paper proposes multi-level co-management for institutional restructuring of protected area management in Southeast Asia for more effective biodiversity conservation.

DEFINING THE ECOLOGICAL-SOCIAL LANDSCAPE FOR PROTECTED AREAS AND CO-MANAGEMENT

From an institutional perspective, the recognition of a buffer zone in national legislation is important for two main reasons. For a protected area authority, it prescribes management responsibilities extending beyond the boundary of the protected area. For communities, it provides an entry point to raise livelihood-related management issues with the protected area authorities. Furthermore, a failure to stem broad-scale loss and degradation of surrounding habitats could increase the likelihood of serious biodiversity declines (Lawrence et al., 2012). The recognition of the buffer zone may have major impacts on co-management options, and the likelihood of multi-level co-management success.

In Southeast Asia, both recognition and definitions of buffer zones are not consistent. Vietnam recognizes management of the buffer zone in Decree 117 (S.R. Viet Nam, 2010), and Prime Minister Decision 24 (S.R. Viet Nam, 2012) promotes the protected area authority to target distribution of funding into buffer zone villages, but the legislation is so new there is little experience. Lao P.D.R. introduced a peripheral impact zone for the management of the Nakai Nam Theun NPA (Lao P.D.R., 2010), a buffer zone where it spends US\$280,000 annually on community development activities. The Kingdom of Cambodia (2008) promotes a community zone. The Philippines (NIPAS, 1992) recognizes buffer zones and designates a multi-stakeholder Protected Area Management Board with management oversight over the buffer zone. Brunei, Indonesia, Malaysia, Myanmar and Thailand have comparatively older protected area legislation and omit reference to the buffer zone in their main national legislation on protected areas, which has a profound influence on the management approach.

DEFINING ESSENTIAL PROTECTED AREA MANAGEMENT TASKS

(a) Protected area management arrangements
Given their importance both to the science of protected area management and the success of multi-level co-management, it is important that the management arrangements for conducting the field activities in a

government-designated protected area are spelled out. The IUCN Report: *Protected Area Staff Training: Guidelines for Planning and Management* states that it **is very difficult to name the “main” training themes** needed by a modern protected area manager as they vary between different regions and countries (Kopylova & Danilina, 2011). However, the authors enumerated the major training packages, drawing from a broad range of sources, from which it is possible to define the units that might make up a management body for a government-designated protected area in a developing country. These are:

- Ecological monitoring and research section;
- Law enforcement section;
- Community outreach and awareness section;
- Community development (alternative livelihoods) section;
- Ecotourism section; and,
- Habitat management section.

Appleton et al. (2003) also developed a generic organizational structure for protected areas in Southeast Asia based upon competence standards, which were further modified in training documents (Appleton et al., 2011). The essential tasks comprise: (i) ecological research and monitoring, (ii) law enforcement, (iii) community outreach and awareness raising, (iv) community livelihoods development, (v) ecotourism, and (vi) habitat management (e.g. forest fire management and reforestation). In Southeast Asia, the organizational arrangements for a protected area authority are largely omitted from national protected area legislation. Vietnam is the only exception, describing the institutional organization and responsibilities of a protected area management board in Decision 117, although it lacks clarity on community engagement (S.R. Viet Nam, 2010).

(b) Protected area management working groups

Any protected area has comparatively few professional staff compared to the populace in the neighbouring buffer zone (Green & Paine, 1999; Rambaldi, 2000). To optimize constructive interactions with buffer zone communities, protected area staff need to be professional and organized, and also operate strategically, seeking allies and support amongst the local stakeholders.

Ideally, staff should identify key partners and formally structure their engagement through well-organized management agendas. This could be achieved by establishing protected area management working groups, which comprise the protected area staff in a particular



Bunaken National Park. Manado underwater, North Sulawesi, Indonesia © Jürgen Freund / WWF-Canon

specialized field of management, together with concerned local community representatives and concerned local government agencies. Although this has scarcely ever been actively promoted internationally, Kopylova & Danilina (2011) moot the establishment of protected area management working groups through:

- **Establishing** “Groups of Friends of PAs and how to organize their work”.
- “Creation of Public Councils and other co-management structures”.
- “Integrating local communities into ecotourism development at a PA” and “Interaction between a PA and tourist companies”.
- “Work with poachers”.

Within Southeast Asia, documented examples of functioning protected area working groups are rare. At Bunaken Marine National Park in Indonesia, co-management started with the development of constituency-based partnerships on different natural resources issues, and evolved to true co-management when the partnerships started working with each other (Erdman et al., 2004). In Mt Kitanglad Range Natural Park, the first and perhaps most successfully managed protected area in the Philippines, the key to success, according to the superintendent, was to change decision-

making from the national agency to the local level (La Viña et al., 2010). Involvement of a range of stakeholders (e.g. rangers, police and villagers from several villages) in joint patrol teams greatly decreased the likelihood of corruption, collusion or conflicts of interest in dealing with violations committed by friends and family members.

(c) Protected area management advisory committee

If a protected area agency engages with both core and buffer zone stakeholders, embracing a wide arrange of management issues involving working groups, it may be worth establishing a protected area management advisory committee, as a centralized think-tank, to define best approach management. Such committees should comprise senior representatives from the protected area, concerned government agencies and local communities, who meet regularly to guide coordination amongst stakeholders, monitor management and ideally monitor budget allocation and utilization. Internationally, supervisory co-management bodies and their role in protected area management have received increasing recognition (Borrini-Feyerabend et al., 2004a); including in Southeast Asia (Clifton, 2003; Erdman et al., 2004; Parr et al., 2007). It is interesting that Kopylova & Danilina (2011) describe two further training packages

Table 1: Organisations represented on three Vietnamese Protected Area Management Advisory Committees

Mu Cang Chai	Khao Ca	Trung Khanh
Protected Area Agency (Mu Cang Chai SHCA Management Board): Vice Director + 2 Heads of Sections (3)	Protected Area Agency (Khao Ca SHCA Management Board): Director and 1 staff (2)	Protected Area Agency (Cao Vit Gibbon SHCA Management Board): Director and 1 staff (2)
District People's Committee (1)	District People's Committee (1)	District Peoples Committee (1)
District Agriculture and Rural Development Office (1)	District Agriculture and Rural Development Office (1)	District Agriculture and Rural Development Office (1)
-	District Agriculture Extension (1)	District Agriculture Extension (1)
District Police Department (1)	-	-
District Office of Natural Resources and Environment (1)	District Office of Natural Resources and Environment (1)	District Office of Natural Resources and Environment (1)
District Judiciary Department (1)	-	Border Army Station (2)
Commune People's Committees: Che Tao, Pung Luong, Nam Khat, Xu Phinh, Loa Chai (5)	Commune People's Committees: Minh Son, Yen Dinh, Tung Ba (3)	Commune People's Committees: Ngoc Con, Ngoc Khe, Phong Nam (3)
Mu Cang Chai Youth Union (1)	-	-
Mu Cang Chai Farmers' Union (1)	-	-
-	-	Quay Son Watershed Protected Area (1)

which might also institutionally map the formation of supervisory co-management arrangements, and some key responsibilities. These tasks comply well with the priority tasks undertaken by a supervisory co-management body or management advisory committee. These comprise:

- PA management: e.g. (i) strategic planning and operational management of a PA; (ii) conflict management (iii) private sector and the PA; (iv) PA and governmental structures – ways of interaction; (v) cooperation with NGO sector; (vi) PA and local communities; (vii) work with cultural and religious leaders; (viii) participatory management; (ix) PA management in the face of global changes (including climate change)
- Institutional setting and management plans: e.g. (i) management planning and business planning; (ii) financial management; (iii) monitoring and evaluation of PA management effectiveness

EXISTING PROTECTED AREA CO-MANAGEMENT BODIES IN SOUTHEAST ASIA

In Southeast Asia, the Philippines provides an interesting and relatively advanced model of co-management, with designated protected area management boards: a model for protected area governance, according to Barber et al. (2004). In Lao P.D.R., Nakai Nam Theun National Protected Area is managed by multi-stakeholder Board of Directors, which meets twice a year to supervise co-management activities in the protected area. Thailand

has developed policy guidelines on establishing Protected Area Committees within its protected area system but these also tend to meet only once every six months. In Vietnam, Buffer Zone Management Committees are currently being proposed in a draft buffer zone circular, as means for the protected area agency to link into the local stakeholders.

In summary, key institutional bodies for protected area management comprise (i) the specialized field sections within the protected area agency, (ii) the protected area management working groups including those linked to existing administrative bodies (district, sub-district and village), and (iii) a landscape co-management body; this is multi-level co-management.

CASE STUDIES IN MAINLAND SOUTHEAST ASIA

(a) Establishing Management Advisory Committees

Mu Cang Chai SHCA, Yen Bai Province in northern Vietnam is a 20,293 ha protected area in a remote mountainous area, home to the only known viable population of the critically endangered Western Black Crested Gibbon (*Nomascus concolor fuvogaster*) in Vietnam. Since its discovery there in 1999, Fauna & Flora International (FFI) has been implementing activities to protect this population including supporting establishment of the protected area, which led to evolving a system for co-management of the area with local ethnic minority communities. Originally an institution called a Forest Protection Council was

established consisting of local representatives from communes around the protected area (Swan & O'Reilly, 2004). This Council had responsibility to advise the protected area agency (Management Board) and report to the local communities. However, the Council lacked an organized framework for operation (i.e. a set of regulations), lacked a structured agenda recognizing different fields of protected area management, and lacked a work plan. It consequently had limited success to operate as an effective co-management forum.

Simultaneously, FFI was also focused on protecting **populations of two of the world's rarest primates** in northern Vietnam following their rediscoveries a decade ago; the Tonkin snub-nosed monkey (*Rhinopithecus avunculus*) at Khau Ca, Ha Giang Province and the cao vit gibbon (*Nomascus nasutus*) in Trung Khanh District, Cao Bang Province on the border with China. Both these primate populations persist in tiny blocks of forest of less than 2,000 ha. The small size of the forest and the consequently limited numbers of people living in the so-called "buffer zones", meant that FFI staff and their government counterparts could get to know and work with surrounding communities and other stakeholders closely, and eventually species and habitat conservation areas (SHCAs) were formally established at both sites.

In 2011 FFI strengthened the formalized co-management arrangements within all these primate sites, through the establishment of Management Advisory Committees (MAC), bringing together representatives from local stakeholders into an organized forum at the protected area level to provide overall management direction to the reserve in question. An MAC comprises representatives from the Management Board (government protected area agency), local community representatives and other local concerned government agencies (see table 1 on previous page). Membership was purposely kept small to facilitate focused management discussions, and local civil society representation omitted in the early stages of their development, given local government management capacities. Importantly, the membership and functioning of a MAC was guided by the development of regulations establishing it and its mode of operation.

The regulations stipulate co-management covering a number of protected area management tasks as described by Kopylova and Danilina (2011), namely (i) boundary demarcation, (ii) wildlife monitoring, (iii) law enforcement, (iv) community outreach, (v) community development, (vi) ecotourism, (vii) natural resource management. They also cover (ix) zoning, (x) management planning, (xi) financial review and (xii)

annual reporting. Significantly, it also mandated the MACs to respond to climate change. It appeared imperative that these MACs link into the protected area management working groups in the different fields of protected area management, which in turn directly supervise day-to-day management of the reserves in question. This included law enforcement patrol groups (with monthly meetings), community outreach networks as well as commune level groups on community development.

The FFI Vietnam programme spent considerable time focusing on understanding the effective functioning of the Management Advisory Committees, and ensured these key elements were implemented to strengthen their operation. Key elements included (i) reviewing membership to involve only the most relevant stakeholders; (ii) facilitating meetings every three months to ensure MAC members were actively engaged and monitoring field implementation, rather than cursory participation through less regularly organized meetings; (iii) preparing the agendas so that they covered the important issues in each of the specialized fields of protected area management, so that quality time was enhanced; (iv) taking minutes of meetings which could be reviewed; and (v) preparing three monthly work plans (which may only be possible at small reserves). It was recognized that these Committees needed succinct summaries of achievement from the grassroots in the respective fields of protected area management. The FFI Vietnam Programme started to amalgamate data from the monthly law enforcement network meetings, the commune working group meetings, and constituency working groups (see below) to formulate the content of the three-monthly co-management meetings. The co-management learning process is still evolving.

b) Creating protected area management working groups

Some examples of protected area management working groups in mainland Southeast Asia are described below. Some, such as law enforcement networks involving interagency cooperation, are comparatively common, particularly in protected areas managed by conservation NGOs. Others, such as community outreach and conservation awareness networks, are scarce as a consequence of the limited expertise in this field of management.

(i) Community development working groups: At Mu Cang Chai SHCA, commune working groups were formally established in each of the five communes situated in the buffer zone to discuss community



The critically endangered Cao Vit Gibbon (*Nomascus nasutus*) which is restricted to a single increasing global population numbering just under 130 individuals in Trung Khanh Species and Habitat Conservation Area in Cao Bang Province, Northern Vietnam, and adjacent forest in Jingxi County, Guangxi Province, China. It has benefitted from strong collaborative management practices over the past 10 years © Zhao Chao, FFI

development issues through a District Regulation (S.R. Viet Nam, 2011). Membership of the commune working groups comprised representatives from the communes, the heads of the commune agencies and the respective village headmen. The commune working group regulation also linked the five communes institutionally with the Mu Cang Chai SHCA MAC. These working groups were mandated to communicate into the grassroots – the 22 ethnic villages in the buffer zone. Through a pilot project funded by the European Union, the Mu Cang Chai SHCA MAC was empowered to distribute five grants to alleviate poverty among villages in the buffer zone, through these commune working groups. The five grants were awarded based upon development proposals the communities themselves had written. In exchange, conservation agreements were signed between the five communities and the Mu Cang Chai SHCA MAC. Two grants supported improving animal husbandry skills, one supported women conserving traditional handicrafts, and two supported planting local fruit trees. This is the first time that forest

conservation and poverty alleviation have been linked in Vietnam through a legally recognized co-management body. The distribution of community development grants have also been initiated at Khau Ca SHCA and at Cao Vit Gibbon SHCA.

(ii) Livestock Working Group (a livelihood constituency working group): At the Cao Vit Gibbon SHCA, a key issue was the control of livestock grazing to reduce its impact on both the protected area and village forests. A Livestock Working Group was established to encourage self-learning. Fodder crops and silage were successfully introduced to these villages for cattle feed. A representative from this constituency working group was invited to join the Cao Vit Gibbon SHCA MAC and participate in three-monthly meetings.

(iii) Ecotourism associations (a specialized livelihood constituency working group): The establishment of government-initiated institutional bodies promoting sustainable community-based



Meeting to establish the Regulation for the formation and functioning of the Trung Khanh SHCA Management Advisory Committee © Nguyen The Cuong

ecotourism within protected areas is also rare in Southeast Asia, as it involves sharing tourism revenues equitably amongst multiple stakeholders. In 2008, the FFI Vietnam Programme initiated a pro-poor nature-based tourism project in Pu Luong Nature Reserve (PLNR), Thanh Hoa Province. A business model was developed that permitted more equitable and sustainable sharing of the tourism benefits between the key stakeholders – the local communities, PLNR Management Board, district authorities and tour operators. Local institutional capacity was recognized to be weak. The participation of local communities in tourism in PLNR was increased through negotiation of an ecotourism development plan involving all relevant stakeholders, which aimed to increase tourism numbers, increase local community participation in tourism management, and achieve a more equitable distribution of tourism revenues. The plan focused on investments in human resources and facility development which allowed communities greater opportunities to provide tourism services, and a community fund managed by the **Women's Unions was set up to ensure that the poorest families benefited from tourism.**

(v) Community outreach and conservation awareness working groups: Community outreach sections are very rare among protected areas in Southeast Asia, despite having extremely important roles, educating villagers, students and enforcement

personnel. At Nakai Nam Theun NPA, a Community Outreach and Conservation Awareness (COCA) Section was established in October 2008 with the appointment of three Watershed Management and Protection Authority (WMPA) staff. Their remit was to raise awareness with local stakeholders, including (i) village leaders, teachers and students; (ii) law enforcement personnel in different agencies and (iii) the general public. The WMPA staff were given vigorous training to engage local stakeholders. It was recommended that a COCA Working Group should be established to increase community outreach and conservation awareness. This Working Group comprised stakeholders from three groups: (i) all the COCA staff, (ii) district representatives from various government agencies, including education, forestry, **police, army, Women's Union and the public relations office**; all these staff had participated in the two training courses, and (iii) representatives from the local communities, including community leaders, three representatives from each commune, spiritual leaders and teachers. The WMPA developed a Conservation Education and Awareness Strategy in collaboration with this COCA Working Group, which was incorporated into the Nakai Nam Theun National Protected Area Management Plan (2010-2015). The small and highly specialized COCA Section underwent regular staff changes, which had knock-on impacts of recognizing a COCA Working Group by the WMPA, and it was never formally established and maintained.

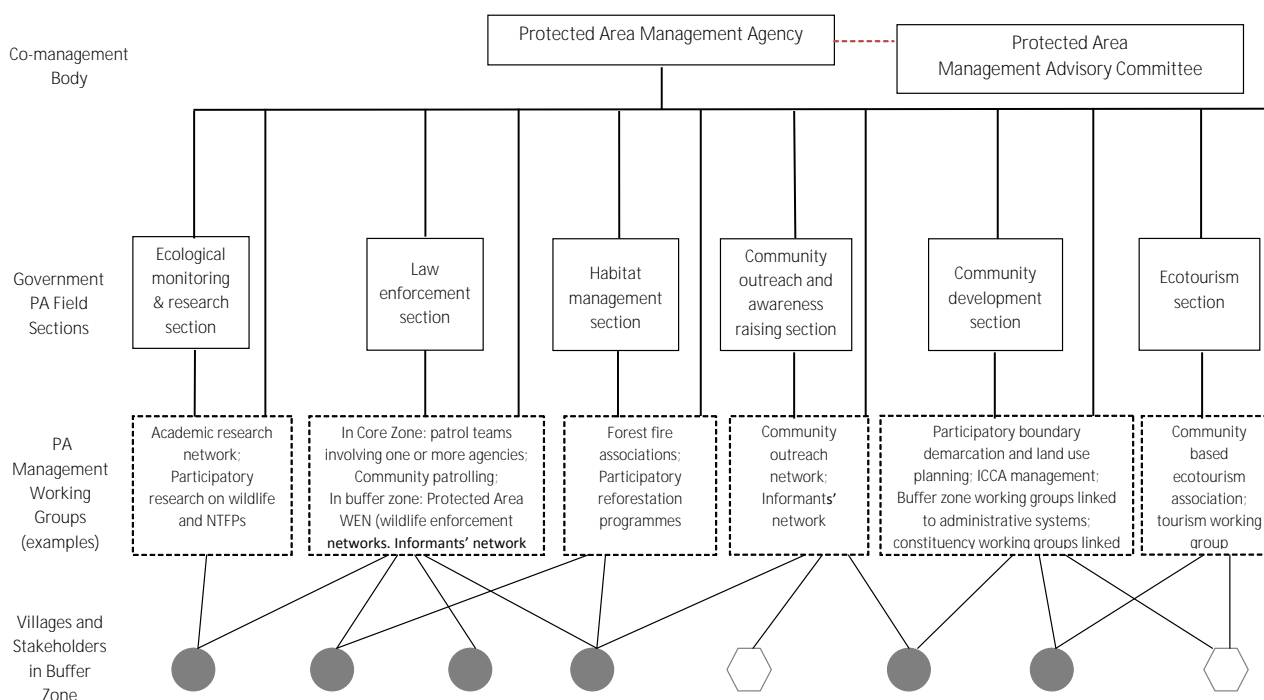


Figure 1. Generic Multi-level Co-management Arrangements for a Government – designated Protected Area in Southeast Asia

(v) Law enforcement working groups: A number of protected areas in Southeast Asia, and particularly those reserves which have received long-term technical support from conservation NGOs, have developed well-structured law enforcement systems; some systems involve partner collaboration, while others do not. Collaboration with enforcement agencies, including police, border police and army (who have stronger legal mandates, a mandate to carry firearms and more social clout), are often promoted. Participation of local villagers in community patrols is also promoted. Regular collection of law enforcement GIS data through the Management Information System (MIST) or SMART patrolling facilitates regular monthly law enforcement meetings to discuss patrolling data and lay out strategic plans for the forthcoming month. Collaboration on law enforcement inside reserves varies according to the availability of human resources within the conservation agencies, while in the buffer zone collaborative enforcement efforts are the norm. At Huai Kha Khaeng Wildlife Sanctuary in the Western Forest Complex, Thailand, intensive law enforcement is undertaken by 20 patrol teams comprising 200 rangers from the Department of National Parks and Wildlife Conservation. These patrol teams hold monthly law enforcement working group meetings to report on past patrolling efforts and prepare monthly strategic plans. Enforcement efforts in the buffer zone tend to be reactive, although the formation of a Huai Kha Khaeng W.S. Wildlife Enforcement Network (WEN) is under consideration. At Nam Et-Phou Loey NPA, in Houaphan Province, northern Lao P.D.R., eight

patrol teams have been established by the Wildlife Conservation Society comprising two forestry officials, two military officials and villagers. Two mobile patrol teams operate in Viengthong and Viengkham Districts in the buffer zone (T. Hansel, per comms). The FFI Vietnam Programme funds and provides ongoing technical supervision to 11 community patrol teams in their endangered primate sites. These teams comprise local Forest Protection Department staff together with local villagers; police occasionally join these patrols. Monthly law enforcement working group meetings are held to report patrolling activities and prepare monthly plans.

DISCUSSION

Lessons from three Management Advisory Committees in northern Vietnam

The case studies provide some insights as to how multi-level co-management systems could be implemented. They have required a lot of outside support and facilitation and it is still not clear how many will continue without this support. In the Vietnamese case studies, FFI has spent several years acting as an intermediary liaising between different stakeholders. The targeted primate sites were not ideal to innovate co-management, as the main constraint to promote co-management was the limited number of protected area staff within the protected area management boards. The Mu Cang Chai SHCA Management Board had only four permanent staff, while Khau Ca SHCA had only five part time staff. These low staffing levels precluded the staff themselves developing specialized fields of expertise in law

enforcement, community outreach and community development, and thence to branch out to engage the local communities in different fields of management. It consequently also placed greater onus on FFI to carry the co-management agenda forward.

Furthermore, the protected area framework in Vietnam precludes any resource use inside protected areas, which seriously limits the legal options for managing natural resources when negotiating with local communities who are all among the poorest rural villagers in Vietnam. At all three sites, resource use inside the protected areas was not such a contentious issue; at the Cao Vit Gibbon SHCA and Khau Ca SHCA there were very few valuable natural resources within the protected areas. Hence involvement of local communities in patrolling could be mooted and there was negligible resentment to restricting access to non-timber forest product utilization in these high-value biodiversity sites. At Mu Cang Chai SHCA, land-use planning exercises conducted in the 22 villagers in 2002 revealed that the forested lands in the buffer zone were sufficient to not warrant access to resources inside the reserve. Nevertheless, close engagement with local communities and other stakeholders meant that the co-management approaches largely evolved out of perceived necessity. Co-management was already taking place in the ground at all three sites, albeit unstructured.

The establishment and subsequent functioning of the three Management Advisory Committees at Mu Cang Chai SHCA, Khau Ca SHCA and the Cao Vit Gibbon SHCA shed some interesting light on the dynamics of structuring the stakeholder interactions. A number of strengths were recognized. The establishment of a regulation provided an invaluable framework for structuring stakeholder interactions and assisting management outcomes. The recognition of the different specialized fields of management seemed important to start generating more focused work programmes, which also required the protected area staff to be more selective in identifying their respective stakeholders. Meetings were held every three months, sufficiently often to ensure management oversight continuum. Well-structured agendas and work plans also assisted focused discussions. Efforts were made to make the meetings of the committees participatory. The Mu Cang Chai SHCA MAC distributed development grants - designed to mitigate threats - through the commune working groups to the buffer zone villagers. This multi-level co-management demonstrates an ICDP mechanism involving the supervisory co-management body, albeit at small scale, of short duration and with strong NGO guidance.

Weaknesses were also identified in the functioning on the Management Advisory Committees. These included having a membership dominated by government officials, and the Management Board staff - particularly the chairmen - lacking facilitation skills for balanced dialogue. Agendas and discussions at all three sites were heavily dependent upon the initiatives and funding streams delivered by the conservation NGO, FFI, as government budgeting for field activities was very modest.

Most recently, the opportunities in Vietnam have been opened for more innovative co-management approaches, although there is the risk that they have opened too much, allowing too much access to resources into protected areas, while protected areas managers still largely do not understand the biodiversity conservation role of their protected areas. Furthermore, where they do understand that goal, they often have too little capacity to conduct the most basic law enforcement. Co-management is a complex process, and requires protected area staff to diversify into completely new skills sets, primarily stakeholder facilitation, community outreach and awareness-raising and community development. It requires continued piloting at select sites in Vietnam and other countries in the region, committed long-term donor support and technical support from experts. It also requires recentralization of the protected area network under a protected area agency to generate institutional memory and technical support to complex landscape management. Piloting innovative co-management approaches would be more appropriately conducted in sites where long-term technical support from a committed NGO with the appropriate levels of technical expertise are assured, or sites without global significance for biodiversity where some level of failure would not pose such a risk to global biodiversity heritage.

The co-management approach has recently been endorsed in national legislation in Vietnam. On 8th **February 2012, Prime Minister's Decision 07 promotes** co-management of special use forests, watersheds and state forest enterprises, including the formation of **committees. On 24th June 2012, Prime Minister's** Decision 24 promotes the distribution of investments by Management Boards into buffer zones.

The necessity to establish management advisory committees at the landscape level

It seems entirely logical to establish a body of local stakeholders with different needs and different perspectives to provide management direction. A management advisory committee provides an institutional bridge between core zone stakeholders and



View of the Trung Khanh District, Cao Bang Province, Vietnam © John Parr

buffer zone stakeholders. A co-management committee can make itself informed of the biodiversity values, threats to these values, and the socio-economic demands of buffer zone villagers, and develop corresponding management responses. It thus has the unique ability to generate targeted development agendas directly linked to conservation outcomes; it therefore warrants further investigation.

Establishing and strengthening protected area management working groups

The concentration of management responsibility within the core zone, and the omission of the buffer zone from the management jurisdiction of the protected area agency, have inadvertently hampered the development of protected area management working groups in many developing countries. Community outreach, conservation awareness and community development agendas have consequently been omitted from management activities for many protected area agencies. Yet, the development of management task forces, building on the existing administrative hierarchy at district, sub-district and village level, provides a potentially strong multi-level

governance arrangement for one key pillar of landscape protected area management - community engagement in the buffer zone.

Interestingly, it is the second pillar of landscape protected area management – law enforcement – which gives us the best management template for effective protected area management. Law enforcement sections in selected protected areas facilitate interagency cooperation through regular monthly meetings with precise agendas to report and plan law enforcement activities using GIS-based patrolling data. By the same token, it may be relatively easy to organize formal district level buffer zone working groups, sub-district working groups and village committees to hold monthly meetings with precise agendas for reporting and planning buffer zone management activities.

The best opportunities to experiment with developing protected area working groups is at sites with long-term technical support from international and national conservation NGOs. However, the professionals within the NGOs may need to be mindful as to whether they are



Commune livelihood interest working group © Nguyen The Cuong

inadvertently taking on a management leadership role, substituting themselves for the coordinating role of co-management committee and/or the management working groups, and undermining both the formation and operation of these institutional bodies. What is not documented is whether this management replacement factor has played a role in buffer zone management and integrated conservation and development initiatives, and the many reported failures, particularly when it should be the conservation staff – with negligible community development skills sets – playing a prominent role in the buffer zone engagement process.

Required institutional arrangements of protected area agencies for co-management
Internationally, the institutional arrangements for a management authority of a government-designated protected area have rarely been discussed (Parr, 2006). Compartmentalization of protected area management tasks is vitally important for effective multi-level co-management for three reasons. Firstly, it allows the protected area staff to have focused professional responsibilities, with technical skills sets which are respected by local stakeholders. Secondly, in sites supported by conservation and/or development NGOs, it permits them to identify clearly their protected area government counterparts for targeting technical and funding support. Thirdly, it permits the conservation NGOs to be more amenable to accepting community development interventions as incremental investments in protected areas, rather than conflicting funding

streams. The protected area management staffing arrangements have a profound impact on the working relationship with the buffer zone communities, and other concerned stakeholders, and thence the degree to which co-management is likely to succeed.

Unfortunately, protected area agencies are being given little advice on staffing arrangements, which has clear implications for successful biodiversity conservation. Even the assessment form of the World Bank METT tracking tool (World Bank, 2007) does not segregate its questions into (i) supporting management documents; (ii) administrative management issues and (iii) field management actions, which would assist both conservation agencies and conservation organizations to reflect on whether the protected area arrangements are optimally arranged for effective management of reserves.

Effectiveness of Multi-level Co-management

Multi-level co-management makes the relationship between core zones and buffer zones, and thence conservation and development, much clearer. It provides a forum and mechanism for working out conflicting conservation and development agendas. Moreover it compartmentalizes protected area activities, so in pilot co-management sites involving NGOs, some activities may be prioritized by the conservation NGOs, while others are prioritized by development NGOs, or local government. The multi-level co-management approach - which optimizes stakeholder engagement – should introduce community development interventions, at no loss to the biodiversity agenda, both technically and financially.

We might therefore expect multi-level co-management to assist in the abatement of habitat disruption, hunting and forest-product exploitation. It should also strengthen **the formation and functioning of informants' networks** and assist in human-wildlife conflict mitigation, forest fire management and climate change adaptation. It will not divert conservation expertise and conservation funding, but will substantially enhance funding coming to protected areas and conservation outcomes.

CONCLUSIONS

A multi-stakeholder landscape management advisory committee can give unified management direction to both the core and buffer zones of a protected area. The effective operation of the multi-stakeholder management committee is entirely dependent upon the institutional arrangements established and maintained at lower levels, in the different specialized fields of management. The law enforcement management networks in this paper provide the clearest practical field examples as to how

effective protected area management should proceed. The protected area agencies need to appoint community development experts to organize the hierarchy of institutional bodies at the different administrative levels for effective buffer zone engagement, and develop their management agendas parallel to those implemented for law enforcement.

This paper introduces a new tier of institutional bodies into protected area management which provides opportunities to link senior reserve management to villages and individual households in buffer zones. The multi-level co-management framework (see figure 1) provides institutional bridges between the conservation and community development agendas, for the long-term sustainable management of protected areas and their buffer zones. The framework provides an institutional roadmap as to how multi-level co-management might develop more effectively, compartmentalizing areas of protected area work. However, the authors stress that multi-level co-management of protected areas is no quick fix conservation strategy, but should be considered a 10-15 year learning process of stakeholder engagement, with further exploration of the establishment of protected area management working groups, and their functioning.

Superficially, multi-level co-management appears a highly complex network of human interactions, particularly when one compares the approach to the fortress approach. But the lessons from law enforcement management in the region indicates that multi-level co-management may work if (i) we recognize the importance of the different of the fields of protected area specialization, (ii) organize and train protected area staff in these different specialized fields, and then (iii) assist them to interact with local stakeholders in a well-structured, formalized manner through protected area management working group and constituency working groups; and then get them (iv) to report their achievements, proposed work plans and hardships to regular monthly meetings, (v) from which distilled, succinct summaries are provided to a supervisory management advisory committee.

RECOMMENDATIONS

Recommendations for conservation organizations

Conservation organizations with long-term commitments to particular sites should actively explore opportunities to pilot protected area management working groups. Having long-term commitments to sites presents a number of advantages. Relations with relevant

stakeholders in the landscape should be well-established, the organization can commit itself to long-term technical and financial support, multi-stakeholder facilitation can be maintained, and resources may be available to support local communities. These working groups can be strengthened by developing regulations and work plans to enhance their recognition and their strategic direction.

However, sometimes outside conservation organizations with long-term commitments to sites get too intimately involved in the management of the protected areas that they are involved with. While this personalized approach helps the protected areas in the short-term, it fails to contribute to the protected area learning process for effective management within the national protected area network. From the outset, it should be made clear that the conservation organization is facilitating a process and that as capacity is built, tasks are handed over to the respective agencies and personnel.

Given the compartmentalization of protected area management tasks, conservation NGOs could consider working in partnership with development NGOs to benefit from the complementary skills and experiences these types of organizations could bring. The conservation organization could support the core zone and the development organization could support the buffer zone. Agreement could be reached by the respective NGOs on the protected area management working groups to be supported, to optimize constructive cooperation. A network of best practice co-managed protected areas could be mooted by the NGO bodies within their respective NGO networks.

Recommendations for government protected area agencies

Government agencies should consider the value of establishing protected area working groups in connection to the management of their protected areas. This may require piloting funding long-term, modest scale, buffer zone management interventions (integrated conservation and development initiatives) in pilot sites. It should be noted that the buffer zone working groups – possibly one of the key institutional engines for promoting multi-level co-management - are usually already functioning under existing government administrative arrangements; all they need is the institutional connection established to the protected areas, supported by conservation-linked funding streams.



A village level stewardship agreement is displayed in a village in the buffer zone of Mu Cang Chai Species and Habitat Conservation Area © Hoang Van Lam

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RESUMEN

Existe un amplio consenso en torno a que los paisajes ecológico-sociales para las áreas protegidas designadas por el gobierno deben abarcar las zonas núcleo y sus zonas de amortiguamiento, y que las tareas esenciales para la gestión de estos paisajes deben incluir: (i) investigación ecológica y monitoreo; (ii) aplicación de la ley; (iii) divulgación y sensibilización a nivel de las comunidades; (iv) desarrollo de los medios de subsistencia de las comunidades e intervenciones en las tierras gestionadas por ellas; (v) ecoturismo; y (vi) gestión del hábitat. En este trabajo se propone que estas tareas no deben necesariamente ser realizadas únicamente por el organismo encargado de las áreas protegidas. Más bien, se recomienda explorar la posibilidad de establecer grupos de trabajo para la gestión de áreas protegidas en los diferentes ámbitos de la gestión para propiciar la creación de vínculos institucionales entre las comunidades de base, otros interesados locales y un comité de cogestión de áreas protegidas. El documento se basa en las experiencias de los autores y describe brevemente algunos modelos de este tipo de redes locales que ya están siendo implementados en el norte de Vietnam y Laos para las áreas protegidas con un alto valor de biodiversidad. Si bien muchos de los enfoques descritos son de muy reciente data para obtener pruebas concluyentes acerca de su eficacia, su implementación demuestra que es posible generar interés local para enfoques innovadores basados en la cogestión.

RÉSUMÉ

Il est communément admis que les paysages écologiques-sociaux pour les aires protégées désignées par les gouvernements doivent comprendre des aires centrales et des zones tampon aux alentours, et que les tâches essentielles pour gérer ces paysages doivent comprendre : (i) une recherche et un suivi écologique ; (ii) une application de la loi ; (iii) des activités de sensibilisation et de prise de conscience auprès des communautés ; **(iv) l'amélioration des moyens de subsistance des communautés et l'engagement avec les terres gérées communautaires ; (v) l'écotourisme ; et (vi) la gestion de l'habitat.** Cet article propose que ces tâches ne soient pas nécessairement et uniquement réalisées par l'agence en charge de l'aire protégée. **L'article recommande au contraire de réfléchir à des groupes de travail sur la gestion des aires protégées** dans les différents domaines de gestion, moyennant quoi ces réseaux créent des liens institutionnels entre **les communautés sur le terrain, d'autres acteurs locaux, et un comité de co-gestion d'aire protégée.** Cet article s'appuie sur l'expérience de l'auteur et décrit brièvement des modèles de tels réseaux locaux déjà mis en place dans le nord du Vietnam et au Laos, pour les aires protégées abritant une biodiversité à forte valeur. De nombreuses approches décrites sont encore trop récentes pour tirer des conclusions qui **prouveraient indéniablement leur efficacité, cependant leur mise en œuvre montre qu'il est encore possible** de susciter un intérêt local pour des approches innovantes dans le domaine de la co-gestion.



THE THREE NEW R'S FOR PROTECTED AREAS: REPURPOSE, REPOSITION AND REINVEST

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ABSTRACT

There appears to be a close convergence in the international policy arena on the goals of sustainable development and biodiversity conservation, including maintaining food and water security, strengthening climate resilience, and contributing to local and national economies, among other goals. Protected area networks can help deliver on these mutual goals, but if they are to do so, we must fundamentally change how we think about protected areas, while at the same time maintaining their fundamental value in safeguarding biodiversity. This article explores how we must repurpose protected areas in order to attain not only ecological but also sustainable development goals; how we must reposition protected areas within a specific policy context in order to ensure policy relevance, including within the development of national sustainable development goals and national biodiversity plans; and how we must reinvest significant financial resources in protected areas as an economically efficient strategy for simultaneously achieving sustainable development and biodiversity conservation goals.

KEYWORDS: international protected area policy, sustainable development goals, national biodiversity plans

PUNCTUATED EQUILIBRIUM AND HOT MOMENTS IN BIODIVERSITY CONSERVATION AND SUSTAINABLE DEVELOPMENT

Social systems, like ecological systems, are often characterized by punctuated equilibrium; change is gradual, incremental and predictable, until a tipping point causes surprising, non-linear changes resulting in abrupt new states. In their analysis of policy changes, Baumgartner and Jones (2009) assert that tipping points for abrupt policy shifts typically include large-scale changes in public perception leading to a changed societal consensus; new stakeholders and audiences; new perceived social mandates; and/or major, often catastrophic, events. An example of a rapid policy shift is the raft of new US environmental policies enacted in the early 1970s, following a decade of heightened environmental awareness (Adler, 2003). Similarly, researchers recently applied the concept of punctuated equilibrium to analyse the creation of protected areas **globally, and found that there are distinct 'hot moments'** in time where gains in national protection occur abruptly, often within a short period of several years (Radeloff et al., 2013).

The international policy arena is now facing what **appears to be a 'hot moment' related to the nexus** between biodiversity conservation and sustainable development. Although the 1987 Brundtland Report on sustainable development first crystallized the notion that there are environmental limits to economic growth, and that environmental and social wellbeing are intertwined, only recently has this notion begun to take hold. There has been a critical global awareness of a series of potential tipping points for human wellbeing, including, a) major biodiversity and ecosystem losses (WWF, 2012; CBD, 2012); b) the economic and social consequences of **these losses, particularly for the world's poorest communities** (ten Brink et al., 2012); c) the limitations imposed by planetary boundaries (Rockström et al., 2009); d) the unsustainable impact of current consumption patterns (Lenzen and Murray, 2003; Lenzen et al., 2012); e) increased societal vulnerability to famine, drought, disease and natural disasters, exacerbated by biodiversity losses, war, and the impacts of climate change (UN, 2012); and f) our inability to change these trajectories with business-as-usual economic and environmental practices and policies (UN, 2012).

Table 1: Selected contributions of protected areas to key themes in sustainable development

Key theme	Emerging themes for the Sustainable Development Goals (SDGs)	Elements of the Convention on Biological Diversity's Strategic Plan	Selected contribution of protected area networks to SDGs and the CBD Strategic Plan
Prevent biodiversity loss and manage resources sustainably	<ul style="list-style-type: none"> • Sustainably manage natural resources • Protect biodiversity and maintain ecosystems 	<ul style="list-style-type: none"> • Halve the rate of loss of natural habitats (Target 5) • Significantly reduce habitat degradation and fragmentation (Target 5) • Manage fisheries within safe ecological limits (Target 6) • Prevent extinctions (Target 12) 	<ul style="list-style-type: none"> • Maintain key habitats and refugia, and ensure connectivity • Prevent conversion of natural land cover to other land uses • Reduce habitat fragmentation • Prevent overharvest of species • Prevent extinctions
Maintain food security	<ul style="list-style-type: none"> • Maintain food security 	<ul style="list-style-type: none"> • Maintain genetic diversity, including of crop wild relatives and domesticated animals (Target 13) 	<ul style="list-style-type: none"> • Maintain genetic diversity, including of crop wild relatives • Provide a safety net in times of famine
Maintain water security	<ul style="list-style-type: none"> • Ensure adequate water • Ensure adequate sanitation 	<ul style="list-style-type: none"> • Combat desertification (Target 15) • Restore and safeguard ecosystem services related to water 	<ul style="list-style-type: none"> • Protect watersheds • Protect key water supplies • Provide water filtration services
Strengthen climate resilience	<ul style="list-style-type: none"> • Reduce risks and impacts from climate change 	<ul style="list-style-type: none"> • Increase climate resilience (Target 15) 	<ul style="list-style-type: none"> • Reduce impacts from climate-related disasters
Improve human health and wellbeing	<ul style="list-style-type: none"> • Address inequality and poverty • Secure employment, livelihoods and inclusive economic growth • Promote health and wellbeing 	<ul style="list-style-type: none"> • Restore and safeguard ecosystem services related to health, livelihoods and wellbeing (Target 14) • Ensure fair and equitable sharing of benefits from genetic resources (Nagoya Protocol, Target 16) 	<ul style="list-style-type: none"> • Sustain livelihoods • Generate employment • Sustain local and national economies • Promote health and wellbeing • Protect genetic material valuable for medicines

Sources for emerging themes of Sustainable Development Goals: Bergh and Couturier, 2013; Cutter and Cornforth, 2013; UN, 2012. Source for CBD strategic plan: CBD, 2010. Source for protected area contributions: Kettunen, M. and P. ten Brink, 2013; Stolton and Dudley, eds., 2010)

This global awareness is reflected in the convergence of recent goals for both sustainable development, in the form of Sustainable Development Goals (SDGs), and for biodiversity conservation, in the form of the 2020 Strategic Plan for the Convention on Biological Diversity (CBD). The Sustainable Development Goals, which are the successor to the Millennium Development Goals that expire in 2015, provide the basis for countries to revise their national development plans. Based on recent analyses of early consultations on the SDGs, there is an emerging consensus around a set of key themes for the SDGs. The CBD Strategic Plan for 2020 was adopted in 2010, and virtually every country has committed to achieving an ambitious set of “Aichi Biodiversity Targets,” and revising their National Biodiversity Strategies and Action Plans (NBSAPs) in accordance with these targets (CBD, 2010). See Table 1 for a summary of these goals.

At the same time, there is growing global consensus that many of the pressing issues in sustainable development and biodiversity conservation – preventing biodiversity losses and managing natural resources sustainably, maintaining food and water security, reducing risks from natural disasters, strengthening climate resilience and improving human health and wellbeing – can be at least partially addressed by comprehensive, well-managed protected area networks (Kettunen, M. and P. ten Brink, 2013; Stolton and Dudley, eds., 2010). Table 1 shows the relationship between the key emerging themes in the SDG development process, the themes embedded within the CBD Strategic Plan, and the contribution of protected areas to each of these themes.

Protected areas clearly have a role in contributing to the emerging key themes of sustainable development in this ‘hot moment’ in history. Yet the global business-as-usual

Table 2: Repurposing protected areas to achieve sustainable development goals

Actions related to protected areas	Current framework – protected areas for biodiversity conservation	Emerging framework – protected areas for biodiversity conservation <i>and</i> sustainable development
Establishing protected areas	Protected areas are established primarily to fill ecological gaps, and to protect rare and endangered species and their habitats.	Protected areas are established to achieve multiple societal goals simultaneously, including ecological, social and economic goals. This may mean, for example, including overlays of ecosystem services as part of ecological gap analyses, and explicitly establishing protected areas for social and economic benefits, such as for protecting genetic stocks of crop wild relatives.
Managing protected areas	Protected areas are managed primarily for biodiversity conservation goals, with some additional social benefits.	Protected areas are managed for multiple benefits, such as maintaining water supplies during times of drought, providing sustainable livelihoods to local communities, and generating revenue through increased tourism. This will require a more concerted, systematic assessment of potential trade-offs between ecological, social and economic benefits and the development of social and ecological safeguards.
Communicating with stakeholders	Protected area stakeholders are mostly viewed as local communities, who may see an increase or decrease in benefits.	Protected areas managed for multiple benefits are likely to include a much broader array of stakeholders, including, for example, national stakeholders involved in water, food, tourism, health, disaster prevention and development, among others.
Assessing effectiveness	Protected areas are assessed primarily for their effectiveness in achieving ecological outcomes.	Protected areas are assessed relative to their delivery of a range of benefits, including social and economic benefits. As countries invest in protected areas as an economic development strategy, they will increasingly want to assess their economic return on investment and to gauge the delivery of benefits.
Monitoring change	Protected area monitoring focuses primarily on the status and trends of threats and biodiversity.	Protected areas will increasingly be monitored against social and ecological safeguards, as well as ecological tipping points and thresholds, in order to ensure that the delivery of social or economic benefits does not erode ecological health and integrity.

scenario for many protected areas must change, if protected areas are to fully deliver on their potential. Traditionally, protected areas face three challenges. The first is inadequate design and management of the protected area network – protected area networks often contain too small, too few and too isolated protected areas, with major gaps in biodiversity representativeness, and there are often chronic problems with effective management, including inadequate staffing, management plans, threat abatement efforts, monitoring and communication (Bertz et al., 2012). The second

challenge is that protected areas are not fully integrated into broad policy frameworks, and are often viewed as isolated land and sea uses (Ervin et al., 2010a). The third challenge is insufficient funding, even for minimal management needs (Bovarnick et al., 2012).

If protected areas are to both overcome these challenges and address emerging goals for both sustainable development and biodiversity conservation, we must fundamentally change how we think about protected areas. We must repurpose protected areas to attain not



Mangroves help mitigate the impacts of storm surges, Sundarbans National Park, Bangladesh © David Woodfall / WWF-UK

only ecological but also sustainable development goals, reposition protected areas within a specific policy context in order to ensure policy relevance, and reinvest in protected areas as an economically efficient strategy for simultaneously achieving sustainable development and biodiversity conservation goals.

REPURPOSE PROTECTED AREAS TO CONTRIBUTE TO BOTH BIODIVERSITY CONSERVATION AND SUSTAINABLE DEVELOPMENT GOALS

There have been several shifts in the way that society has envisioned protected areas over the past 150 years, from a classic model in the 1800s through the 1970s, where protected areas were established and managed for scenic and recreational values; and from a modern model from the 1970s through the mid-2000s where protected areas were established and managed for scientific, economic and cultural reasons, to an emerging model where protected areas are expected to maintain critical life support services and contribute to sustainable development (Ervin et al., 2010). Never have we expected more from protected areas, and never have the stakes been higher for protected areas to fully deliver a wider range of social, economic and ecological benefits. In addition to conserving biodiversity, protected areas must now also provide jobs and livelihoods, drive economic

growth, safeguard wild crop relatives, protect and maintain key ecosystem services, and buffer humanity from the worst of climate change impacts. Therefore, we must rethink how new protected areas are established, and repurpose existing protected areas, including how they are managed, communicated, assessed and monitored, if protected areas are to fully contribute to sustainable development goals (see Table 2).

REPOSITIONING PROTECTED AREAS WITHIN SPECIFIC ECONOMIC AND DEVELOPMENT POLICIES TO ENSURE POLICY RELEVANCE

If protected areas are to help achieve sustainable development goals, the second task will be to reposition them within specific economic and development policies and policy frameworks, in order to ensure policy relevance. In most countries, protected areas are positioned within a national ministry of environment, natural resources, wildlife, fisheries or forestry. As a result, they are often viewed as a distinct and isolated land use, completely separate from other economic and social land uses in the surrounding landscape and seascape, and are rarely positioned within specific economic and development policies (Mose, 2011; Ervin et al., 2010). There are two specific planning opportunities where protected areas can be better repositioned within

the policy landscape, to capitalize on their social and economic contributions: 1) the revision of national sustainable development strategies (SDGs), and 2) the revision of National Biodiversity Strategies and Action Plans (NBSAPs).

Repositioning protected areas within national sustainable development strategies and plans

Following the publication of “Our Common Future” (WCED, 1987), the global community embraced the idea of sustainable development as an organizing framework for developing national development goals. In 1992, the Rio Earth Summit resulted in Agenda 21, with global consensus that all countries should develop a national sustainable development strategy. This call was repeated at the World Summit on Sustainable Development a decade later, and most recently at Rio+20 in 2012. Now more than 100 countries have developed national sustainable development plans and goals. However, of the 72 national sustainable development reports listed on the United Nations Sustainable Development website, fewer than a dozen specifically mention protected areas in their national sustainable development reports¹, and of these, only a handful clearly show the contributions that protected areas can make in achieving national sustainable development goals. If protected area policy makers are to ensure that protected areas are relevant to national sustainable development planning, they must understand how to reposition protected areas as clearly delivering on sustainable development goals. This may include, for example, demonstrating how protected areas can:

- **Enhance national food and water security:** Lao PDR, for example, clearly links protected areas, non-timber forest products and national food security in its Fourth National Report (Government of Lao PDR, 2010), and links protected areas to water security in both its Water Sector Strategy and Action Plan as well as in its National Report on Protected Areas and Development (ICEM, 2011).
- **Secure employment and livelihoods:** Botswana clearly links local income generation from tourism within protected areas (Government of Botswana, 2012), South Africa’s “**Working for Water**” program links job creation, ecosystem services protection and restoration of protected areas (DWA, 2013), and a new collection of studies shows how protected areas can drive regional economic development across Europe (Mose, 2011).
- **Buffer vulnerable communities from disasters:** Both Moldova (Government of Moldova, 2012) and the South Africa (DEA, 2011) identify

protected areas as a key strategy to strengthen resilience to climate impacts and natural disaster risk reduction.

- **Foster healthy populations: Parks Victoria’s** Healthy People Healthy Parks Initiative highlights the many health benefits that protected areas provide to communities (Parks Victoria, 2013).
- **Reduce border-related conflicts:** Trans-boundary protected areas have been clearly linked with reducing border-related conflicts (Sandwith et al., 2001). Timor Leste, for example, links protected areas and nature conservation to conflict prevention in its national report on sustainable development (MED, 2012).

These examples illustrate just a few of the ways that policy makers can reposition protected areas within national sustainable development goals in order to ensure national relevance beyond biodiversity conservation.

Repositioning protected areas within National Biodiversity Strategies and Action Plans (NBSAPs) National Biodiversity Strategies and Action Plans (NBSAPs) are the primary national instruments for implementing the Convention on Biological Diversity, and are required by all signatories (CBD, 2010). To date, 178 countries have completed an NBSAP, and nearly all countries are in the process of revising their NBSAPs to be in accordance with the Aichi Biodiversity Targets by 2015. This represents an unprecedented opportunity to reposition protected areas within broader conservation and development goals for a decade or more. While the vast number of NBSAPs submitted to date include a section or chapter on protected areas (Prip and Gross, 2010), very few of these plans clearly show specifically how protected areas can contribute to a broader range of economic and development goals. Yet, as shown in Table 1, protected areas can contribute to a number of Aichi Biodiversity Targets (including Targets 5,6,11, 12, 13, 14, 15 and 16), many of which relate directly to sustainable development goals.

Instead of developing separate chapters that simply catalogue their existing and planned protected area network, national planners developing their NBSAPs can ensure that protected areas are properly positioned within their NBSAPs by taking the following actions:

- **Position protected areas at the centre of NBSAPs instead of the periphery:** Given their disproportionate role in simultaneously achieving ecological, social and economic goals, as well as achieving multiple Aichi Biodiversity Targets,

protected areas should feature prominently within NBSAPs as an organizing framework, rather than as an isolated section or chapter. More than 100 countries have developed detailed national plans for implementing the CBD Programme of Work on Protected Areas (CBD, 2013), and these plans can provide a strong core for the NBSAP.

- Position protected areas within different ministries: In the vast majority of countries, protected area agencies fall solely within the confines of environmental ministries, without cross-pollination with other related ministries. As they develop their biodiversity and sustainable development plans and goals, countries may want to consider formal linkages between protected area agencies and those agencies and ministries related to economic and social development, such as tourism, water and sanitation, and land use planning.
- Articulate the many values and benefits of protected areas: Planners should clearly articulate the many values and benefits of protected areas, including the social and economic benefits related to sustainable development. In doing so, they help lay the foundation for making the economic case for further investments in the protected area network.
- Link the establishment of new protected areas to multiple goals and targets: Most NBSAPs identify the need for new protected areas, but nearly all do so solely within a biodiversity conservation framework without linking to social or economic benefits. In order to achieve the Aichi Targets, approximately 5.5 million km² of new terrestrial and 10.8 million km² of new marine protected areas will need to be established globally (Ervin and Gidda, 2012). To fully capitalize on the potential multiple contributions that these new protected areas can make, planners should explicitly link the establishment of new protected areas not only to ecological goals (e.g., decreasing habitat fragmentation, preventing extinctions), but also to social and economic goals (e.g., strengthening national food and water security; safeguarding genetic resources for wild crop relatives; securing sustainable livelihoods; and strengthening resilience to floods, droughts, storms and natural disasters).

By repositioning protected areas within national sustainable development goals and plans, and within broader national biodiversity plans, policy makers can ensure that protected areas are viewed not only as a strategy for conserving biodiversity, but also as a strategy for achieving broader national goals and objectives.

REINVESTING IN PROTECTED AREAS AS AN EFFECTIVE, EFFICIENT STRATEGY FOR ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

The third task required of policy makers for helping protected areas deliver on sustainable development goals is to reinvest in protected areas themselves. The current global protected area estate covers nearly 13 per cent of **the world's terrestrial area (Bertzky et al., 2012)**, representing an unprecedented global investment in biodiversity conservation in the form of acquisition costs, lost opportunity costs for other forms of economic activity, and ongoing management costs. Yet there remain significant gaps in the total protected area finance requirements, estimated at approximately US\$34 billion annually (Ervin and Gidda, 2012). Compared with this figure, the current levels of official development assistance for protected areas² is but a tiny fraction, while governments currently provide on average less than half of the finance required (Bovarnick et al., 2010). Simply put, countries themselves will need to reinvest in protected areas, and if protected areas are to receive adequate funding to fully deliver on increased expectations, they will need to compete with other forms of societal investment. However, it is likely that by any estimate, protected areas will compete well as an efficient, cost-effective investment strategy; citing numerous cases, one study estimates the economic return on investments on protected areas of between 1:25 and 1:100 (ten Brink, 2012).

To reinvest in protected areas, policy makers will need to shift how they think about protected area finance, including by taking the following actions:

- Calculate the full costs and benefits of protected areas: The overwhelming majority of NBSAPs over the past decade did not identify the specific costs associated with the strategies and plans (Prip and Gross, 2010), including for protected areas. Planners must lay out the full range of costs associated with implementing protected area strategies, including establishment and management of protected areas that address additional societal goals. In order to understand the potential development and economic return on investment in protected areas, planners will need to understand both the full short-term and long-term costs and benefits, and the likely distribution of those benefits.
- Undertake a protected area expenditure review: By analysing what is currently being spent by both public and private actors, planners can better understand the incremental costs required for further investment, and better evaluate the benefits against other forms of investment.



About 80 per cent of the 1.5 million population of the capital of Ecuador population receive drinking water from two protected areas: Antisana and Cayambe-Coca Ecological Reserve (pictured here) © Kevin Schafer / WWF-Canon

- Review and remove harmful policies and instruments: There are a wide number of perverse subsidies and incentives that harm biodiversity in general, and protected areas in particular (CBD, 2011). Reviewing, and where appropriate removing, these policies can not only reduce pressures on protected areas, but also unlock finance to fill critical resource gaps.
- Develop a resource mobilization plan for protected areas: A resource mobilization plan can help planners develop a financial road map for fully investing in protected areas. By linking the costs of protected areas to the multiple benefits, planners can tap new finance streams, such as insurance companies, national defence budgets, agricultural companies who rely on pollinators and irrigation, municipal drinking water budgets and other sources.

By treating protected areas as an investment vehicle, policy makers will be better able to unlock and mobilize the financial resources required to enable protected areas to fully deliver on their potential.

CONCLUSION

It is clear that this is a potentially 'hot moment' for the convergence of biodiversity conservation and sustainable development goals. There is widespread recognition that the current trajectories of economic development and biodiversity loss are unsustainable, and that biodiversity conservation in general, and protected areas in particular, stand as one of the most efficient and cost-effective strategies for simultaneously changing both of these trajectories. No discussion about the changing role of protected areas is complete, however, without acknowledging that repurposing, repositioning and

reinvesting in protected areas may require new trade-offs, and this will require a more deliberate and conscious application of social and ecological safeguards. This debate is already fully underway (Minteer and Miller, 2011; McShane et al., 2011; Redpath et al., 2013), and there is already emerging guidance for key sectors, such as tourism (Drumm et al., 2011), but practical guidance and global consensus will need to mature quickly to keep pace with global policy trends.

Protected area policy makers must now make concerted efforts to repurpose protected areas to deliver on both biodiversity and sustainable development goals, to reposition protected areas within national economic and development policies and planning frameworks, to reinvest in protected areas as a viable, economic strategy, and to ensure critical safeguards for doing so. Only then with this hot moment in history truly take hold.

ENDNOTES

1. See sustainabledevelopment.un.org/rrio20nationalreports.html (Accessed October 1, 2013).
2. For example, the Global Environmental Facility, the largest source of Official Development Assistance, allocated about US\$700 million over four years for all of its global work on protected areas.

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RESUMEN

Parece haber una gran convergencia en el escenario de la política internacional con respecto a los objetivos de desarrollo sostenible y la conservación de la biodiversidad, incluyendo la preservación de la seguridad hídrica y alimentaria, el fortalecimiento de la adaptación al cambio climático, y la contribución a las economías locales y nacionales, entre otros objetivos. Las redes de áreas protegidas pueden ayudar al logro de estos objetivos comunes, pero para ello debemos cambiar fundamentalmente nuestra forma de pensar con respecto a las áreas protegidas, manteniendo al mismo tiempo su valor primordial en la protección de la biodiversidad. Este artículo explora cómo debemos replantear las áreas protegidas con el fin de alcanzar no solo los objetivos ecológicos sino también los de desarrollo sostenible; cómo debemos reorganizar las áreas protegidas dentro de un contexto político específico para garantizar la pertinencia de las políticas, incluso dentro de la definición de las metas nacionales de desarrollo sostenible y los planes nacionales sobre biodiversidad; y cómo debemos reinvertir cuantiosos recursos financieros en las áreas protegidas como estrategia económicamente eficiente para lograr de manera simultánea los objetivos de desarrollo sostenible y de conservación de la biodiversidad .

RÉSUMÉ

Il semble qu'il y ait une étroite convergence sur la scène politique internationale entre les objectifs du développement durable et ceux de la conservation de la biodiversité, autour notamment des points suivants : préservation de la sécurité alimentaire et de l'approvisionnement en eau, renforcement de la résilience du climat, et contribution aux économies nationales et locales. Les réseaux d'aires protégées peuvent permettre de réaliser ces objectifs mutuels, mais dans ce cas, nous devons fondamentalement changer notre façon de considérer les aires protégées tout en préservant leur valeur fondamentale pour la préservation de la biodiversité. Cet article s'interroge sur les façons de réadapter les aires protégées afin d'atteindre des objectifs de développement écologiques, mais également durables ; de repositionner les aires protégées dans un contexte politique spécifique afin de garantir leur pertinence politique, notamment avec la mise en place des objectifs nationaux de développement durable et les plans nationaux de préservation de la biodiversité ; et de réinvestir des ressources financières significatives dans les aires protégées, dans le cadre d'une stratégie économiquement efficace qui permette d'atteindre en même temps les objectifs de conservation pour le développement durable et pour la biodiversité.



A DRAFT CODE OF PRACTICE FOR RESEARCH AND MONITORING IN PROTECTED AREAS

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ABSTRACT

Protected areas are favoured sites for ecological research and monitoring and responsible, well-managed research can help to improve management effectiveness and enhance conservation outcomes. Many countries have formalized processes for approving and monitoring research within their protected area systems. There are already a number of codes addressing ethical and social issues with respect to research in protected areas, sacred natural sites and in the traditional territories of indigenous peoples and local communities. However, less attention has been paid at a global scale to the ecological impacts of and access to information from ecological research within protected areas. There are numerous examples of research that is of little value to management or is poorly planned, where the results are not shared with the protected area, and even where research causes significant ecological (and / or social) damage. This paper contains a draft code of practice for those carrying out research in protected areas, which we believe should provide a basis for discussions on minimum standards for academic and other researchers in the future.

KEYWORDS: code of practice, ecological research, monitoring, ethical and social issues, protected areas

INTRODUCTION

As ecosystems become increasingly modified, fragmented and converted, ecological research is focused progressively onto those areas that remain in a relatively intact state. Protected areas provide an ideal laboratory for field research: they are managed to maintain wild species and natural ecosystem functioning, provide valuable controls for monitoring longer-term environmental change, and are often the subject of long-term data sets (e.g. the UK Environmental Change Network, www.ecn.ac.uk/); most have sympathetic and knowledgeable staff who can provide assistance and data; they supply ideal conditions for both observation and controlled experiments; and many also contain **accommodation and other facilities**. Some of the world's most strictly protected areas (e.g., many IUCN category Ia) have been set aside explicitly for research purposes, such as the H J Andrews Experimental Forest in Oregon, which hosts over a hundred research projects every year (Luoma, 1999), and the forest reserves research network

in Europe (Parviainen et al., 2000). Many protected areas across all IUCN categories host important, sometimes permanent, research efforts. In Serengeti National Park in Tanzania for example, the Frankfurt Zoological Society has a research station, both for its own staff and many visiting researchers (e.g., Sinclair and Arcese, 1995) and Cocha Cashu Biological Station, located in Manú National Park in Peru, was established specifically as a research site inside a protected area (cochacashu.sandiegozooglobal.org/). Many academics and other researchers also become involved in monitoring work within protected areas, for instance of population levels of target species, often in association with protected area staff.

Protected areas are also places that require science to inform their management, and nature conservation requires good science. Research is fundamental to the location, design, justification, protection and management of protected area; and the substantiation of



WWF Sumatran Rhino Survey Team in Ujung Kulon National Park, Indonesia © R.Isotti, A.Cambone - Homo Ambiens / WWF-Canon

their effectiveness. Well-designed research projects can therefore provide information that increases management effectiveness and conservation outcomes; provides better understanding for visitors, local communities and stakeholders; addresses actual or potential problems or helps on a broader front through supplying new techniques, information for planning; and creates opportunities to increase funding. For example, in Bwindi Impenetrable National Park, Uganda, researchers from the Institute of Tropical Forest Conservation, which is based at the edge of the park, worked with local people to determine sustainable harvest levels for medicinal plants from designated zones. This helped to provide access to medicines for local people without undermining the ecology of the protected area (Hockings et al., 2008). The Seychelles Islands Foundation, which manages Aldabra Atoll World Heritage site, provides a list of research priorities on its website (www.sif.sc/index.php?langue=eng&rub=30) to help maximise the benefits from scientific research **within the protected area (Stolton et al., 2012)**. Canada's Fundy National Park provided a benchmark site for a whole set of experiments looking at the impacts of

forestry on biodiversity, which were implemented outside the park, leading to a new set of forest management guidelines for the region (Betts and Forbes, 2005).

However, there are potential risks that research activities could have deleterious effects on protected species and ecosystems. To ameliorate these risks, a number of international regulations have been developed and a growing number of protected areas have agreed conditions for research and principles for researchers, who have to apply for permission and abide by a strict set of conditions. Key international milestones include the development of CITES regulations for export of specimens, the 1992 signing of the Convention on Biological Diversity (CBD), which gave countries partial control over their genetic resources and the much stronger controls introduced under the 2010 Nagoya Protocol of the CBD. These have been mirrored by a series of ethical regulations, discussed below. At country level, laws and regulations have also started to control what was once a very *laissez faire* approach to research. In Finland, for example, any research in a state-run

protected area requires a permit, with conditions listed for each individual research project, while the government agency Metsähallitus has framework agreements with research institutes, nominated cooperation groups that meet twice a year to discuss ongoing and proposed projects, and annual meetings of directors to agree priorities and allocation of resources. Parks Canada has an online Research and Collection Permitting System that streamlines and harmonises research in Canadian protected areas (www.pc.gc.ca/apps/rps/page1_e.asp). The Great Barrier Reef Marine Park Authority in Australia maintains a research needs document to guide researchers on research topics of particular management relevance (elibrary.gbrmpa.gov.au/jspui/handle/11017/968) and maintains an active dialogue with major research institutions who conduct extensive research in the Great Barrier Reef. In Tanzania, the wildlife research institution TAWIRI, has a comprehensive set of research conditions applying to wildlife research in the country with specific provisions applying to work in protected areas (TAWIRI, 2012). And in Nepal research guidelines have been developed by the Department of National Parks and Wildlife Conservation (DNPWC, 2012) with the objectives of facilitating and regulating the research permission process, helping protected areas utilize the findings and build the capacity of the protected staff and local people through research.

These kinds of mechanisms are however absent in many countries. Protected area managers complain that researchers cause damage, are reluctant to share data or credit, and often do not even supply copies of any reports and papers that result from their work. Furthermore, in some areas research tends to be highly specialised, with little if any practical management application even when practical research is critically needed. Governments, particularly in developing countries, complain that researchers from rich corporations also use protected areas as sources of information, genetic material and ideas, but give nothing back in return. On the other hand researchers complain that park managers will not share existing data, are overly bureaucratic, and put up unnecessary obstacles to doing research in protected areas.

Whilst many reports of problems remain anecdotal, the limited research available supports the idea that things could be improved. A questionnaire to 155 natural World Heritage sites, distributed as part of the still ongoing second round of Periodic Reporting on status of World Heritage, revealed that 12 sites (~8 per cent) reported that research and monitoring activities are currently a **“threat” in the park and 21 (~13 per cent) reported them**

as a potential threat (some sites reported both as current and potential so that the figures cannot be summed). **Furthermore, 63 sites (40 per cent) reported that “There is considerable research but it is not directed towards management needs and/or improving understanding of Outstanding Universal Value” (all figures calculated from World Heritage periodic reporting data).**

A survey of information transfer between scientists and protected area managers in Australia suggests that even where scientists are consciously attempting to provide relevant research there can still be large gaps in understanding. Both managers and scientists believed communication between the two groups to be good, overwhelmingly as a result of personal and frequently informal contact (Boughton et al., 2008). But agreement on the relevance of the research differed dramatically. Most managers believed that the majority of research carried out by scientists was not relevant to their work (even when the scientists were employed by the protected area agency). Conversely most scientists believed that their research was highly relevant, but not used: for example 42 per cent of researchers judged that 80-100 per cent of their research was applicable to management but only 2 per cent believed that the majority of it was actually applied. Despite good working relationships, there was still a major gap in understanding (Boughton et al., 2008).

The increasing recognition of the pervasive threats to biodiversity posed by novel invasive species and pathogens imposes a number of additional challenges for good practice research in protected areas. In some cases, as in the Antarctic, scientific researchers have been prime vectors for introduction of invasive species (Hulme et al., 2012). An example of the need for controls is the amphibian fungal disease chytridiomycosis, a major driver of amphibian declines. Guidelines are slowly emerging to reduce risk that research might actually accelerate the transmission and/or virulence of the disease. For instance, the Australian Department of the Environment and Heritage (2006: 57–59) *Threat Abatement Plan* includes clear recommendations for field research (3.23–3.43). Similarly, biosecurity measures are in place for any research personnel visiting the Kakapo islands in New Zealand. Incorporation of such guidelines into best practice elsewhere in the world, and their extension to include risk mitigation for other diseases and invasive species, is an important priority.

The challenges are recognised and a number of individuals and organisations have raised the question internationally, including the Science and Management of Protected Areas Association, the George Wright



Park ranger taking part in research related to the Yellow-spotted river turtle (*Podocnemus unifilis*) in the Manu River area of Peru © André Bärtschi / WWF-Canon

Society and the World Commission on Protected Areas. A guide to *Coordinating Research and Management to Enhance Protected Areas* was published at the IVth World Congress on National Parks and Protected Areas in Caracas, Venezuela (Harmon, 1994). Scientific journals such as *Oryx* include ethical and environmental principles that published research papers should meet and a code for researchers was included in a UNESCO manual on managing natural World Heritage sites (Stolton et al., 2012). Some of these issues are also being addressed through international agreements and conventions, particularly the Convention on Biological Diversity and its Nagoya Protocol on Access to Genetic Resources and Equitable Sharing of Benefits arising from their Utilization (ABS) (SCBD, 2010), although controls remain controversial and poorly enforced. However, these international efforts focus principally on issues of access to genetic material and equitable sharing of any benefits thus derived; they say little about less economically important and politically sensitive areas of ecological research.

The ethical and practical issues increase in number and complexity in other protected area governance types and management categories, particularly in indigenous **peoples' and community conserved territories and areas** (ICCAs - www.iccaconsortium.org/) and areas of shared governance, co-management, and multiple use arrangements. Indeed, in reality social and political contests over land-use, governance and ownership face a substantial number of government or privately-owned protected areas, wherein responsible researchers need to take account of intricate social issues. It is not our aim here to provide a detailed guide to these situations.

Indeed, this is not necessary, because a number of existing standards, codes of practice and guidelines exist; **our researchers' code should be applied alongside these** wherever the former apply. Of particular importance are three from the Convention on Biological Diversity – the *Akwe Kon* guidelines for the conduct of cultural, environmental and social impact assessments in or near sacred sites (CBD, 2004) the *Tkarihwaí:ri Code of Ethical Conduct to Ensure Respect for the Cultural and Intellectual Heritage of Indigenous and Local Communities* (CBD, 2010), and the *Nagoya Protocol on Access to Genetic Resources and Fair and Equitable Sharing of Benefits Arising from their Utilization* (CBD, 2010) – **and the International Society for Ethnobiology's Code of Ethics** for researchers (ISE, 2006). Following the CBD standards is an obligation to all 193 State Parties. Other regional codes are also important and useful, for example guidelines produced for carrying out social research with communities adjacent to Kruger National Park (Tapela et al., 2009). As part of requirements for obtaining ethical clearance for research, the requirements relating to social issues in research should be fully identified and addressed.

The following code of practice is therefore suggested as a framework for building improved cooperation between, on the one hand, protected area agencies and other key actors and rights-holders such as Indigenous peoples and local communities and, on the other hand, researchers. It has drawn existing literature and on the experiences of people from a wide variety of backgrounds connected with protected areas. It is necessarily preliminary and we welcome further ideas and input.

A DRAFT CODE OF PRACTICE FOR RESEARCH AND MONITORING IN AND AROUND PROTECTED AREAS

Responsible research and monitoring in the protected area

1. All research must have the necessary national to local approvals and permits, pay any fees required, and strictly follow laws, regulations and social norms and protocols relating to research within protected areas, including with respect Access and Benefit Sharing (ABS) under the Convention on Biological Diversity.
2. All research should obtain necessary ethics approval from research organisations, funding agencies, and protected areas with respect to both animal research and social research.
3. Field researchers must adopt the highest precautionary standards to avoid the accidental introduction and distribution of invasive and pathogenic organisms (e.g., Wittenberg and Cock, 2001).
4. Field research should minimise disturbance both to the organisms being studied and to other species and ecosystems
5. Data collection involving the killing of an organism should only take place when this is absolutely essential to the research and has been agreed by managers and follows national rules.
6. Research involving significant alteration to ecosystems including through killing of organisms should normally not be undertaken in IUCN category I-IV protected areas unless there is no feasible alternative research location, or unless research is likely to be of significant importance to the conservation goals of the protected area. In all such cases, a detailed impact assessment and cost-benefit analysis should be undertaken before permission is granted, and research should focus on less strictly protected zones of the protected area. Particular attention should be given to whether the areas or species are considered sacred or culturally important to indigenous peoples or local communities and to the degree of threat faced by the species (drawing on Red List categories).
7. Where research involves fieldwork in areas occupied by people, or affects species or ecosystems to which people have de facto or de jure tenure rights or cultural connections, it must have free prior and informed consent (FPIC) from right-holders in relation to the rights that may be affected and be carried out in a way that respects local beliefs, economic and cultural interests, and rights.
8. Managers of protected areas should seek to partner with research organisations to develop collaborative research that will both inform management and meet the needs of the research community for cutting-edge science. In turn, researchers should seek collaborative relationships with managers where the results of their research are likely to inform park or conservation management and build capacity.
9. Researchers should consider the aesthetic values of protected areas and impact on visitor experience when selecting methods of data collection, radio collaring, constructing research plots, field bases, etc, and remove all equipment and other materials at the end of the research.
10. Researchers employed by protected area organizations or associated government departments should abide by the same rules and code of conduct, where applicable, as external researchers.
11. Protected area managers should welcome research as an important value of protected areas. They should create clear conditions for permitting research and seek to encourage suitable research in protected areas ideally through a process (e.g. a research working group) which identifies research priorities.

Participation of relevant stakeholders

12. Projects should wherever possible be developed collaboratively with representatives from protected area agencies, managers and staff, and where appropriate, should also involve the participation of local partners and stakeholders, including as co-researchers involved in both project design and decision-making processes
13. Research (data, analysis and recommendations) should, wherever possible, seek to increase local and national capacity to understand and manage the protected area, improve environmental education and knowledge and supply material used by local interpretive guides.
14. Local partners should be rewarded appropriately for their contributions, for example through recognition in publications and presentations.
15. Where appropriate, the approvals process should include opportunity for concerned stakeholders, such as local communities, to comment on applications where the research will significantly impinge on their interests, such as when it would take place on their traditional land or near sacred natural sites.
16. Use of traditional ecological knowledge should be appropriately recognised, with free, prior and informed consent for any information used. If the research process or intended uses change, the rights-holders must be re-engaged as part of a continual process of free, prior and informed consent,

particularly if traditional knowledge or associated genetic resources could be placed in the public domain.

17. Research involving people and their beliefs, attitudes and behaviours should respect the privacy of an **individual's information and responses, where possible following the privacy rules established for the country.** Where privacy rules are absent, researchers should report aggregate data or data that cannot be tracked to individuals rather than suppress data altogether. All personal data should be stored and kept in a confidential manner.

Contribution to effective protected area management

18. Professional and amateur researchers should be encouraged to undertake responsible studies within protected areas as a positive contribution to knowledge and management effectiveness (e.g., by tracking trends in species numbers)
19. Researchers should consider management priorities and information gap and work towards providing data and recommendations that as far as possible will help to improve protected area management.
20. Research methodologies should be developed with the appropriate protected area managers and rangers, particularly where they have direct management application.
21. Field researchers should supply any useful incidental information collected (on species movement,

management problems, illegal activities that may need immediate action by protected area staff and protection force, etc) to protected area staff through regular constructive briefings (briefing papers, progress reports and verbal reports) rather than wait till they research is completed, whilst respecting confidentiality of information collected through anonymous interviews and questionnaires.

22. Researchers should be mindful of the need to avoid general sharing of photographic or other information (e.g. through websites, social media or group emails) which could damage the protected area (e.g. be used by poachers and illegal wildlife traders).

Intellectual property rights, access to information and sharing of results

23. Intellectual property rights on data and results must be recognised and research should not infringe local rights in intellectual property (e.g. customary laws and community protocols and procedures of the indigenous peoples and local communities concerned); if research is carried out in a host country that has few legal requirements, researchers should follow the standards of their country of origin, relevant international standards
24. Where protected area staff, field assistants and others have contributed significantly to the research, through data collection and analysis, they should be offered co-authorship of resulting papers, or for lesser inputs included appropriately in acknowledgements.

BOX: PARKS VICTORIA RESEARCH PARTNERS PROGRAM, AUSTRALIA

The major delivery mechanism of Parks Victoria's applied research program is the Research Partners Program (RPP).

The RPP commenced in 2000 with the aim of creating a strategic and cost efficient way to fill critical knowledge gaps for the management of the parks system. Prior to the creation of the RPP, research in parks was often localised, ad hoc and of limited value in answering the most strategic and important park management questions.

With limited in-house science capacity, the RPP provides the major vehicle for Parks Victoria to access a diverse range of scientific knowledge, expertise and research skills needed to enable informed management decision-making. By bringing together the scientific knowledge and skills of Research Partners with the practical management skills of Parks Victoria staff it seeks to address real-life applied management questions to directly benefit and improve on-ground management.

The objectives of the RPP are to:

- Improve understanding of the values of, and threats to, the park system and the benefits of parks to the community
- Encourage collaboration in scientific research and enable scientists and park managers to work together to enhance the conservation and management of parks
- Build a strong body of knowledge to inform adaptive park management.

Through the RPP, Parks Victoria has established formal partnership agreements with ten universities and other research institutions to undertake collaborative research to improve park management. The RPP also enables opportunistic (project-based) agreements to be developed with other research institutions.



The Monitoring and Research Co-ordinator for WWF's RUMAKI Seascape Programme surveying the Kitutia reef in the south of Mafia Island Marine Park in Tanzania © Brent Stirton / Getty Images / WWF-UK

25. A copy of all research should be provided to the protected area management authority. Copies of reports and publications resulting from the research should, wherever possible, be freely available electronically as far as possible and provided to all relevant local and national organisations in the country where the research is undertaken (e.g., local libraries or resource centres and protected area management office) in an appropriate form (paper or electronic according to local storage and search capacity); and language (including when appropriate local languages for any Indigenous peoples or local communities involved).
26. Samples collected should, where appropriate and agreed in the research design, eventually be deposited in public collections such as museums or botanical gardens and/or returned to Indigenous peoples or local communities from whom they were collected; ensuring that local rules and CITES export rules are followed.
27. As a general principle raw data should be supplied to the protected area along with relevant explanatory documentation (where necessary with a time lag to allow results to be published).
28. Researchers should publish results in a reasonable time period and not use publication delay to withhold data from protected areas managers.
29. Any practical implications for protected area management that have been highlighted by the research should be reported to the protected area managers within a reasonable time period and where face to face meetings will be necessary to relay findings, the costs to travel back to a protected area to present results is included as part of the research budget.
30. Where research is ongoing over a number of years, researchers and protected area staff should meet regularly (e.g. quarterly) to report back on progress, discuss results and identify research priorities



Polar Bear research in Wapusk National Park, Manitoba, Canada © Kean MOYNIHAN / WWF-Canada

CONCLUSIONS: PARTNERSHIPS BETWEEN MANAGERS AND RESEARCHERS

Partnerships are important at both the individual manager-researcher level and between management and research institutions. Capacity building may be needed at both levels: e.g. an increased understanding of how protected areas are designated and managed by researchers / research institutions and on how research is developed, carried out, reported and used by protected area managers and management agencies. Individual relationships tend to develop and evolve over time but institutional mechanisms can help develop capacity, create collaborative arrangements and provide a means to bring managers and researchers into more regular and focussed discussion. Through such mechanisms, park managers can develop, in discussion with researchers, outlines of key research themes and needs that can help guide potential researchers to relevant topics that have a ready application to park management. This can be particularly useful to research students and early career researchers.

Where an on-going collaboration exists between a research institution and a protected area management agency, there may be an opportunity for the Agency to grant an institutional or umbrella permit, under specific conditions, to help facilitate research that meets the conditions of the permit and thereby save administrative overheads for both the researchers and the managers.

The current code of practice is presented as a draft. The authors welcome feedback and intend to publish a more definitive version at the World Parks Congress in Sydney, Australia, in 2014.

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RESUMEN

Las áreas protegidas son sitios apetecidos para la investigación ecológica y el monitoreo, y la investigación responsable puede ayudar a mejorar la eficacia de la gestión y a intensificar los resultados de la conservación. Muchos países han formalizado procesos de aprobación y monitoreo para la investigación dentro de sus sistemas de áreas protegidas. Ya existe una serie de códigos para abordar las cuestiones éticas y sociales relacionadas con la investigación en las áreas protegidas, los sitios naturales sagrados y los territorios tradicionales de los pueblos indígenas y las comunidades locales. Sin embargo, menos atención se ha prestado a escala global a los impactos ecológicos de la información derivada de la investigación ecológica en las áreas protegidas. Hay numerosos ejemplos sobre investigaciones que son de poco valor para la gestión o que están mal planificadas, donde los resultados no son compartidos con el área protegida, o incluso donde las investigaciones provocan daños ecológicos (o sociales) importantes. Este documento contiene un proyecto de código de prácticas para quienes realizan investigaciones en áreas protegidas, que podría servir de base para debates sobre normas mínimas para académicos y otros investigadores en el futuro.

RÉSUMÉ

Les aires protégées sont des sites privilégiés pour la recherche et le suivi écologique. Une recherche responsable et bien gérée peut permettre d'améliorer l'efficacité de la gestion et les résultats de la conservation. De nombreux pays ont officialisé des processus permettant d'approuver et de suivre la recherche au sein de leurs systèmes d'aires protégées. Il existe déjà plusieurs codes abordant les questions éthiques et sociales relatives à la recherche dans les aires protégées, les sites naturels sacrés et les territoires traditionnels des populations autochtones et des communautés locales. Cependant, à l'échelle mondiale, les impacts écologiques et l'accès à l'information issue de la recherche écologique au sein des aires protégées suscitent peu d'intérêt. Un grand nombre d'études s'avèrent peu utiles pour la gestion, mal planifiées, ou bien leurs résultats ne sont pas partagés avec l'aire protégée. Parfois même, la recherche peut causer des dommages écologiques (et/ou sociaux) significatifs. Cet article contient un code de bonnes pratiques provisoire pour les chercheurs réalisant leurs travaux dans les aires protégées. Nous pensons que ce code devrait, à l'avenir, servir de base pour les futurs débats portant sur les normes minimum applicables aux chercheurs universitaires ou autres.



TRANSBOUNDARY PROTECTED AREAS MANAGEMENT: EXPERIENCES FROM W-ARLY- PENDJARI PARKS IN WEST AFRICA

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ABSTRACT

This paper presents the experiences of W-Arly-Pendjari (WAP) parks in West Africa to improve conservation strategies with the support of partners within a transboundary management system. The W Regional Park and WAP complex conservation, funded respectively by the European Union and the Global Environment Facility (GEF) projects since 2001, has allowed the development of a technical basis for the transboundary approach and enhanced the effectiveness of protected areas management. This paper outlines the results of these projects including the harmonization of management strategies and the establishment of the regional patrol and biodiversity survey systems which have strengthened threat reduction. An important tool developed through the cooperative management is the establishment and implementation of a regional coordination system that brings together the three countries and all stakeholders involved in WAP protected areas management. A GEF small grant system was also implemented to support rural activities that contribute to biodiversity conservation and improve riparian **communities' livelihoods in the WAP complex. The transboundary management of the complex is an** experience which provides excellent lessons and deserves to be supported by natural resource funding to ensure the main management objective - the long-term conservation of biodiversity.

KEYWORDS: transboundary, W-Arly-Pendjari, management effectiveness, GEF, livelihoods, biodiversity survey, regional coordination system

INTRODUCTION

The cooperative management of shared resources between countries is an interesting model that needs to be promoted to enhance the sustainable conservation of protected areas. Several examples of cooperative action between two or more contiguous protected areas separated by international and sub-national boundaries have been implemented worldwide (Sandwith et al., 2001; Wolmer, 2003). In Africa, as in other parts of the world, many protected areas extend across national borders and their sustainability cannot be effective in the absence of collaborative management systems (Wolmer, 2003). As underlined by Sandwith et al., (2001), transboundary protected areas play an important role in co-operation and provide tools to improve peace among countries. Moreover, the importance of transboundary protected areas is widely recognized for effective biological conservation since they offer wide ranges to large herbivore and carnivore populations whose viability

are area dependent. In this regard, Blanc et al., (2003) reported that in West Africa, the W-Arly-Pendjari (WAP) transboundary complex shelters more than half of the West African elephant population and argued that the success of transboundary protected area management will increase the success of elephant species conservation.

The WAP complex is the largest and most important continuum of terrestrial, semi-aquatic and aquatic ecosystems in the West African savannah belt. It covers about 50,000 km² including riparian areas (UNDP, 2004). The complex contains a number of protected areas, including the transboundary W Regional Park based around a w-shaped bend in the river Niger, the Pendjari National Park in Benin and Arly National Park in Burkina Faso (Figure 1). It is divided between Benin (43 per cent of the area), Burkina Faso (36 per cent) and Niger (21 per cent) (UNDP, 2004). It is recognized for its

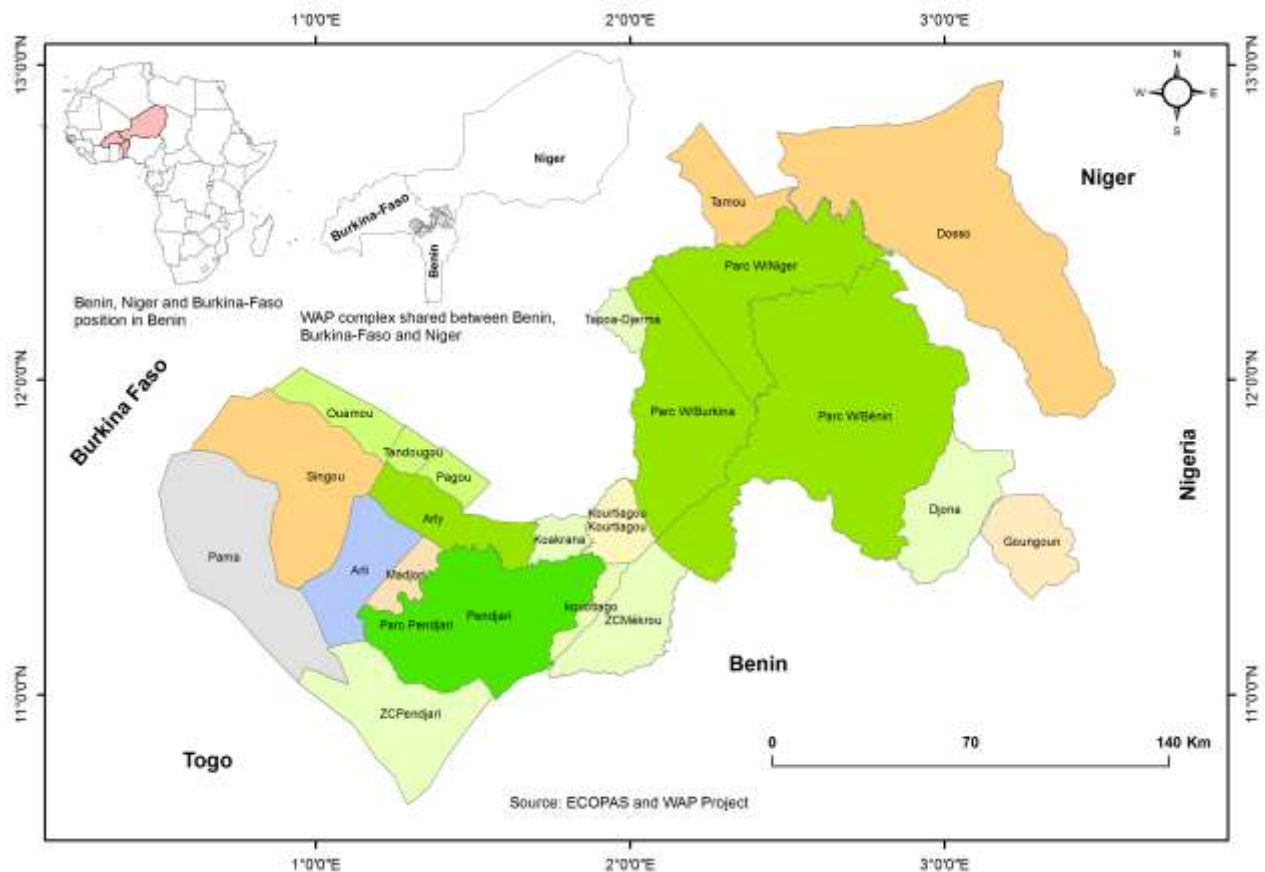


Figure 1: Map of W – Arly – Pendjari complex

high importance for the biodiversity conservation of West Africa savannahs by the United Nation and Development Programme (UNDP, 2004). The part of W Park that lies in within Niger was added to the World Heritage list in 1996. However the area's biodiversity still faces various threats such as agricultural encroachment, transhumance within parks, poaching, uncontrolled bushfires, siltation and pollution of surface waters, climate change and variability, and unsustainable harvesting of Non Timber Forest Products (NTFPs), timber and fish overexploitation (UNDP, 2004).

An initial analysis of management issues in the WAP protected areas highlighted the low involvement of the local population in decision-making and management implementation, the lack of management capacity of parks managers and the inequality of management experience and capacities between the protected areas in the complex (UNDP, 2004). Diagnostic analysis also showed differences in policies and strategies between the three countries concerning the shared biological resources (UNDP, 2004). There was a clear need therefore for dialogue and experience sharing and harmonized management tools (institutional, juridical and technical) for successful coordinated action across the countries involved. The regional approach of the

WAP complex management, envisioned by the managers and decision-makers, was therefore to reduce threats and improve biodiversity of the WAP protected areas by the harmonization of management tools and approaches and to develop successful cooperation between all stakeholders involved in the WAP parks management.

This regional vision began in 2001 with the European Union (EU) project *Ecosystèmes Protégés en Afrique Soudano-Sahélienne* (ECOPAS) that supported the W Regional Park—a transboundary park across Benin, Niger and Burkina Faso (ECOPAS, 2005). The initiative continued with the support of the Ecosystem Management project, WAP-Global Environment Fund (GEF), from 2010 to 2013. In 2012, the *Programme d'Appui aux Parcs de l'Entente* (PAPE) began which also focuses on transboundary protected areas management and is currently ongoing. In addition to W Regional Park, Arly and Pendjari National Parks, this last programme also includes Oti-Mandori parks in Togo.

To date there has been no summary of the experience gained from this regional approach of transboundary protected area management within the WAP complex in order to assess the sustainability of the approach in biodiversity conservation. This paper aims to fill this gap.

THE W-ARLY-PENDJARI COMPLEX INSTITUTIONAL AND MANAGEMENT FRAMEWORK

One challenge for transboundary management is the different protected area management structures in the three countries involved. In Benin the *Centre National de Gestion des Reserves de Faune* (CENAGREF) is the national office in charge of W park in Benin and Pendjari parks; in Burkina Faso and Niger the protected areas in the WAP complex are governed by two different national institutions. One of the objectives of the WAP-GEF project was therefore to establish the technical and institutional basis of the cooperative management of the complex. The project elaborated the official documents relative to these structures and the process of sign-off by the different governments involved is ongoing. The documents provide the framework for international cooperation for the sustainable management of the complex and define the stakeholders and their roles and responsibilities in the management of the WAP complex.

The management structures of the WAP complex are the Ministry Committee of Orientation (CMO) and the Technical Committee of Control (CTS). All the decisions are taken by the CMO which is directed by the ministers in charge of protected area management of the three countries (Figure 2). The CMO plays the role of the steering committee for the project at regional level. Its main mission is to define the general orientation for project management. It analyses the project activities and directs the activities with respect to the global project objectives and outcomes. In addition to this regional committee each country has a National Committee of Project Steering which brings together

twice a year the protected area and national administration to validate and evaluate the work plan of the project at national level. An important asset of this institutional framework is the fact that it is permanent and all the technical and financial partners and conservation project activities are directed by this regional framework established and recognized by the three countries.

At national level, each park in the complex is directed by a national administration of park management which implements field management actions with close involvement of local association and private entities. In Benin, local associations have been involved in park management decision since 1996 in Pendjari and 1999 in W Park. In Burkina Faso, local communities are organized in village committees called Wildlife Management Committee (CVGF = *Comité Villageoise de Gestion la Faune*) and are involved in protection and hunting activities. The wildlife management system is a partnership between private entities, local communities and the government. In Niger, local communities named Local Land Commission (COFOB = *Comité Foncière de Base*) participate in wildlife management activities but are not so well organized.

- The regional management of WAP is supported by a number of national, regional and international laws: International conventions of Rio de Janeiro on Environment and Sustainable Development (United Nation Convention on Biological Diversity, United Nation Convention to Combat Desertification, United Nation Convention on Climate Change) in 1992



Figure 2: Flow chart of the regional complex W-Arly-Pendjari

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1973
- Ramsar Convention on Wetland in 1975
- Convention on Migratory Species (CMS) (Convention of Bonn) in 1979
- World Heritage Convention in 1972
- Agreement on W regional management with the support of the EU
- Tripartite agreement on the struggle against poaching between Benin, Burkina Faso and Niger in 1986
- Economic Community of West African States (ECOWAS) agreement for transboundary transhumance in 2004

Overall, all these conventions and agreements strengthen the cooperative management of the WAP complex protected areas and biodiversity conservation.

ECOLOGICAL POTENTIAL

The WAP complex includes nineteen ecological sites distributed in three protected area groups (W, Arly and Pendjari). Several factors support the importance of the WAP complex: (i) WAP protected areas represent about 25 per cent of the sub-region's savannah habitats, (ii) WAP protected areas are acknowledged as the most significant remaining area for elephant conservation in West Africa (Bouché et al., 2004) and they also protect more than 370 bird species, 94 insect species, 80 fish species and various species of reptiles and amphibians (UNDP, 2004). Many of these species can only be found today in West Africa in the WAP protected areas. WAP protected areas are also critical for the conservation of **the last Sahelian and Sudanese mammals' population**. More than 60 mammal species have been listed, among which are elephants (*Loxodonta africana*), buffalos (*Syncerus caffer*), waterbucks (*Kobus defassa*), buffon's kobs (*Kobus kob*), topi antelopes (*Damaliscus korrigum*), bubals (*Alcelaphus buselaphus major*), giraffes (*Giraffa camelopardalis*), hippopotamuses (*Hippopotamus amphibius*), roan antelopes (*Hippotragus equinus*), lions (*Panthera leo*), cheetahs (*Acinonyx jubatus*) and a variety of monkeys (olive baboon (*Papio anubis*), patas (*Erythrocebus patas*), green monkeys (*Cercopithecus aethiops*). The presence of supposedly missing or rare species such as cheetah and leopard has recently been demonstrated (Henshel et al., 2012). The presence of the African wild dog continues to be discussed among parks managers and scientists. According to White (1986), the WAP vegetation belongs to Sudanian biogeographical zone with presence of riparian forest, grass savannah, woodland and tree/shrub savannah (see Appendix 1).

SOCIO-ECONOMIC SITUATION

There are more than 340 villages within 25 km of the WAP complex. The rainfall in the WAP complex is higher than in central and northern Burkina Faso and Niger, so the area is considered of high productivity for agricultural migrants and cattle transhumant (UNDP, 2004). However, high levels of poverty and rapid population growth result in increasing threats to natural resources, including poaching, overgrazing, uncontrolled fishing and agricultural encroachment within the protected areas. Transhumance is a major concern for wildlife conservation within the reserve since it contributes to wildlife habitat degradation. Before the implementation of ECOPAS from 2002 to 2008 W Park (mainly on the Benin side) was illegally occupied during the dry season (December to April), with cattle breeders coming from neighbouring Nigeria, Niger and Burkina Faso. Today, although transhumance still persists in the region, its magnitude inside the W Park has gradually **decreased since the parks' administrations have** enhanced boundary control and communication strategies with the help of ECOPAS (see below for details); this strategy is extended to Arly and Pendjari Parks through the WAP project. Regarding poaching, the phenomenon is diffused and park managers struggle daily to overcome this issue in association with local wildlife associations. Cotton cultivation emerged in the 1990s as the most important activity within the riparian area of the WAP complex, especially in Burkina Faso and Benin. The cotton production is encouraged by the two governments who provide farmers with technical support such as fertilizers, pesticides and tractors to improve **their capacity. It also provides essential farmer's income**. Unfortunately, cotton cultivation threatens biodiversity conservation due to the use of pesticides and land cleaning for its cultivation (Clerici et al., 2006; Houessou et al., 2013).

Overall, it should be observed that the attitude of the bordering population toward resources conservation in the protected areas has improved positively with the increased involvement in parks management activities of local people and the sharing of generated incomes.

ACHIEVEMENTS OF W PARK TRANSBOUNDARY MANAGEMENT: ECOPAS PROJECT

The ECOPAS project ran from 2001 to 2008. The overall objective of ECOPAS was to reverse the processes of natural resources degradation by preserving the biodiversity of W Park for the benefit of the populations bordering the reserve. Specifically the project aimed to (i) better valorize (i.e. give a value to) natural resources in order to release more benefit from their sustainable



Promoting beekeeping in Banikoara for sustainable conservation of biodiversity and local population livelihood enhancement, Benin Republic (West Africa) © Isidore O. Amahowé

use; and (ii) promote mechanisms for the equitable sharing of the benefits arising from sustainable use of natural resources. The main activities implemented by the project were: combating transhumance and poaching inside the protected area, promotion of income-generating activities for the populations around the park, insuring participatory management, the valorization of the park through ecotourism and ecological restoration utilising monitoring and research activities.

As noted above an important issue was regional **transhumance inside the parks' boundaries and thus a major objective was to define strategies for sustainable use of pastureland around the park in order to lessen grazing pressure in W (Kagone, 2004)**. This vision was implemented through joint action by the three countries Benin, Niger and Burkina Faso. An ad hoc committee on transhumance management was established composed of deputies from each country. This committee defined five regional transhumance corridors (see Appendix 2) around W Regional Park crossing Benin, Niger and Togo, developed regional strategies for communication/

sensitization toward transhumance issues and to set up pastureland monitoring in the park. Before the implementation of the programme, W Park was densely occupied by cattle herds and its degradation was a great concern. An important achievement of ECOPAS has been the removal of cattle breeders from inside the park and the progressive restoration of the grazing land and wildlife habitat.

As for transhumance, ECOPAS has developed a regional patrol system to combat poaching inside the reserve. Through a collaborative patrolling system, park guards in each country worked together and exchanged experiences and knowledge. This strategy helped to increase the capacity and the effectiveness of protection activities at the regional level.

In each country park managers helped developed income-generating activities at the periphery of the park in order to overcome poverty within surrounding **populations and to lessen pressure on the park's resources**. In this regard, ECOPAS supported local

population activities which were compatible with sustainable conservation of biological resource of the park such as bee keeping and shea butter production. Moreover, local populations were closely involved in park management activities through local wildlife association in Benin, wildlife conservation Committee (CVGF) in Burkina Faso and local land commission (COFOB) in Niger. In Benin for instance, park managers return annually 30 per cent of the income generated by hunting zones to the wildlife associations for local initiatives such as building school classrooms and health centres, forage purchase, etc in order to improve local population livelihoods. The fund is also used by local wildlife associations to compensate for human wildlife conflict, **such as helping farmers' who are victims of fauna damage** in their fields and for population sensitization for the sustainable conservation of the park. Management activities in the W region were also supported by several research projects which aimed to improve the global comprehension of ecological functioning and biodiversity conservation issues in W (Clerici et al., 2006; Bouyer et al., 2007).

Overall, the transboundary management experience of W Regional Park under ECOPAS was the first time that the three national administrations willingly cooperated on the management. This initiative led to a regional agreement involving the three countries to manage W Regional Park together and focus on:

- The protection and valorization of natural, archaeological and cultural heritage
- Harmonization of policy and management strategies of the protected area with respect of individual interests in each country
- Promoting participatory and co-management of natural resources with emphasis on the sharing of incomes from management activities

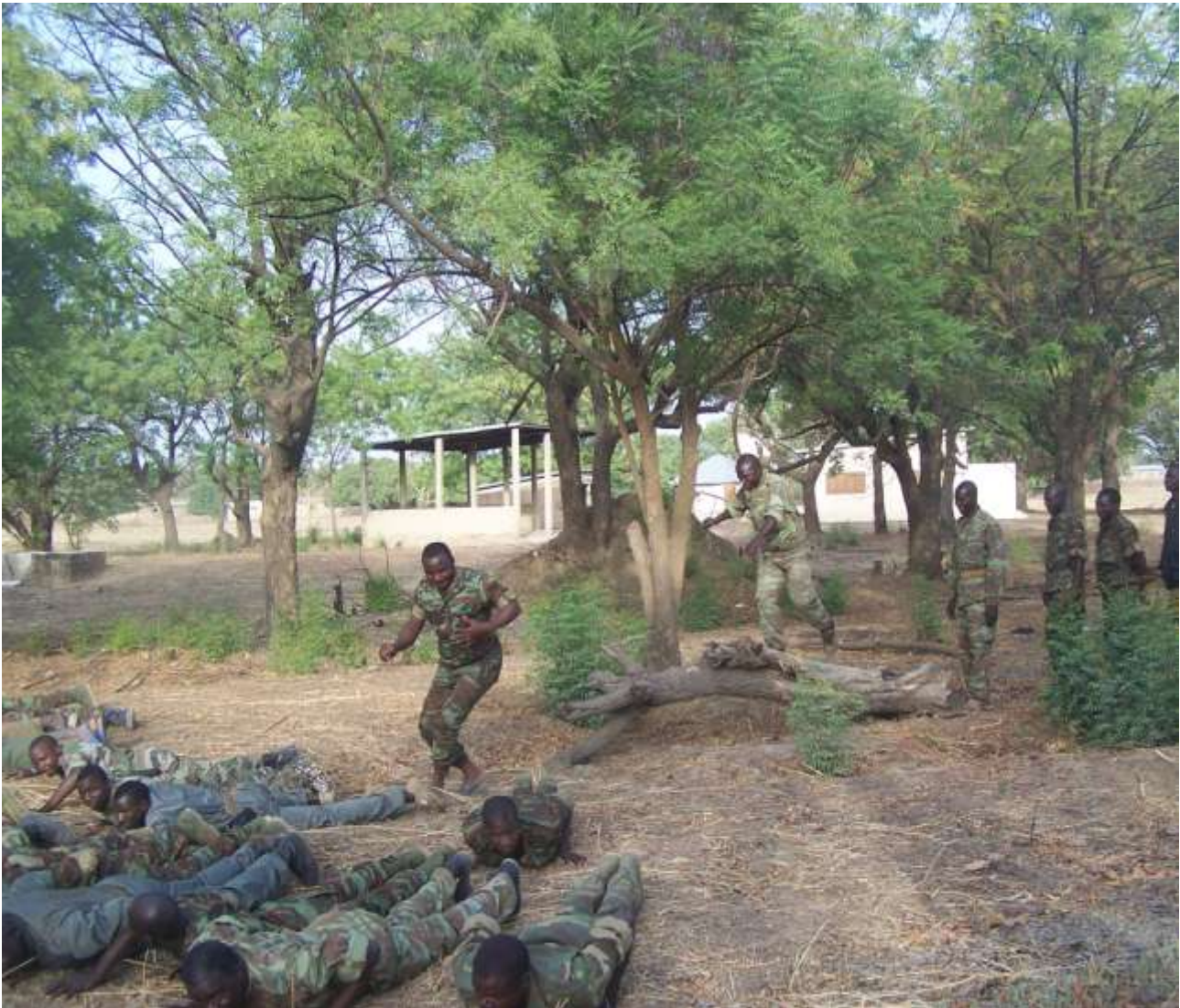
The impact of ECOPAS for transboundary protected area management in the field was noticeable since the initiative helped to reverse wildlife habitat degradation induced by transhumance in the park, to combat poaching through regional strategies and to lessen local population pressure on the park through income-generating activities and their involvement in management activities. Unfortunately, however at the end of the financial support to the park the administration failed in several management issues and it became difficult to ensure minimum protection actions. This raised the insight of the importance of the implementation of a sustainable financing system that could support activities of essential management beyond the life of project led activities.

ACHIEVEMENTS OF WAP: GEF PROJECT

The aim of the WAP-GEF project is the enhancement of long-term biodiversity conservation in the WAP complex. The project began in 2010 with regional and national workshops and developed on much of the work carried out by the ECOPAS project across the complex by tackling anthropogenic threats (e.g. transhumance, poaching, agriculture, etc.). Through supporting frequent consultative meetings of stakeholders involved in park management at local and regional level, the WAP project enhanced the partnership between the key stakeholders including park managers, local associations, private partners managing the contiguous hunting zones and technical and financial partners.

The WAP project also contributed to local communities' livelihood through financial support to local associations which were involved in activities respectful to biodiversity. A total of 13 micro-projects were elaborated by the biodiversity local group with the technical support of WAP Experts. The micro-projects were developed on ecological tourism and beekeeping activities in Benin, pastureland management and beekeeping activities in Niger, NTFP development (Shea butter processing) and bush meat valorization in Burkina Faso. The total budget of these micro-projects was over US\$420,000 supported primarily by the GEF with the remaining funding coming from local associations (see Table 1 for details of all the projects). In addition to the funding, training was provided to local association members to improve their knowledge on the development of activities respectful to biodiversity conservation. It should be noted that despite the efforts made by the WAP project, the support was still insufficient to meet the need of all the riparian villages.

The WAP project also worked to increase the awareness of the local population on the global importance of biodiversity in the WAP complex through a strong communication strategy using local radio, sensitization of local authority and environmental education for primary school students in the riparian villages. Institutional communication was produced for literate public and partners. A training plan realized with technical assistance from IUCN significantly increased the capacity of protected areas managers. Trainings was conducted on management tools such as the Management Effectiveness Tracking Tool (METT), Financial Scorecard (FSc), Matrices of Capacity Development (MDC), data base management, Geographical Information Systems (GIS), analytical accountancy management in protected area administration, sustainable financing mechanism and



Capacity building for park guards to develop a cooperative patrol system implemented between Benin, Burkina Faso and Niger (West Africa) © Isidore O. Amahowé

anti-poaching and transhumance within the protected areas. All these helped park managers within the transboundary area to harmonize their outlook on key management issues and working strategies.

A framework for cooperative patrol systems was designed for the three countries to exchange experiences and harmonize research techniques to track poachers. **Regional training was organized to enhance guards' knowledge on litigation management and on laws related to nature conservation in general and wildlife management in particular.** The cooperation in patrol activities reinforces and facilitates litigation management between parks administration, and protection officers help each other in litigation when offenders come from a neighbouring country. These cases are frequent with cattle herders arrested in W Park in Benin coming from Niger, whilst most poachers arrested in Niger and Burkina Faso are Bariba from Benin (Amahowé, 2007).

The WAP project has conducted a collaborative census of elephant in W Regional Park. This census was planned for all the WAP protected areas but was not possible due to helicopter availability and census planning being impacted by instability in the West Africa region (in particular Mali) and other internal issues. All of which highlight how socio-political instability impacts on wildlife conservation activities. The result from this census showed that elephant population within W Regional Park was 761 individuals (Coefficient of variation CV: 53 per cent), buffalo 3,991 (CV: 32 per cent) and roan antelope 2,757 (CV: 8 per cent) (Bouché et al., 2012). A carnivore census was carried out in the whole WAP complex in collaboration with the PAPE and WAP projects and the NGO Panthera. This study estimated lion populations at 311 (± 188) individuals, of which 148 (± 87) lions where in Benin, 147 (± 88) in Burkina Faso and 15 lions (± 12) in Niger (Henschel et al., 2012).



A group of elephant counted through the aerial census of May-June 2012 © WAP-Project

A geographical database is under construction for all three national administrations involved in WAP protected areas management. This database is recognized as an important tool to aid good management of protected areas data in order to easily generate information that can help managers take efficient decision for biodiversity conservation at a regional level. The WAP project has also established a website with **links to the existing parks' websites and others partners** to allow the access of information of WAP protected areas and other information that could increase the **parks' visibility (www.complexewap.org)**.

PAPE PROJECT: CONTINUING ACTIVITIES

Based on the important insights and outputs gained from the ECOPAS and WAP projects, cooperative management of transboundary protected areas in West Africa is now be continued by the PAPE project with funding from the EU. PAPE covers the WAP complex plus Oti-Mandori Park in Togo. The project started in 2012 and continues to reinforce WAP Project activities.

LESSONS GAINED FROM COOPERATIVE MANAGEMENT OF WAP

The long-term funding by these three linked projects for the cooperative management of transboundary protected areas in the WAP complex is an opportunity for different

partners to build a robust network of experience sharing among parks managers across borders and create a bridge between different management system in different countries governing shared biodiversity. This cooperative experience for shared resource management has impacted management in many ways. An assessment of the main strengths, weaknesses, opportunities and threats (SWOT) was carried out to identify any continuing obstacles to transboundary management and understand the ways forward in enhancing the effectiveness of this cooperative management within this outstanding West Africa savannah belt. A summary of the SWOT is given below:

Strengths

- Agreement of regional and concerted management of the WAP complex involving three countries: Benin, Burkina Faso and Niger
- Involvement of local communities in this management approach
- Establishment of a regional institution to direct conservation actions within the WAP protected areas
- Capacity enhancement of local community and development of activities respectful of biodiversity conservation
- Establishment and support of regional patrol activities in the WAP complex

- Establishment of regional planning system involving all conservations partners working toward the long-term conservation of biodiversity in this complex
- Establishment of a regional biodiversity database and WAP website that can help facilitate access and information sharing among park managers

Weaknesses

- High social and cultural diversity among managers and people living around the WAP complex
- Differences in the laws governing protected area resource management in the three countries
- Different structures and institutions in charge of protected area management in each country, which sometimes makes the implementation of management difficult
- Unequal management capacity in the protected areas of the WAP complex

Opportunities

- The possibility for the whole WAP complex to be registered as World Heritage
- The availability of the United Nations Office for Project Services (UNOPS) to lead a new project to support sustainable management within the local communities through the development of infrastructure respectful to environment
- The ongoing support of the EU and UNDP for the WAP complex

Threats

- The anthropogenic threats of poaching, transhumance and agricultural encroachment
- High population increase around the complex
- Absence of a sustainable funding system

Table 1: Micro projects funded by the WAP Project around W-Arly-Pendjari protected areas

Title and beneficiaries	Description	Funding (US\$)			
		Total	Requested	In kind	Other
BURKINA-FASO					
Shea fruits processing for butter and soap: Women's association 'TINFI' of Kotchhari	Equipment provided to the association; enhancement of technical and organizational capacity	12,530.26	10,046.80	2,483.45	
Shea fruit processing for butter and soap: Women's association 'FANOIMA' of Pama	Improvement of material and financial means; enhancement of organizational capacity	12,840.94	10,272.75	2,568.19	
Bush meat processing before sale to increase its value; Wildlife management association of Pama	Enhancement of organizational capacity; equipment provided; improvement of sales system and link with restaurant	25,883.63	20,706.91	5,176.73	
Total:		512,54.84	41,026.47	10,228.37	
BENIN					
Honey commercialization: Woman association 'Sé Sourou' of Founougou	Improvement of honey quality; improvement of the quality of honey packaging; promotion of honey	17,709.00	13,173.82	4,535.18	
Ecotourism development at the waterfall site of Tanougou; TINFI Association 'luttons pour progresser'	Capacity building; development of ecotourism reducing anthropogenic pressure on the resources of Pendjari Biosphere Reserve	13,173.82	10,551.16	2,622.66	
Beekeeping development at Batran; Beekeepers association of Batran village	Enhancement of beekeeper marketing capacity; labeling of honey production; promotion of beekeeping by radio broadcasting	17,759.44	14,150.26	3,609.18	
Ecotourism development at the periphery of the Djona hunting zone (W Park - Benin)	Improvement of the visibility of Alfakoara site destination and offer of services to tourists: e.g. lodging, food service, art objects, etc	10,107.33	9,804.71	2,723.53	
Improvement of the production of beekeepers: village association of Dokossouan; Beekeepers village association of Dokossouan	Enhancement of individual and organizational capacity of beekeepers; provided beekeepers with appropriate equipment	18,741.12	14,146.22	4,594.90	
Total		77,490.72	61,826.18	1,8085.46	
NIGER					
Restoration and management of grazing area of 'Pete Ed'; Breeders association 'ballagaljawdi' of 'Pésé Ed'	Improved management of the grazing area and carrying capacity of the grazing area 'Pete Ed'	20,935.88	13,995.92	6,939.96	
Improved production of the beekeepers association 'Forgay Ban'; Beekeeper association of Kareykopto	Bee keeping equipment; enhancement of technical and organizational capacity of beekeepers	8,622.80	6,982.32	1,640.47	
Improved production of the beekeepers association 'Tamou' the main site of honey production in the district of Tamou	Supply equipment and technical capacity building; improvement of the quality of production and performance of the beekeepers and beekeeping site management	33,945.38	23,350.75	2,904.19	806.97
Improvement of the beekeepers association 'Djamwala'; Beekeeper association of Weygorou village	Bee keeping equipment; enhancement of technical and organizational capacity of beekeepers	8,641.56	5,796.08	2,038.51	7,690.44
Increasing the value of honey and by products to the women's association of Tamou (W Park - Niger)	Improve access to the required inputs for increasing the value of honey and by products; increasing technical knowledge; ensuring local demand in soap, pomade and candle produced from honey and beeswax	9,959.55	7,790.30	2,169.24	
Total		82,105.18	57,915.39	15,692.38	7,690.44
Total Amount USD		210,850.75	160,768.03	44,006.21	8,497.42

CONCLUSION

In West Africa, the W-Arly-Pendjari complex is one the largest protected areas shared between Benin, Niger and Burkina Faso. The complex has been under transboundary management since 2001 through the involvement of the managers of the three parks in cooperative management strategies for biodiversity conservation. Through this cooperative approach, regional tools and management system have been established and are functioning at the complex level. The assessment of this ongoing regional approach made in this paper indicates the progress made but it is clear that a sustainable financial system must be urgently established to provide resources for essential management activities to be sustained.

APPENDIX 1

Shrub savannah/tree savannah are mainly represented by *Combretum collinum*, *Combretum nigricans*, *Combretum molle*, *Terminalia avicennioides*, *Terminalia laxiflora*, *Terminalia macroptera*, *Acacia sieberiana*, *Acacia hockii*, *Isobertinia doka*, *Isobertinia tomentosa*, *Anogeissus leiocarpa*, *Balanites aegyptiaca*, *Ziziphus mauritiana*, *Daniellia oliveri* and *Burkea africana*. In riparian forest along the rivers, species occurring are: *Acacia sieberiana*, *Diospyros mespiliiformis*, *Borassus aethiopum*, *Mitragyna inermis*, *Kigelia africana*, *Cola laurifolia*, *Sizygium guineense*, *Antidesma venosum*, *Carapa procera*, *Voacanga africana* and *Antiaris africana* (Lamarque, 2004; ECOPAS, 2005).

APPENDIX 2

Details on transhumance corridors are provided in Convers et al (2008). The corridors are:

- Corridor 1: **Fada N’Gourma** – Pama – Porga – to Togo or to Tanguiéta – Natitingou – Djougou – Bassila
- Corridor 2: (a) Sebba – Kantchari – Diapaga – Namounou - Pagou – Porga – to Togo or to Tanguiéta – Natitingou – Djougou – Bassila; (b) Torodi – Makalondi - Kantchari – Diapaga – Namounou - Pagou – Porga – to Togo or to Tanguiéta – Natitingou – Djougou – Bassila
- Corridor 3: Say – Tamou – Botou – Tapoa Djerma – Kotchari – Kondio - Kérérou – Toura – Goumori – Kerou – to zone Alibori supérieur
- Corridor 4: Say – Kirtachi – Boumba – Monsey – Karimama – Karigui – to Goungoun.
- Corridor 5: **Birni N’Gaouré** – Dosso - Gaya – Malanville – Guéné - to Goungoun

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RESUMEN

Este artículo presenta las experiencias del complejo de parques W-Arly-Pendjari (WAP) en África occidental para mejorar las estrategias de conservación con el apoyo de socios dentro de un sistema de gestión transfronteriza. El W Regional Park y el complejo de conservación WAP, financiados desde 2001 por la Unión Europea y el Fondo para el Medio Ambiente Mundial (FMAM), respectivamente, ha permitido el desarrollo de una base técnica para el enfoque transfronterizo y ha incrementado la eficacia de la gestión de las áreas protegidas. En este trabajo se describen los resultados de ambos proyectos, incluyendo la armonización de las estrategias de gestión y el establecimiento de los sistemas regionales de patrullaje e inventario de la biodiversidad, que han consolidado la reducción de amenazas. Una herramienta importante desarrollada a través de la gestión cooperativa es la creación e implementación de un sistema de coordinación regional que reúne a los tres países y a todas las partes involucradas en la gestión de las áreas protegidas de WAP. También se implementó un sistema de pequeñas donaciones del FMAM para apoyar las actividades rurales que contribuyen a la conservación de la biodiversidad y a mejorar los medios de subsistencia de las comunidades ribereñas en el complejo WAP. La gestión transfronteriza del complejo es una experiencia que ofrece excelentes lecciones y merece ser apoyada por los fondos para recursos naturales para la consolidación del principal objetivo de gestión –la conservación a largo plazo de la biodiversidad.

RÉSUMÉ

Cet article présente les enseignements des parcs W-Arly-Pendjari (WAP) en Afrique de l'Ouest pour améliorer les stratégies de conservation, avec le soutien de partenaires au sein d'un système de gestion transfrontalier. Le parc régional W et la conservation du complexe WAP, financés respectivement depuis 2001 par des projets de l'Union européenne et du Fonds pour l'environnement mondial, ont permis de développer une base technique pour l'approche transfrontalière, et ont mis en avant l'efficacité d'une gestion des aires protégées. Cet article souligne les résultats de ces projets, notamment l'harmonisation des stratégies de gestion et l'établissement des systèmes de patrouille régionale et d'études sur la biodiversité, qui ont amélioré la réduction des menaces. Par ailleurs, un important outil mis au point par la gestion de la coopérative est la création et la mise en œuvre d'un système de coordination régionale qui rapproche les trois pays et tous les acteurs impliqués dans la gestion des aires protégées WAP. Un système de prêts de petite envergure a également été mis en place par le FEM pour soutenir les activités rurales contribuant à la conservation de la biodiversité et améliorant les moyens d'existence des communautés riveraines dans le complexe WAP. La gestion transfrontalière du complexe est une expérience permettant de tirer des enseignements très instructifs. Elle mérite d'être soutenue par un financement pour les ressources naturelles, afin de garantir le principal objectif de la gestion – la conservation à long terme de la biodiversité.