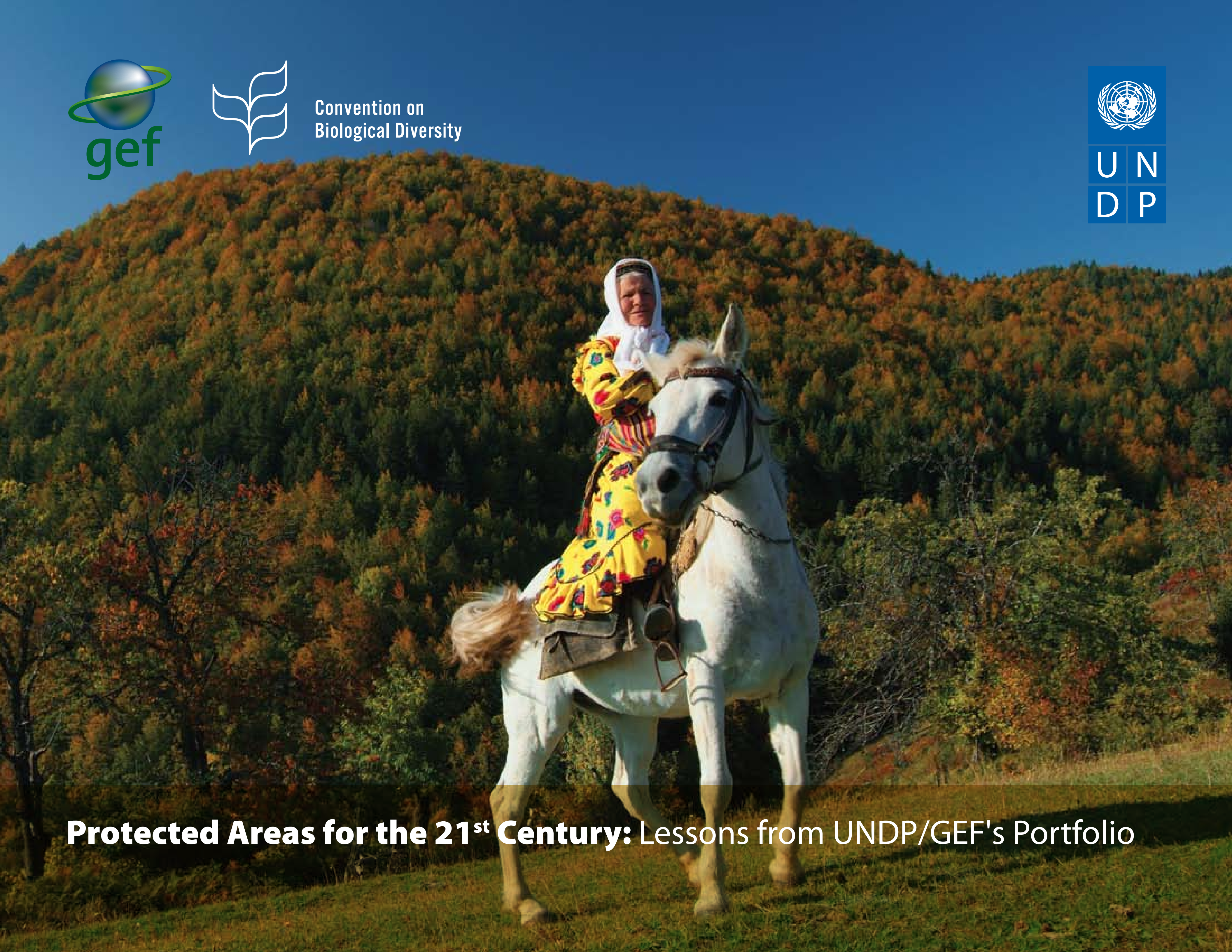

Convention on
Biological Diversity

Protected Areas for the 21st Century: Lessons from UNDP/GEF's Portfolio

A woman collecting fish at sunset in Dili, Timor-Leste © UN Photo/Martine Perret

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Designed by Sandra Rojas

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Biological Diversity

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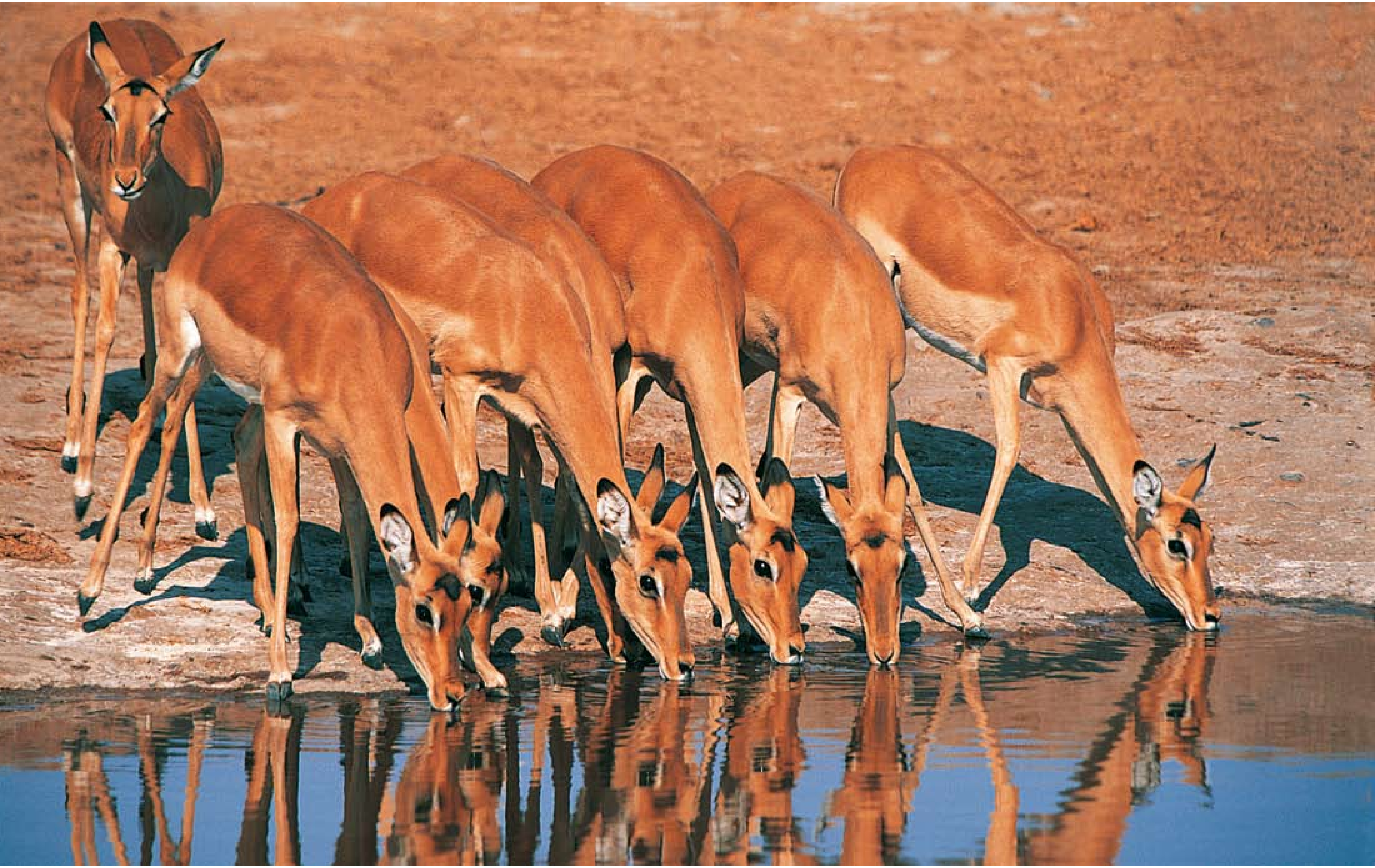
Lessons from UNDP/GEF's Portfolio

Group of Impala Drinking at a Water Hole, Savuti, Botswana, Africa © SRstock



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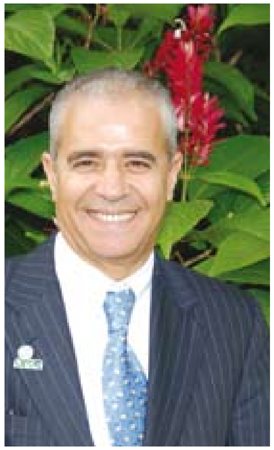
Yannick Glemarec



Ahmed DJoghlaf

Gustavo A. B. da Fonseca

FOREWORD

Close to 80 percent of the world's threatened species owe their poor status to widespread habitat loss. Therefore, the most immediate and effective response to the imminent biodiversity crisis is the strategic expansion in the coverage of protected areas worldwide. Moreover, protected areas provide a range of vital ecosystem services that people everywhere rely upon. For example, 33 out of 105 of the world's largest cities source their clean water from protected areas. The economies of many developing countries depend heavily on tourism revenue associated with protected areas, and governments increasingly consider protected areas to be true engines of local development. Therefore, the establishment of comprehensive, effectively managed and financially secure protected area networks is a critical strategy not only for conserving biodiversity, but for securing ecosystem goods and services, enabling climate change adaptation and mitigation, and helping countries achieve the Millennium Development Goals.

Recognizing the critical role of protected areas in conserving biodiversity and promoting sustainable development, the Parties to the Convention on Biological Diversity (CBD) in February 2004 committed to a comprehensive and specific set of actions called the Programme of Work on Protected Areas. Its goal is to establish comprehensive, ecologically representative and effectively managed networks of terrestrial protected areas by 2010 and of marine protected areas by 2012. The program includes measurable targets and actions with specific timelines and can be considered to be the defining framework or blueprint for protected areas in the coming decades. It is not an exaggeration to claim that the Programme of Work on Protected Areas is the Convention's most successful initiative; since the Convention on Biological Diversity came into force in 1993, the world's protected areas have increased by nearly 60 percent in both numbers and total area. As a result, the concept of protected areas is arguably the most widespread societal franchise worldwide. There are three times as many protected areas as there are McDonald's restaurants and Walmart stores – two icons of the global economy - combined.

While hard data are still scant, there is emerging evidence that the global network of protected areas is responsible, directly and indirectly, for the generation of jobs that rival in number those provided by these companies. Sometimes criticized for presumably preventing people from accessing natural resources, the sheer scale in the global coverage of protected areas is a testimony that the concept, in its many forms, has been embraced by virtually all governments, civil society and local and indigenous communities, all in a relatively short period of time.

The Global Environment Facility (GEF), the operating entity of the financial mechanism of the Convention on Biological Diversity, is widely recognized as the world's leading facility for catalyzing countries to implement their obligations under the CBD Programme of Work on Protected Areas. A key strategic objective of the GEF biodiversity strategy is enhancing the sustainability of protected area systems by a) improving financial sustainability; b) improving protected area coverage, representativeness and connectivity; and c) improving protected area capacity and management effectiveness. The GEF has invested in more than 2,300 protected areas, covering more than 634 million hectares – an area equivalent to Greenland, Mongolia and Kazakhstan combined. The GEF has also provided more than $1.89 billion to fund protected areas, leveraging an additional $4.5 billion in co-financing from project partners. This investment will be further strengthened through the commitment of $700 million specifically for protected areas within the GEF V (2010-2014) funding cycle. In this new cycle, the aim is to enhance the sustainability of protected area systems such that they continue to deliver the global benefits of conserving biodiversity, provide a range of ecosystem goods and services, and enable climate change mitigation and adaptation. But this is not all. During GEF V, a new $250 million window dealing with REDD+ has also become available for eligible countries, which could be used to establish new protected areas that can generate global benefits in biodiversity and help to reduce emissions from deforestation and forest degradation.

UNDP, as one of the implementing agencies of the Global Environmental Facility, is the world's most significant contributor of technical assistance to protected areas. Since the CBD Programme of Work on Protected Areas was ratified in 2004, UNDP has supported more than 700 protected areas in 55 countries, covering nearly every goal, target and action of the Programme of Work on Protected Areas. UNDP has helped to improve protected area management effectiveness across more than 85 million hectares, and to establish new protected areas covering more than 15 million hectares. UNDP's rationale for making such a significant investment in protected areas is simple: protected areas and community conserved areas together represent as much as a quarter of the world's land surface, and this land and sea mass represents an enormous potential to contribute to human development by securing ecosystem services, maintaining the livelihoods of hundreds of millions of people, and buffering humanity from the impacts of climate change.

With this publication we aim to both showcase success stories of UNDP-implemented projects financed by the GEF in supporting the implementation of the CBD Programme of Work on Protected Areas, and to explore emerging best practices under a new paradigm that views protected areas as part of a planetary life-support system. As nations begin to chart a course toward a low-emission and climate-resilient future, they will be looking for ways to find the most efficient and innovative solutions to meet both their social development needs and their biodiversity conservation goals. Protected areas are one of the most efficient and effective strategies available for simultaneously addressing the global challenges of alleviating poverty, adapting to and mitigating climate change, and maintaining key ecosystem services. Although the upfront investments in protected areas are high, the long-term ecological, social and economic dividends are enormous. By taking bold steps and by demonstrating firm political will, the world's leaders and decision makers can ensure that protected areas truly are for the 21st Century. This publication is an attempt to point the way forward.

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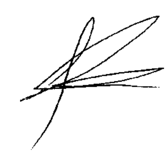

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Cypripedium guttatum in Syktykvarsky reserve, Komi Republic © Adriana Dinu

Introduction

The world's biodiversity – the species, ecosystems and ecological processes that compose the natural world – are of incalculable value to humanity. The world's agricultural systems depend upon biodiversity to sustain genetic plant and animal diversity, to provide pollination services, and to maintain irrigation services.[1] The world's cities depend upon biodiversity to provide clean drinking water to their burgeoning populations.[2] The world's coastal communities, in which one-half to two-thirds of all of humanity resides,[3] depend upon the natural infrastructure of coral reefs, sea grass beds, and mangroves to buffer them from the impacts of climate change, including sea-level rise and increased storm surges. The world's inland communities depend upon the natural infrastructure of healthy forests, grasslands and wetlands to buffer them against increased drought, flooding, disease and natural disasters.[4] While biodiversity provides the fundamental goods and services upon which all life depends, including human societies, it is of particular importance to the 2.7 billion people – more than a quarter of the world's population – who survive on less than $2 a day.[5] As much as 70 percent of the world's poorest people depend critically upon biodiversity to provide them with life's most basic necessities, including food, water, shelter, medicine and their livelihoods, and a sixth of the world's population depends upon the biodiversity within protected areas for their livelihoods.[6,7]

Despite the fundamental importance of biodiversity to human life and social development, the world is facing unprecedented and largely irreversible losses in biodiversity. Current extinction rates are approaching 1,000 times the background rate,[8] and may climb to over 10,000 times the background rate during the next century if present trends in species loss and climate change continue.[9] As many as 70 percent of the world's known species are at risk of extinction by 2100 if global temperatures rise more than 3.5° Celsius.[10] The loss of biodiversity and the resulting destabilization of ecosystem services undermine the very foundations of human welfare – in short, the social costs of biodiversity loss are enormous and immeasurable.

Protected areas are the cornerstone of global biodiversity conservation. Over the past 40 years, governments and non-governmental organizations alike have made unprecedented investments in the establishment of protected areas around the world. As a result, the world's terrestrial protected areas encompassed more than 18 million sq km in 2010, compared with just over 2 million sq km in 1970.[11] As the first decade of the 21st Century comes to a close, emerging drivers of change are transforming our concept of protected areas – what they are and what they should do. Protected areas are expected to do more – in terms of their ecological, social and economic contributions – than ever before. Not only are they expected to provide habitat for endangered wildlife, but also to contribute to livelihoods for local communities, to generate tourism revenues to bolster local and national economies, and to play a key role in mitigation of and adaptation to climate change, among many other diverse functions and contributions.

Purpose and objectives of this publication

The following report looks at how changing 21st Century expectations about the roles and functions of protected areas are beginning to shape protected area management around the world and identifies emerging best practices for protected areas under a new paradigm that views protected areas as part of a planetary life support system.

The report is based on case studies drawn largely from the portfolio of projects financed by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP). The GEF is the world's most significant multilateral funding source for protected areas. Since the Convention on Biological Diversity's Programme of Work on Protected Areas was ratified in 2004, UNDP/GEF has supported work in more than 700 protected areas around the world, covering nearly every goal, target and action under the Programme of Work.

Following this introductory section, which presents background on historical and evolving concepts of protected areas and their roles, the report is organized according to eight key themes that are shaping protected areas management in the 21st Century. These themes range from enabling policy environments to management planning, governance, participation, and sustainable finance, to name but a few. For each of the eight themes, the report presents a snapshot of the current status of implementation, a set of emerging best practices, and one or more case studies that illustrate innovative and successful approaches.

History of protected areas: classic, modern and emerging models

The concept of protected areas has existed for at least several thousand years in the form of private and communal game reserves and spiritual areas, including, for example, royal decrees in South Asia, sacred groves in Africa, and restricted "taboo" areas in the Pacific, to name a few.[12,13] Modern protected areas in the form of national parks, however, only began in the mid-1800s. Since then, the concept of protected areas has evolved significantly, reflecting the norms, attitudes and values of each passing era. The evolution of societal views toward protected areas over the past 150 years can be characterized by three distinct models: the classic model, the modern model, and an emerging, post-2010 model (see Table 1).

In the classic model, protected areas were generally viewed as existing independently from their surrounding landscape and seascape. Instead of being considered as part of an integrated and comprehensive land-use plan, protected areas were often viewed as isolated "jewels in the crown," developed in an ad hoc manner, and located in areas with low economic and ecological value.[14] Until the 1970s, societal benefits were mostly viewed as incompatible with protected area objectives, and attempts to steer protected areas toward

Woman holding grain in Madagascar © UN Photo/Lucien Rajaonina

delivering social and economic benefits were largely viewed as compromising biodiversity conservation objectives. Protected areas were primarily a government-driven enterprise – owned and managed by national and sub-national governments, maintained and managed by government staff, and funded through tax dollars and annual government allocations.

As a "modern" model of protected areas began to emerge in the 1970s, major themes in protected areas – management effectiveness, protected area network design, governance and sustainable finance – began to reflect a changing view of protected areas. In this modern model, planners began to acknowledge the importance of local communities, recognize governance models beyond government-run national parks, and address the need for more systematically and comprehensively designed protected area networks. Protected areas began to be viewed more as social enterprises and managed with the needs of local communities in mind, often in partnership with social scientists and local communities. They began to be funded by many partners, including non-governmental organizations, and new forms of protected areas – such as community-conserved areas – were created and/or recognized. The drivers of change behind the modern model of protected areas included increased scientific sophistication and understanding, a heightened awareness of human rights, including through international conventions such as the Declaration on the Rights of Indigenous Peoples, a greater move toward democratization and the role of civil society, and technological advances such as geographical information systems (GIS), remotely sensed data, and spatial modeling tools.[15]

Table 1: Classic, modern and emerging models of protected areas[16]

	CLASSIC MODEL (MID-1800s – 1970s)	MODERN MODEL (1970s – MID-2000s)	EMERGING MODEL (MID-2000s AND BEYOND)
Rationale for establishing protected areas	"Set aside" from productive use	Concurrent social, ecological and economic objectives	Strategy to maintain critical life support systems
Purpose of protected areas	Established primarily for scenic values rather than functional values	Established for scientific, economic and cultural reasons	Established to support ecosystem services, and promote climate change adaptation, resilience and mitigation
Management purpose	Managed mostly for park visitors	Managed with local people in mind	Managed for social, economic and ecological values, with an emphasis on maintaining ecosystem services
Role of wilderness in protected areas management	Emphasis on intrinsic value of wilderness	Emphasis on ecological and cultural importance of wilderness and large, intact areas	Emphasis on protection of intact areas and restoration of degraded areas to maintain ecosystem functioning
Management actors	Managed by central government	Managed by central government and by local communities	Managed by many partners with many governance models
Financing of protected areas	Protected areas are financed by a central government (e.g., through annual budget allocations)	Protected areas are financed by many partners (e.g., bilateral donors, foundations, NGOs)	Protected areas are financed by mainstreaming protected areas into national and local economies and through innovative finance mechanisms
Planning	Excludes local people	Conducted with, for and sometimes by local people	Conducted with, for and by many different stakeholders from many different sectors
Connection of protected areas with surrounding landscape and human uses	Viewed as islands, isolated from the surrounding landscape, seascape and human uses	Viewed as part of a comprehensive ecological network	Viewed as integral part of national economies and sectoral plans, including land-use, climate adaptation, energy, social development, disaster mitigation, transportation and infrastructure plans
Asset value of protected areas	Viewed as national assets	Viewed as a valuable community asset and global concern	Viewed as ecologically, socially and economically valuable at all levels
Management planning horizon	Managed by natural scientists over short-term planning horizons	Managed by natural and social scientists over medium-term planning horizons	Managed by multi-disciplinary professionals over long-term planning horizons

Protected areas are increasingly viewed as a critical component of a life support system, and they are expected to do more – ecologically, socially and economically – than they ever have before.

Drivers of change

In the 6 years since the Convention on Biological Diversity's (CBD) Programme of Work on Protected Areas was established in 2004, a new set of drivers of change has emerged, promising to again transform societal notions of what protected areas are and what they should do.

» ***Climate change.*** First, climate change has become a major priority on the global environmental and development policy agenda. The issue of climate change adaptation and mitigation now pervades nearly all biodiversity conservation discourse, including the discourse on protected areas. Funding priorities have also shifted, and climate change mitigation and adaptation efforts are receiving substantial amounts of funding, while the gap between protected area needs and protected area financing continues to grow.

» ***Millennium Development Goals.*** The second major driver of change has been the growing commitment of governments to achieve the Millennium Development Goals. This set of eight global goals aims to end poverty and hunger, provide universal education and gender equality, improve maternal and child health, combat HIV/AIDS, achieve environmental sustainability and promote global partnerships. As these goals have risen in prominence, so too have the trade-offs in many countries between securing the long-term health and wellbeing of their poorest populations, and securing the long-term protection of biodiversity.[17] For a very large number of developing countries, the predominant national agenda is to improve the livelihood and welfare of their citizens; environmental concerns are viewed as secondary. Reversing the loss of biodiversity has been an explicit part of the Millennium Development Goals agenda since 2006. The loss of provisioning resources, such as food, has exacerbated poverty and hunger around the world. The degradation of regulating services that ecosystems provide has affected the health of millions. Supporting services have also been reduced as farmlands have become overexploited. Therefore, the loss of biodiversity is increasingly regarded as a major barrier to fulfilling the Millennium Development Goals.

» ***Finite natural resources.*** The third major driver has been a growing recognition that the earth's natural resources are truly finite. The recent and ongoing fisheries crashes around the globe are one of the clearest signs that we have passed certain ecological thresholds and tipping points – a situation in which an ecosystem experiences a shift to a new state, often with significant reductions to biodiversity

and associated services.[18] A recent UN report,[19] for example, estimates that unless there are dramatic changes in fisheries practices, there will likely be a global fisheries collapse by 2050. We are currently consuming more resources than the earth can sustainably provide – in cities we are consuming as much as 10 times the earth's carrying capacity.[20] The result is that humans are passing critical thresholds, leading to the unraveling of basic ecosystem services and functioning. A recent study found, for example, that three of nine "planetary life support systems" have already been exceeded, and several others are fast reaching their limits.[21]

» ***Value of ecosystems and their services.*** The fourth major driver is governments' increasing awareness of, and appreciation for, the value of ecosystems, and the value of protected areas in maintaining economically significant ecosystem services, particularly the provisioning of municipal and agricultural water. A recent publication, for example, found that more than a third of the world's largest countries rely upon protected areas for their drinking water.[22] More recently at an intergovernmental meeting,[23] the world's governments recognized the "benefits of protected areas to national and sub-national economies, public health, maintenance of cultural values, sustainable development and climate change adaptation and mitigation" among other benefits, and they renewed their commitment to assessing the full range of benefits of protected areas. As a result of increased governmental awareness, the valuation of ecosystem services is beginning to affect national resource use policies and decision making.[24]

» ***Global financial crisis.*** The fifth major driver has been an unanticipated global financial crisis that has pervaded the financial decisions of nearly all nations since late 2008. As of late 2010, even as economies slowly recover, the period of economic fluctuation, turmoil and uncertainty is most probably far from over, and will continue to influence global, regional, national and local financial decisions, including for biodiversity conservation, for many years to come. As a result of this crisis, governments are forced to make difficult trade-offs, pitting investments in biodiversity conservation against investments in economic recovery.[25] For example, a recent study across Europe, the Caucasus and Central Asia found that the global financial crisis is limiting the ability of a significant number of countries in the region to achieve the Millennium Development Goals, and has resulted in all of the pan-European economies falling short in terms of achieving Goal 7, environmental sustainability, especially compared with the other goals.[26]

Taymir plateau, Russian Arctic © Adriana Dinu

Emerging, post-2010 model of protected areas

Taken together, these five drivers of change have again transformed the concept of protected areas, leading to an emerging, post-2010 model of protected areas. In this model, protected areas are viewed as a critical component of a life support system, and they are expected to do more – in terms of their ecological, social and economic contributions – than they ever have before. Protected areas are expected to do more ecologically not only by providing habitats and refugia for species, but also by enabling humans and wildlife to adapt to the impacts of climate change, by securing the ecosystem services upon which humanity depends, and by mitigating climate change through the storage and sequestration of carbon. They are expected to do more socially not only by sustaining communities in and around their boundaries, but also by significantly contributing to the aims of the Millennium Development Goals, and by buffering humanity from the impacts of climate change. They are also expected to do more economically not only by generating revenue to sustain their own operation, but also by bolstering local and national economies through tourism; the supply of minor forest products, fish and other resources; and the provision of ecosystem services such as the regulation of water supplies.

The CBD's Programme of Work on Protected Areas reflects many elements from both the "modern model" of protected areas, including an emphasis on indigenous and local communities, and from the "emerging model" of protected areas, including an emphasis on restoration and managing for climate change (see Table 2).

Table 2: Summary of the Convention on Biological Diversity's Programme of Work on Protected Areas[27]

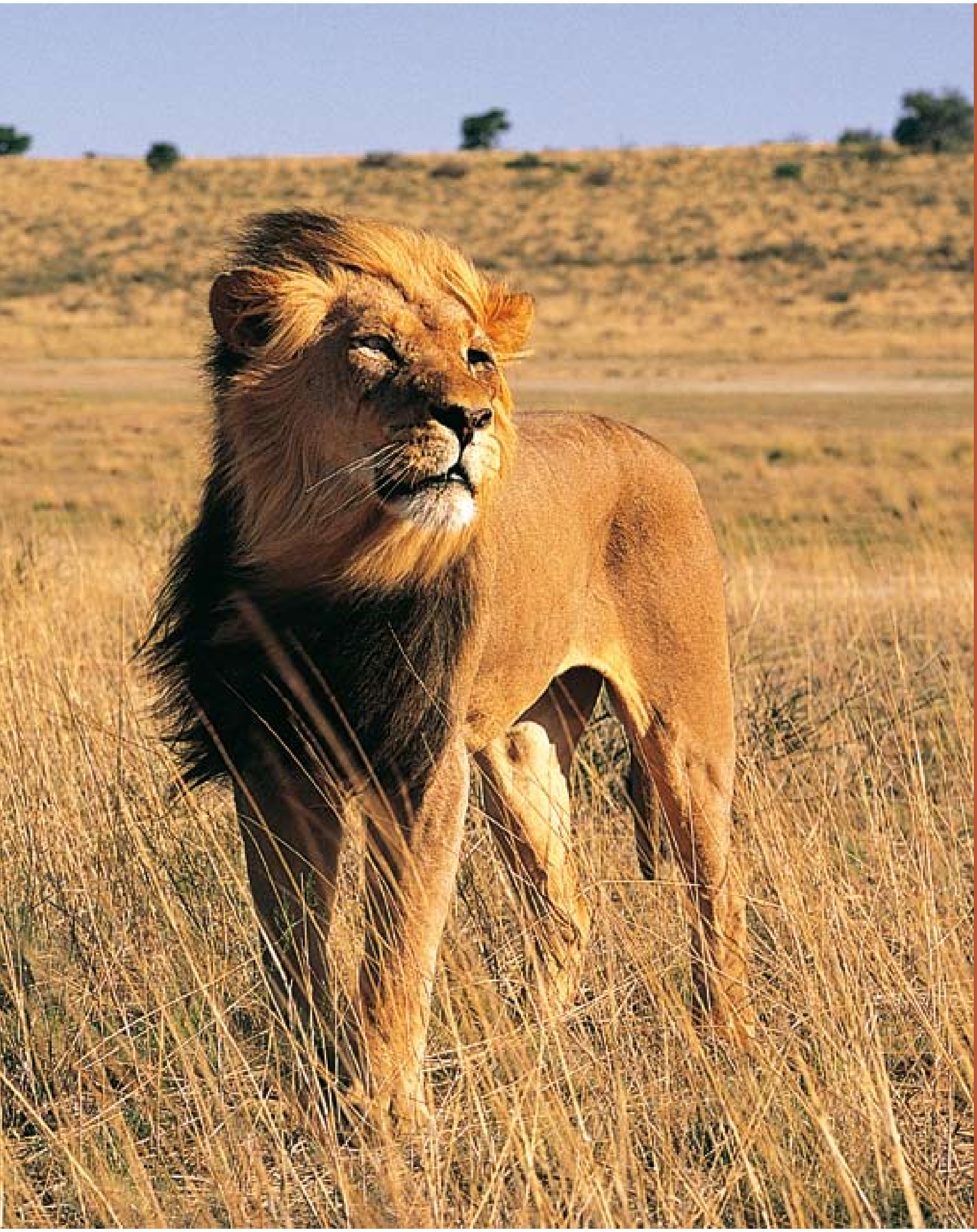
ELEMENT 1: STRENGTHENING PROTECTED AREA SITES AND SYSTEMS	ELEMENT 2: GOVERNANCE, PARTICIPATION, EQUITY AND BENEFIT SHARING	ELEMENT 3: ENABLING ACTIVITIES	ELEMENT 4: STANDARDS, ASSESSMENTS AND MONITORING
» Protected area networks and gap assessments » Protected area integration into landscapes, seascapes and sectors » Transboundary protected areas and regional networks » Management planning, including managing for climate change adaptation » Threat assessment, mitigation and restoration	» Governance, equity and benefit sharing » Participation of indigenous and local communities	» Enabling policies, institutions and socio-economic environments » Protected area capacity » Appropriate technology » Sustainable finance » Communication, education and public awareness	» Minimum standards and best practices » Management effectiveness » Monitoring of status and trends » Science and research

The way forward

The linkages between comprehensive, resilient, effectively managed, and economically secure protected areas on the one hand, and the economic and social wellbeing of countries, communities and individuals on the other hand, are undisputed. Biodiversity sustains the ecosystems that sustain human life. As biodiversity continues to be lost and ecosystems continue to unravel, the ability of communities and nations to provide basic societal needs has become compromised.

As nations begin to chart a course toward creating a low-emission and climate-resilient future, they will be looking for ways to find the most efficient and innovative solutions to meet both their social development needs and their biodiversity conservation goals. This publication is an attempt to point the way forward.

Lion, Kgalagadi National Park ,South Africa © SRstock



Theme 1

Enabling Policy Environment for Protected Areas

Overview

Protected areas do not exist in isolation: they exist within a specific legal and policy context, often called the "enabling policy environment." This enabling environment includes the suite of policies, laws, legal frameworks, incentives and other mechanisms that either encourage or inhibit the establishment and effective management of protected areas. This section addresses three issues related to the enabling policy environment for protected areas: a) policies, incentives and legal frameworks; b) the assessment of protected area values and their contribution to local and national economies; and c) the integration of protected areas into sectoral plans and strategies.

Protected area laws, policies, incentives and legal frameworks

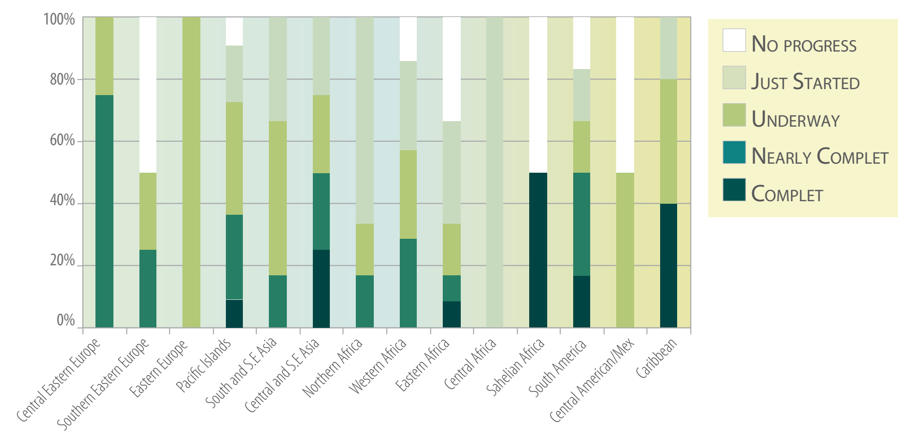
Introduction and analysis

In all countries, laws, policies, incentives and legal frameworks affect the establishment, management and effectiveness of protected areas. These issues are related to Goal 3.1 of the Programme of Work on Protected Areas, which states that governments should provide an enabling policy, institutional and socio-economic environment for protected areas. Specific activities of this goal include:

- Identifying legislative and institutional gaps and barriers
- Conducting assessments of the contributions of protected areas
- Harmonizing sectoral policies and laws
- Considering principles of good governance
- Identifying and removing perverse incentives
- Identifying and establishing positive incentives
- Adopting legal frameworks for establishing and managing protected area systems
- Developing incentives to support the full range of protected areas, including private protected areas
- Identifying and fostering mechanisms for funding protected areas through ecosystem services
- Developing mechanisms for achieving institutional and financial sustainability
- Cooperating with neighboring countries to establish an enabling environment for transboundary protected area

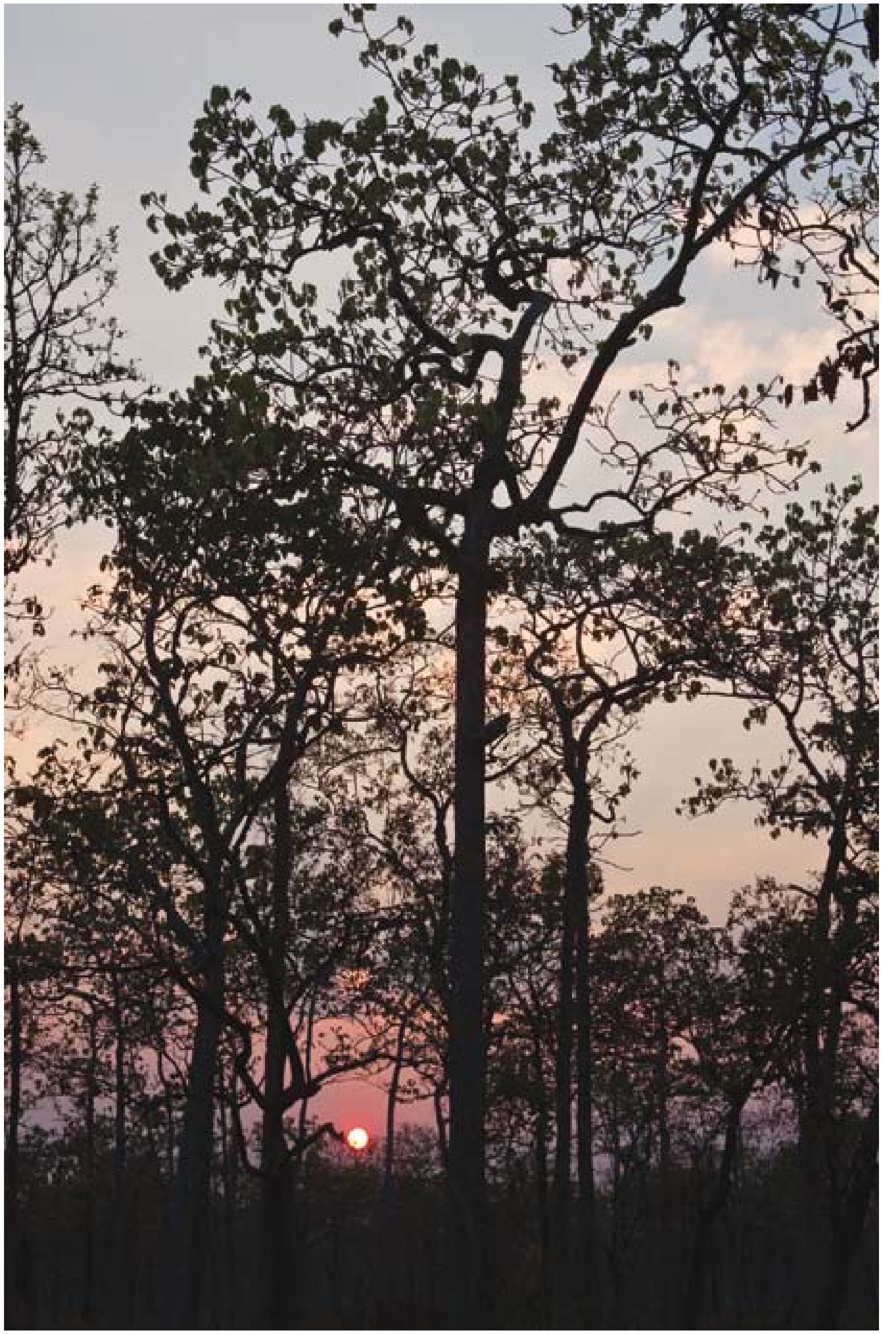
A number of countries have made significant progress in assessing their protected area policy environment; see Figure 1 for a snapshot of global progress. For the most part, these efforts have focused on the development of mechanisms that remove legal and financial barriers, provide financial incentives, and remove perverse incentives for establishing new protected areas.

Figure 1: Summary of global progress on assessing protected area policy environment[28]



As the global agenda for protected areas evolves and changes, so too must the policies that guide the establishment, planning, resource use and management of protected areas – they must be created or modified in order to meet these changing expectations. In particular, protected area policies will need to be adapted in order to better contribute to climate change risk management, both in terms of mitigating emissions and contributing to adaptation, to sustain ecosystem services and to generate sustainable livelihoods. These issues are explored in the best practices and case studies described below.

Sunset in Preah Protected Forest © Eleanor Briggs



Best Practice1: Create a supportive policy environment to promote climate change mitigation, adaptation and resilience and to maintain ecosystem services within protected areas

One of the most vexing challenges and pervasive weaknesses in protected area management is the lack of integration among protected area agencies, natural resource sectors, ministries and divisions.[29] As a result, resource policies are rarely coordinated, and in many cases may actually conflict with one another. In a number of countries, for example, the forestry agency manages the forests within protected areas, while the protected area agency manages the wildlife, resulting in uncoordinated planning and inter-agency conflict.

In order to ensure a supportive protected area policy environment that contributes to climate change mitigation, adaptation and resilience and that maintains key ecosystem services, planners will need to improve a range of policies, as well as improve the integration and coordination between these policies, across many sectors. Table 3 highlights examples of policy actions that will be needed in order to improve the overall policy environment for climate change and ecosystem services.

Table 3: Examples of policies needed to strengthen sectoral policies for climate change mitigation, adaptation and resilience

	SAMPLE POLICIES
Invasive species	» Develop national and local policies for the detection, control and eradication of invasive species within and around protected areas, with particular emphasis on policies that incorporate likely shifts in the range, distribution and intensity of invasive species under climate scenarios, and prioritize efforts to control invasive species where they are likely to increase under climate change scenarios.[30]
Private protected areas and other conserved areas	» Develop policies that provide positive incentives, and remove perverse incentives, for the establishment of private protected areas and other conserved areas, with particular emphasis on creating these areas in places important for climate adaptation and resilience, such as areas of climate refugia.[31]
Land use planning	» Develop national, regional and local land use plans that fully incorporate protected areas as an integrated strategy for mitigating and adapting to the effects of climate change and strengthen overall landscape resilience.[32]
Natural resource management	» Develop forest management policies that maintain overall forest health and integrity within and around protected areas (e.g., by mimicking natural disturbance regimes, minimizing negative synergies with other threats such as invasive species) particularly for those species and ecosystems that will face increased climate impacts.[33] » Develop policies that maintain corridors and connectivity between protected areas, particularly in places important for climate-related species shifts. » Develop policies for grazing and grassland management within, around and between protected areas to ensure the long-term ecological health of the grasslands, and to avoid conditions of over-grazing that can lead to regime shifts under climate scenarios.[34] » Develop policies for managing peat lands within and around protected areas that avoid the drainage of peat lands, to prevent the switch of such areas from carbon sinks to carbon sources.[35]
Marine and coastal management	» Develop fisheries policies that maintain the overall health and integrity of fish populations within marine protected areas (e.g., clearly identify and protect areas, such as mangroves, spawning areas, coral reefs and upwellings, that are important for the life cycle stages of a variety of fish species, such as larval dispersal) in order to promote overall resilience to climate impacts.[36] » Develop policies that identify and protect areas important for providing natural buffers to increased storm surges, such as seagrass beds and coral reefs.
Freshwater management	» Coordinate water use policies between municipalities, power companies, protected area agencies and other users to ensure that water policies promote water use that is sustainable and will adequately meet users' needs while still maintaining hydrological regimes under projected climate change scenarios. » Develop policies that create payments for ecosystem services within protected areas, such as payments to private forest owners to maintain forest cover within private protected areas in order to ensure water supplies.[37] » Develop safeguards that protect native freshwater fish populations within and around protected areas from the intensification of fish farming (e.g., increased parasites and cross-breeding from fish farming)[38] and other social responses to climate change and biodiversity loss.
Infrastructure, transportation and energy	» Develop policies for infrastructure, transportation and energy that maintain the overall integrity and climate resilience of protected areas by minimizing fragmentation, strengthening environmental safeguards, avoiding areas important for climate adaptation, and ensuring the maintenance of key ecosystem services, such as maintaining water quality and quantity. » Develop policies that encourage biodiversity offsets for transportation and energy infrastructure, and create frameworks that encourage such offsets to promote climate adaptation and to maintain ecosystem services.[39]

Pelister National Park, FYR Macedonia © UNDP Photo library

Case Study: Strengthening the protected area system of the Former Yugoslav Republic of Macedonia by strengthening the policy environment

Through a UNDP/GEF project entitled *Strengthening the Ecological Institutional and Financial Sustainability of Macedonia's National Protected Areas System*[40] the Government of Macedonia is creating an enabling policy environment for protected area establishment and management. The project aims to strengthen national regulations and policies that will enable the country to fully implement the Convention on Biological Diversity's Programme of Work on Protected Areas. The project includes a focus on climate change adaptation, and identifies important climate "refugial zones" including Tair Gorge, Treska River Gorge, Crna River, Jama, Mavrovo-Radika, Pelister, Ohrid-Prespa and Nidze-Kozhuf, that should be protected in order to strengthen adaptive resilience to climate change. The project is also creating payments for ecosystem services as a means of improving participation and tapping into the value of protected areas, and the project has resulted in the inclusion of an article on payments for environmental services as a draft amendment in the national Law on Nature Protection.

Best Practice 2: Create a supportive policy environment to sustain livelihoods within and around protected areas

Protected areas can play an important part in reducing poverty and sustaining livelihoods,[41,42,43] provided there is a supportive and enabling policy environment. If protected area planners and policy makers are to fully consider how protected areas can sustain livelihoods and reduce poverty, they will likely need to develop and/or improve a new set of policies, including those listed below.

- **Develop policies for the sustainable use of resources to promote livelihoods:** In many protected areas around the world, the use of natural resources is allowed, but there are no policies delineating sustainable levels of use. The progress made by third-party certification and accreditation bodies in developing standards and criteria for resource use[44] could be valuable to planners and policy makers as they grapple with developing policies and guidelines for the use of natural resources within protected areas. In some cases, protected area managers may want to use independent third-party certification bodies within their protected areas to ensure that they are following best practices. Certification may also be an important option in community forests and community-run concessions, such as the Maya Biosphere Reserve in Guatemala,[45] where management authority tends to be more diffuse and complex than in government-run protected areas.
- **Develop tourism guidelines:** Tourism is one of the most widely recognized economic benefits of protected areas, and is a major source of jobs and livelihoods for those living in and around protected areas. However, balancing tourism and associated livelihoods with the protection of biodiversity will require policies that create clear standards and outline best practices. Planners should consider adopting some of the best practices and guidance in existing literature[46,47] in order to ensure the long-term sustainability of tour-

ism operations and to ensure that communities benefit equitably from tourism operations.

- **Develop safeguards and thresholds:** In developing alternatives for sustaining livelihoods, one of the most important steps is to develop safeguards and thresholds that balance the need for biodiversity conservation with the needs for economic development. Having thresholds and safeguards is considered a fundamental best practice in conservation and financial planning.[48,49] Thresholds delineate where resource use begins to degrade or compromise an ecosystem beyond acceptable levels, and safeguards are mechanisms that ensure that these levels are not passed, or if they are passed, that they are quickly addressed. Safeguards and thresholds can also reduce conflicts over the use of protected area resources. While some guidelines already exist for developing safeguards and identifying thresholds of sustainability within certain sectors, such as tourism,[50] protected area planners should proactively develop such guidelines for other sectors. More importantly, guidelines, thresholds and safeguards should be fully embedded within protected area policies and annual plans.
- **Develop policies for equitable sharing of benefits of livelihood-related resources:** A fundamental precept of the Programme of Work on Protected Areas, and of the Convention on Biological Diversity itself, is the equitable sharing of the benefits of protected areas. When considering options for increasing sustainable livelihoods, protected area planners must also consider the distribution of such benefits. In many protected areas there is significant variation in the extent to which households depend upon and benefit from protected areas,[51] and policies that provide access may not equitably benefit poor households.[52,53] Therefore, planners must develop policies that ensure equitable access to the protected area resources that can sustain livelihoods and reduce poverty, including policies that address issues related to bio-prospecting, commercial research, and revenue-sharing from commercial operations within the protected area.[54]

Honey and silk market, Kenya © Suresh K. Raina

Case Study: Commercializing insects in Kenya's protected areas

The UNDP/GEF project *Developing Incentives for Community Participation in Forest Conservation Through the Use of Commercial Insects in Kenya*[55] aims to demonstrate in three forest sites that the biodiversity of Kenya's forest protected area system can be maintained through collaborative management systems using incentives based on income from commercial insects. The project focuses on strengthening institutions and raising awareness in order to improve decision making at local, district and central levels. The project is also aimed at improving policies for buffer zone management, involving the local village forest association, and developing marketing support for the sale of silk and honey products at all three sites in order to secure local livelihoods.

Nuratau Reserve, Uzbekistan © Adriana Dinu

Case Study: Changing policies to sustain local livelihoods in Nuratau – Kyzylkum Biosphere Reserve, Uzbekistan

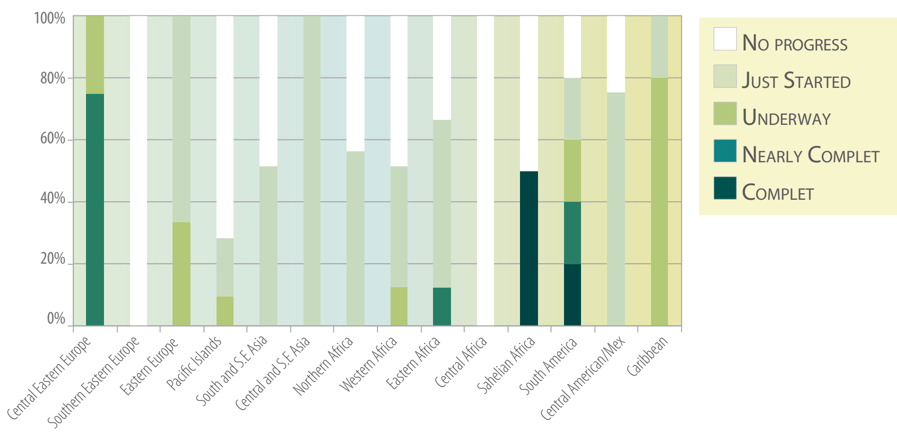
The UNDP/GEF project *Establishment of the Nuratau-Kyzylkum Biosphere Reserve as a Model for Biodiversity Conservation* [56] is a project aimed at improving the long-term sustainable development of the area through the establishment of an integrated conservation and development program, based on local traditions and capacities. The project has changed the policy environment within the proposed Nuratau- Kyzylkum Biosphere Reserve by focusing on two main policy changes. The first was a change in the timeline of the agreements between land users and the forestry department – the agreements changed from 1-year agreements to 5-year agreements, and then to indefinite agreements, to promote long-term tenure, access and security. The second change was from a scheme where land users paid 70 percent of the harvest to the forestry department, to a scheme where they only paid 50 percent. The project also supported local communities to improve land productivity on abandoned land which had been cultivated by their ancestors, including 20 hectares (ha) of desert land where it supported the plantation of 10,000 local saxaul trees (*Haloxylon*) and 42 ha of mountain land where it supported the plantation of about 2,500 fruit seedlings of peach, apple, apricot, pear, walnut and other fruit trees. Because these actions were embedded within an enabling policy environment, the project will sustain local livelihoods into the future.

Assessing protected area values and benefits

Overview and analysis

Assessments of protected area values and benefits, and their contribution to national economies, are not nearly as widespread as national assessments of laws, policies and legal frameworks. Although protected area valuation is explicitly included in the Programme of Work on Protected Areas, only a handful of countries have completed an assessment of protected area values and their contribution to local and national economies (see Figure 2).

FIGURE 2: SUMMARY OF GLOBAL PROGRESS ON ASSESSING PROTECTED AREA VALUES[57]



In the relatively few cases where they have been completed, protected area valuation assessments have primarily focused on identifying direct protected area benefits with clear monetary implications, such as municipal drinking water, tourism, fisheries and material goods.[58] Few valuation studies have explicitly incorporated aspects related to the less tangible and quantifiable, but no less critical, benefits of protected areas, including food security, human health, natural disaster mitigation, carbon sequestration, national security, water security and poverty reduction.

Best Practice 3: Incorporate climate, livelihoods and ecosystem services issues into protected area valuation studies

Planners who conduct protected area valuation studies should consider incorporating issues related to climate change, ecosystem services and sustainable livelihoods as integral components of their assessments. These additional values will serve to strengthen the case that protected areas provide an array of values that fulfill broader societal objectives beyond biodiversity conservation. Table 4 shows some examples of issues that planners might include in their protected area valuation studies.

As the global agenda for protected areas evolves and changes, so too must the policies that guide protected area planning, management and funding.

Table 4: Key climate, poverty and ecosystem services issues to consider in protected area valuation assessments

PROTECTED AREA BENEFIT	DESCRIPTION AND RATIONALE
Food security	Food security, defined as the ability of a country to produce and/or secure food sufficient for its population, includes a range of factors, many of which depend upon intact, functioning protected areas. Some of these include: securing centers of crop genetic diversity; preserving traditional knowledge on agricultural practices for resilience, such as drought-resistance varieties; and protecting and conserving key pollinators.[59]
Human health	Protected areas have a huge role to play in securing human health benefits, including the provisioning of clean drinking water, the maintenance of medicinal plants, and the prevention of various diseases.[60] At the same time, climate change is likely to have an adverse impact on human health by increasing vector-borne infectious diseases such as malaria and dengue fever, and food-borne pathogens such as Salmonella, which thrive under warmer conditions.[61] Protected area valuation studies should explore the role of protected areas in securing positive human health benefits and buffering against the adverse human health effects that are likely to increase under climate change scenarios.
Natural disaster mitigation and reduction	Disaster mitigation, defined as the ability of a country to predict, prevent and mitigate the impacts of natural disasters, includes disasters that are likely to be aggravated by climate change, such as increased frequency of flooding and erosion, and increased storms with higher coastal storm surges. Protected areas can play a key role in reducing and mitigating such disasters,[62] and protected area valuation assessments should consider these benefits.
Carbon sequestration	There have been numerous studies highlighting the overlap between protected areas and areas important for carbon sequestration.[63,64] A study in Brazil, for example found that if all protected areas in the Amazon were effectively managed, they would together avoid about eight billion tons of carbon emissions by 2050.[65] As the economic value of carbon sequestration becomes increasingly recognized and quantified in the global marketplace, the value of protected areas as carbon "sinks" is expected to rise substantially, and protected area valuation studies that do not consider these values will increasingly be viewed as incomplete.
REDD and REDD+ funding	As REDD (reducing emissions from deforestation and degradation) schemes develop and mature, the value of protected areas as a means to secure funding through REDD and REDD+ mechanisms is also likely to increase. A valuation study of protected areas in Cambodia, for example, recommended REDD as a possible funding mechanism, and several authors have suggested that REDD+ mechanisms could provide a substantial economic value to protected areas,[66] provided that there are suitable mechanisms in place to ensure effective protected area management practices.[67]
National security from climate-related risks	Issues related to national security from climate-related risks may include, for example, heat waves, heavy precipitation and flooding, droughts and increased intensity and frequency of tropical cyclone activity. In addition, countries will likely face increased conflict over water in drought-prone regions.[68] Although it may be difficult to place a monetary value on these issues, valuation studies should explore the role of protected areas in providing national security benefits from climate-related risks.[69]
Water security	Water security is the ability of a country to secure an adequate quantity of suitable quality to meet the needs for drinking water, irrigation, hydropower and other water-related needs. Although water security is already typically included in protected area valuation, the increase in this benefit under climate scenarios is generally not included. Planners should consider how the value that protected areas provide in securing water quality and quantity will increase over time, especially in drought-prone areas.[70]

Poverty reduction	Protected areas have a fundamental role to play in reducing poverty and sustaining local livelihoods for populations living in and around protected areas. A recent report explored how protected areas can influence several dimensions of poverty, including subsistence, economic, cultural, ecosystem services and political governance, and cited cases from more than 30 countries where protected areas significantly reduced poverty in local communities.[71] Similar authors also propose that valuation studies include the full range of costs and benefits for local livelihoods.[72,73] Planners conducting valuation studies, therefore, should look beyond just incomes, and consider how protected areas address the various dimensions of poverty.

In order to fully consider climate, ecosystem services and livelihood issues in their valuation studies, protected area planners will first need to identify a suite of indicators that will allow them to measure the contribution of these benefits in economic terms, and to compare these values with other types of land uses. Yet developing indicators to quantify food security, human health, sustainable livelihoods, disaster risk reduction, and climate change adaptation can be difficult; quantifying indirect benefits is a common challenge in protected area valuation.[74] Planners may need to consider creative and proxy indicators that help them quantify these benefits, and that help them make the case to policy makers regarding the full benefits of protected areas. Table 5 provides some examples of indicators that could be used to demonstrate the many values of protected areas.

The world's biodiversity - the species, ecosystems and ecological processes that compose the natural world - are of incalculable value to humanity.

Table 5: Sample indicators for climate, ecosystem services and livelihood issues in protected area valuation studies

THEME	SAMPLE INDICATOR
Food security	Number and percentage of households using food sources from the protected area List and importance of food resources used from protected areas in the local diet Calculation of average protein intake per person from food resources from protected area
Health	List of the types and uses of medicinal plants from the protected area Number and percentage of people who regularly use medicinal plants from the protected area Equivalence in US$ from the use of medicinal plants as alternative medicine
Fisheries, coral reefs, and other marine resources	Total amount in US$ generated by fisheries List of species and volume of annual catch Number and percentage of households dependant on fish for their diets Number of people employed by fisheries Average household income from fishing Contribution of coral reefs and mangroves to local fisheries
Disaster mitigation and prevention	Hectares of avoided erosion processes from maintaining vegetation cover in protected areas Populations within communities that mangroves and coral reefs will protect from storm surges Estimated regulation of floods based on floodplain protection and vegetative cover
Water resources	Volume of water (in cubic meters per second) contributed by sources originating in protected areas Population using drinking water from sources originating from the protected area Hectares irrigated with water from sources that originate from the protected area Energy (in megawatts) generated by water sources that originate from the protected area Sediments (in tons) avoided from protected area vegetation, and estimated cost of cleaning avoided
Income, employment, subsistence, tourism and poverty alleviation	Total number of types of protected area products and their volumes used by local households Total number of households dependent upon protected area products Average income in USD$ per household from protected area products Total income in US$ from sustainable use of biodiversity products Contribution (in US$) of protected area-based tourism to gross domestic product Number of jobs and household income in US$ from protected area-based tourism Amount of income in US$ from protected area entrance fees Amount of US$ from fees (e.g., copyrights, research, concession, payments for ecosystem services) Average amount in US$ spent per protected area tourist per day in surrounding areas Number of people employed in protected area-related activities (e.g., concessions, park staff)
Carbon and climate change	Amount and value (in US$) of megatons of carbon stored (Mt CO_2) in forest protected areas Deforestation rates in protected areas compared with other areas outside of protected zone Amount in US$ generated by existing and potential carbon funding

Women fuelwood carriers in Jelo-Muktar Forest, West Hararge © Alexander Horst

Case Study: Revealing the primary values of Ethiopia's protected areas

The UNDP/GEF project *Sustainable Development of the Protected Area System of Ethiopia*[75] is a project aimed at improving the conservation and management of Ethiopia's protected areas in two ways – by strengthening national and regional management capacity and coordination, and by developing a protected areas system plan. As part of this system plan, the project commissioned an economic assessment of the contribution of Ethiopia's protected area system to the economy.[76] The assessment found that the main values of protected areas are the environmental services they provide to poor rural communities, many of whom do not have food security. It calculated the value of select environmental services (e.g. US$ 13 million for medicinal plants, US$ 432 million for hydrological services and potentially US$ 266 million for water quality control services), which dwarf recreational use values (current park entrance fees amounted to just US$ 19,000 in the year 2008 to 2009). Overall, the results clearly show that the economic value of protected areas is of immense benefit to the sustainable development of the Ethiopian economy and plays a significant role in the fight against poverty. The results of the report are being incorporated into Ethiopia's national poverty strategy, which sets the development priorities that guide government and donor funding flows.

Integration of protected areas into sectoral plans and strategies

Overview and analysis

One of the actions within the Programme of Work on Protected Areas is integrating protected areas into broader sectors. A recent guide on integrating protected areas into the wider landscape, seascape and sectoral plans and policies[77] identifies a range of sectors into which protected areas can and should be integrated, including land-use planning, transportation, energy, tourism, wildlife, agriculture, grazing, forestry, fisheries, freshwater, waste, invasive species, and climate change. Two examples of integrating protected areas into related sectors – climate change adaptation and food security – are explored below.

↘Best practice 4: Integrate protected areas into National Adaptation Programmes of Action and other national climate plans

Most countries around the world have developed or are developing national plans and strategies to adapt to climate change. However, the vast majority of the plans and strategies developed to date do not adequately incorporate protected areas as one of the strategies to adapt to climate change. For example, out of 434 actions within 47 recent National Adaptation Progammes of Action (NAPAs), ecosystem-based approaches accounted for only about a quarter, and protected areas were explicitly cited in only 8 percent of all strategies, representing only 4 percent of the total budget of all actions.[78]

Similarly, protected areas are rarely included in other climate-related plans and strategies, even though they have a potentially huge role to play in buffering society from the impacts of climate change, in sequestering carbon, and in reducing carbon emissions.[79] Strategies based on ecosystem management in general, and on protected areas management in particular, provide low-cost and efficient solutions for climate change adaptation and mitigation.[80] Table 6 includes some specific examples of activities that countries have already included in their National Adaptation Programmes of Action that highlight the role of protected areas.[81]

Table 6: Examples of actions that integrate protected areas into National Adaptation Programmes of Action

» Restore degraded forests with drought-resistant forest species (Burundi)
» Improve enforcement of protected area encroachment (Burundi)
» Diversify governance types of protected areas by establishing community conserved areas (Burundi)
» Restore coral reefs and mangroves to buffer impacts of storms (Djibouti)
» Protect key fish spawning areas to improve food security (Guinea)
» Create buffer zones around lands and within floodplains to secure water flows (Burundi)
» Expand community participation in protected area management to secure livelihoods (The Gambia)
» Restore degraded forests to mitigate floods and improve food security through irrigation (Haiti)
» Identify and protect areas prone to landslides (Bhutan)
» Restore degraded landscapes and encourage the establishment of community forests to control soil erosion (Eritrea)
» Develop community-based forest fire plans to ensure resilience of lowland forests to other climate-related threats (Samoa)
» Increase carbon sequestration and improve forest resilience by establishing new forest protected areas (Sierra Leone)
» Restore and protect rangelands to reduce the vulnerability of livestock to drought (Sudan)
» Eradicate invasive alien species in order to improve forest resilience (Zambia)
» Increase the protection of coastal areas and mangrove forests to buffer against sea-level rise (Benin)
» Protect areas of high fish diversity to improve food security (Mauritania)

Woman holding fish from a protected area © J. Ervin

Case study – Integrating protected areas into Sierra Leone's National Adaptation Programme of Action

A UNDP/GEF project in Sierra Leone entitled *Preparation of a National Programme of Action for Adaptation to Climate Change*[82] is aimed at developing a national program of immediate and urgent adaptation activities that address the current and anticipated adverse effects of climate change. As part of this project, UNDP supported Sierra Leone's efforts to complete a National Adaptation Programme of Action.[83] The sectors addressed in the plan included agriculture, fisheries, food security, water resources, forests and associated resources, land erosion, coastal management and human health. The establishment and effective management of protected areas is a prominent feature of Sierra Leone's National Adaptation Programme of Action. Specific protected area actions identified in the plan included:

» Conducting a natural resource inventory and mapping degraded areas Developing an integrated natural resource and environmental management system
» Establishing new forest reserves, protected areas and national parks
» Developing management plans to improve the effectiveness of protected areas
» Increasing the protection of forest catchment areas
» Establishing a technical support unit for protected area management
» Restoring and protecting critical fisheries habitats
» Developing an integrated coastal zone management plan

Best practice 5: Integrate protected areas into food security planning:

Food security has become a major global issue. A wholesale shift from fossil fuels to biofuels may further exacerbate concerns about long-term global and national food security.[84,85] In addition, many governments are increasingly worried about a global trend toward more genetically homogenous crop varieties. These varieties may be particularly susceptible to drought, flooding, temperature shifts and extremes, pests, pathogens and invasive species – all of which are likely to increase with climate change.

Protected areas can provide a major contribution to food security by securing the genetic variability within wild crop relatives that can be used to help domesticated crops adapt to predicted climate change impacts, such as higher temperatures and increased drought, salinity and flooding. Planners should consider some basic steps in integrating protected areas into food security planning, including a) identify and protect crop wild relatives such as wheat, corn, rice and potatoes within existing and new protected areas and avoid genetic erosion of these plants; b) identify and protect areas important for pollination; c) protect areas important for crop irrigation, such as headwaters; and d) maintain agricultural knowledge and practices within and around protected areas through agro-biodiversity practices.[86]

Wild apple tree in Zhungar Alatau National Park © Vagapov.R

Case study: Protecting the wild apple in Kazakhstan

A UNDP/GEF project in the Kazakhstani part of Northern Tien Shan called *Conservation and Sustainable use of Biodiversity in the Kazakhstani Sector of the Altai-Sayan Mountain Ecoregion*[87] aims to protect the globally significant genetic resources of Sievers apple, one of the main ancestors of domesticated apples. The project focuses on the protection and rehabilitation of wild fruit forest ecosystems, the establishment of genetic reserves, and the improvement of national laws on plant resource management. Effective management will be enhanced by a proactive awareness campaign and through the involvement of local communities in the decision-making process and management of protected areas, mainly by establishing protected area community boards. The project helped to establish a new national protected area, called Zhongar-Alatau State National Natural Park. This park will enable better management of the mountainous natural complexes that include wild fruit ecosystems, and its importance in protecting the natural gene pool of the apple is invaluable.

Pistachio woodlands in Badkhyz. © Chris Magin

Man planting rice in China © UNDP Photo Library

Case study: Protecting wild pistachios in Turkmenistan's Badkhyz Nature Reserve

As part of a UNDP/GEF project to advance the *Programme of Work on Protected Areas,*[88] Turkmenistan is focusing on improving the management of Badkhyz Nature Reserve. This reserve is considered a center for the wild relative of pistachio nuts, a nut whose global trade is worth $3.2 billion annually, and is an important food source for millions of people.[89] The UNDP/GEF project aims to improve the management effectiveness of the Badkhyz Nature Reserve, and to ensure the sustainable use and conservation of wild crop relatives within the reserve, including the wild pistachio nut tree.

Case study: Protecting the world's bread basket in China

A UNDP/GEF project in China called *Conservation and Sustainable Utilization of Wild Relatives of Crops*[90] aims to support the Chinese government in setting up protected areas with an integrated landscape approach. The focus of these landscape-level protected areas is the protection of the native habitat of wild relatives of soybean, wheat and rice—three of the most globally important crop wild relatives. The project focuses on strengthening protection and conservation measures for measures for crop wild relatives, developing an enabling policy environment, raising public awareness, and developing best practices for sustainable use. The project could be considered to be protecting the world's bread basket.

Issues, challenges and solutions in improving the enabling policy environment for protected areas

» Developing policies, legal frameworks and incentives can be a time-consuming, expensive and politically fraught process. By fully disclosing the intended and unintended consequences and outcomes of policy changes, and by linking the policy changes to widely accepted social objectives such as the Millennium Development Goals, planners can build the confidence of decision makers who will ultimately be held accountable for the success or failure of the recommended policies.

» Land-use planning requires a level of interagency cooperation that is rarely found in most countries. A recent survey of management effectiveness found that one of the most prevalent system-level weaknesses in protected areas is the lack of inter-agency coordination.[91] One solution to overcoming inter-agency cooperation is to form a multi-sectoral advisory committee. This step, which was specifically recommended at CoP-10 in Bonn, Germany,[92] brings together stakeholders from a range of agencies in order to achieve the goals of the Programme of Work on Protected Areas. Such a partnership could also form the basis of inter-agency cooperation on broader issues, such as integrating protected areas into land-use planning.

» Integrating protected areas into National Adaptation Programmes of Action may require a paradigm shift – the overwhelming trend is toward strategies that strengthen built infrastructure, such as levees, dams and dikes, rather than natural infrastructure, such as seagrass beds and mangroves. Having clear case studies that show how protected areas can be well integrated, and having examples of cost-benefit assessments to show the efficiency of protected areas will be helpful in making this shift.[93]

» Valuation techniques for assessing some protected area benefits, such as tourism, water and park entrance fees, have been fully developed and tested,[94] but many other benefits remain difficult to assess and quantify, such as the value of protected areas in enabling climate change adaptation or in mitigating natural disasters. There is a clear role for universities and protected area agencies in developing and testing methodologies that account for new and emerging benefits and services from protected area systems that relate to climate, ecosystem services, and livelihoods.

» Protecting the genetic diversity of wild crop relatives is a strong step towards ensuring food security, as the genetic variability inherent in such areas provides humanity with the means to develop new cultivars. However, this step alone is insufficient. Countries must also establish supportive research and agro-biodiversity programs to capitalize on the genetic banks in protected areas with wild crop relatives, and they must focus their wild food research on developing varieties that are likely to withstand climate impacts, such as drought, flooding and temperature extremes.

Ranger station in Uzon caldera Kronotsky Biosphere Reserve, Kamchatka © Adriana Dinu

Theme 2

Management Planning, Research, Monitoring and Assessment

Overview

Management planning has long been recognized as a prerequisite of effective protected area management. Research and monitoring efforts play a critical role in management planning by providing the scientific basis for adaptive management, and management effectiveness assessments enable planners to measure how well they are achieving protected area objectives. This section focuses on management planning, research, monitoring and assessment, and the need to update traditional approaches to these activities by incorporating aspects of climate change, ecosystem services, and sustainable livelihoods.

Management planning

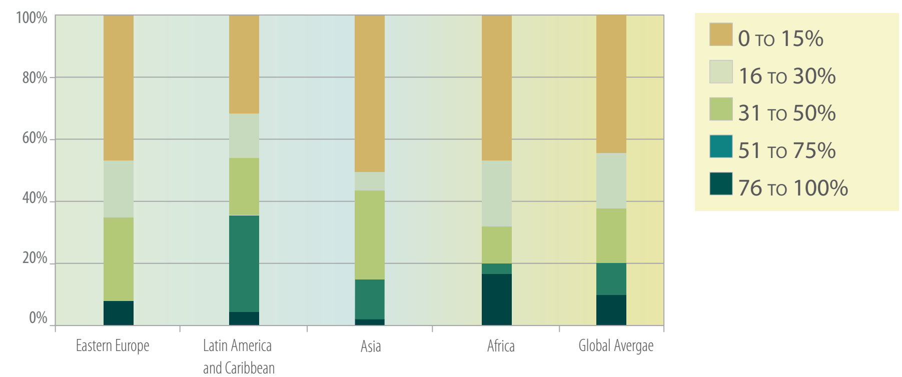
Introduction and analysis

Developing robust management plans is an urgent priority for the world's protected areas. The process of developing a management plans helps protected area managers identify natural and cultural resources, understand key threats to those resources, and develop plans and strategies for their long-term protection. Management planning is related to Goal 1.4 of the Programme of Work on Protected Areas, which states that governments should substantially improve site-based protected area planning and management. Specific activities of this goal include:

- Create a highly participatory approach to site-based planning
- Identify measurable conservation targets for sites
- Develop or update management plans, and include opportunities for sustainable use of biodiversity
- Integrate climate change adaptation measures in protected area planning and management
- Ensure a well-trained, skilled and well-equipped staff

Numerous examples, guidelines, manuals and case studies exist on protected area management planning from around the world.[95] The vast majority of these guides, and consequently the vast majority of management plans, focus on a) identifying and managing important species and their habitats, including rare, threatened and endangered species; b) developing tourism and visitor plans, including trails, camping areas, and educational displays; and c) identifying, mitigating and preventing internal and external threats, including poaching, encroachment, pollution and illegal logging. Figure 3 shows global progress in developing protected area management plans across more than 100 countries.

Figure 3: Global progress in developing protected area management plans[96]



Management planning is a fundamental weakness of protected area management – it ranks among the top five management weaknesses across a wide range of indicators and a wide number of protected areas.[97,98] Furthermore, a management plan is among the top five most critical elements for management success.[99] Based on the data in Figure 3, the proportion of protected areas with management plans is estimated at fewer than 30 percent globally. If this estimate is correct, given the 130,000 protected areas in existence, there is a tremendous opportunity to incorporate climate change, ecosystem services, and sustainable livelihoods issues not only into updated plans, but also into the roughly 90,000 management plans that have yet to be developed.

Goal 1.4 of the Programme of Work on Protected Areas specifies that protected area management plans should include provisions for sustainable development opportunities and measures for climate change adaptation. Despite these provisions, and despite the growing recognition of the important role that protected areas can play in sustaining livelihoods, maintaining ecosystems and enabling climate change adaptation and mitigation, very few managers incorporate these elements into their management plans. A representative survey[100] of recent management plans, for example, shows that protected area management planning focuses predominantly on wildlife management, tourism and threat reduction, but does not address issues related to climate adaptation, food security, sustainable livelihoods or ecosystem services (see Table 7). By incorporating these issues into management plans, planners can better understand how to manage their protected areas in order to provide a broader range of societal benefits.

Table 7: Representative survey of recent management plans

PROTECTED AREA MANAGEMENT PLAN	TRADITIONAL MANAGEMENT PLANNING ISSUES			EMERGING MANAGEMENT PLANNING ISSUES		
	Wildlife management	Visitor management	Threat reduction	Climate adaptation	Sustainable livelihoods	Ecosystem services
Agulhas National Park, South Africa[101]	X	X	X	—	—	—
Aleipata Marine Protected Area, Samoa[102]	X	X	X	—	X	—
Antarctic Specially Protected Area, Antarctica[103]	X	X	X	—	—	—
Bow Valley Protected Area, Canada[104]	X	X	X	—	—	—
Bwindi /Mgahinga Conservation Area, Burundi[105]	X	X	X	—	X	—
Byfield Area, Australia[106]	X	X	X	X	—	X
Capricornia Cays National Park, Australia[107]	X	X	X	—	—	—
Carnarvon National Park, Australia[108]	X	X	X	—	—	—
Dorset and East Devon Coast World Heritage Site, United Kingdom[109]	X	X	X	—	—	—
Eagle's Nest Lake, New Mexico, USA[110]	X	X	X	—	—	—
Hawar Islands, Bahrain[111]	X	X	X	—	—	X
Henderson Island World Heritage Site, Pitcairn Islands[112]	X	X	X	—	—	X
Hohe Tauern National Park, Austria[113]	X	X	X	—	—	X
Kakwa Provincial Park and Protected Area, Canada[114]	X	X	X	—	—	—

Kibale National Park, Uganda[115]	X	X	X	—	X	X
Komodo National Park, Indonesia[116]	X	X	X	—	X	—
Mabini Protected Landscape and Seascape, The Philippines[117]	X	X	X	—	X	—
Reimaanlok, Marshall Islands[118]	X	X	X	—	X	—
Rio Grande State Park, USA[119]	X	X	X	—	—	—
Safata Management Area, Samoa	X	X	X	—	X	—
St. Croix East End Marine Park, Virgin Islands[120]	X	X	X	—	—	—
Umngeni Vlei Nature Reserve, South Africa[121]	X	X	X	—	X	X

The process of preparing a management plan is typically described as an iterative process, beginning with pre-planning and preparatory stages, through to the plan approval stage, and beyond to implementation, monitoring and adaptation.[122] This adaptive management cycle provides a useful lens for thinking about how protected-area managers could identify actions to better identify, plan for and strengthen actions throughout the management planning process (see Table 8).

Table 8: Actions to strengthen management planning to address climate, ecosystem services, and livelihood issues

Management planning elements	Actions to strengthen management planning for climate resilience and adaptation	Actions to strengthen management planning to maintain ecosystem services	Actions to strengthen management planning for sustainable livelihoods
Identify goals and objectives	Develop specific goals and objectives for improving climate resilience (e.g., improving viability of key ecosystems)	Develop specific goals and objectives for the maintenance of key ecosystem services (e.g., sustaining important fisheries)	Develop specific goals and objectives for creating and maintaining local livelihoods within the management plan

MANAGEMENT PLANNING ELEMENTS	ACTIONS TO STRENGTHEN MANAGEMENT PLANNING FOR CLIMATE RESILIENCE AND ADAPTATION	ACTIONS TO STRENGTHEN MANAGEMENT PLANNING TO MAINTAIN ECOSYSTEM SERVICES	ACTIONS TO STRENGTHEN MANAGEMENT PLANNING FOR SUSTAINABLE LIVELIHOODS
Identify protected area resources	Identify areas and species of particular importance to climate adaptation (e.g., altitudinal gradients) and climate mitigation (e.g., carbon sinks)	Identify areas of particular importance to maintaining key ecosystem services (e.g., headwaters, fish nurseries)	Identify species, areas and resources of particular importance to sustaining community livelihoods (e.g., non-timber forest products)
Identify protected area threats	Identify and prioritize protected area threats that negatively impact climate adaptation (e.g., habitat fragmentation, invasive species)	Identify and prioritize protected area threats that negatively impact ecosystem services (e.g., high-elevation logging)	Identify and prioritize protected area threats that negatively impact livelihoods (e.g., illegal fishing)
Identify critical management actions to achieve objectives and reduce threats	Develop an action plan to strengthen the resilience of the protected area to climate change (e.g., to improve viability and ecological integrity, to restore connectivity)	Develop an action plan for fully valuing and effectively managing the full array of ecosystem services within the protected area (e.g. create payment for ecosystem services schemes)	Develop an action plan for creating new, and maintaining existing, opportunities for sustainable livelihoods related to protected area resources (e.g., promote ecotourism scheme)
Prioritize protected area management actions and interventions	Prioritize management actions through the lens of climate change, and identify the most feasible and viable options for adaptation and mitigation (e.g., manage forests for carbon sequestration)	Prioritize management actions through the lens of ecosystem services, and identify the most feasible and viable options for maintaining these services (e.g., manage forests for water provisioning)	Prioritize management actions through the lens of sustainable livelihoods, and identify the most feasible and viable options for sustaining these livelihoods (e.g., manage forests for non-timber forest products)
Define the impacts of management actions and policies relative to key objectives	Define the impacts of a range of management actions on the resilience and adaptive capacity of the protected area (e.g., the impacts of grassland management on species vulnerable to climate change)	Define the impacts of a range of management actions on the functioning and provisioning of key ecosystem services (e.g., the impacts of grassland management on water flow and carbon sequestration)	Define the impacts of a range of management actions on existing livelihoods, and on future livelihood options (e.g., the impacts of grassland management on grazing capacity for domestic livestock)

Define appropriate zones, regulations, policies and practices	Incorporate areas important for climate change adaptation and mitigation into protected area zones and regulations (e.g., special protection zones for species vulnerable to climate change impacts)	Incorporate areas important for ecosystem services into protected area zones and regulations (e.g., zones for protecting headwaters)	Develop zones that demarcate acceptable uses, including those uses related to local livelihoods, (e.g., zones for harvesting non-timber forest products)
Develop indicators for measuring progress and incorporate into monitoring plan	Develop indicators for measuring resilience to climate change and include in monitoring plan (e.g., distribution and abundance of climate-sensitive species)	Develop indicators for the quality and quantity of ecosystem services and include in monitoring plan (e.g., volume and quality of drinking water)	Develop socio-economic indicators related to sustainable livelihoods and include in monitoring plan (e.g., number of households benefiting from ecotourism)

↘Best practice 6: Incorporate climate change into management planning

One of the foundations of effective management planning is identifying key biodiversity features – the species and ecosystems for which management goals and objectives are set. In identifying key biodiversity features, planners can use a vulnerability assessment, which describes the degree of exposure and sensitivity that species and systems will face under climate change scenarios.[123] Factors that may influence the vulnerability of a species include specific biological traits that limit adaptive capacity, physical barriers to dispersal and other adaptation methods, and high exposure to existing or future threats that will be exacerbated by climate impacts. When deciding which key biodiversity features to include in a management plan, therefore, planners can focus on the following questions:

- » Which species, populations, habitats or ecosystems are most vulnerable and likely to shift their range as a result of climate change impacts?
- » Which are less vulnerable or are likely to benefit from climate change?
- » Which are most vulnerable to climate extremes, climate variability, and/or changes in average temperature or precipitation?
- » Which impacts can be managed by increasing the adaptive capacity of species or systems, and which are unavoidable?
- » Where the details of future changes are uncertain, which of the likely scenarios are the most or least harmful?
- » What species might be expected to move into the area under future climate conditions, and what new assemblages might emerge?

Sea Spider © Santiago Carrizosa

Case study: Incorporating climate change into the management planning of marine protected areas in Colombia

The UNDP/GEF project, *Designing and Implementing a National Sub-System of Marine Protected Areas,*[124] centers on promoting the conservation and sustainable use of coastal and marine biodiversity in the Caribbean and Pacific regions through the design and implementation of a financially sustainable and effectively managed system of marine protected areas. The project focuses on addressing the threats posed by rising sea levels and higher sea surface temperatures on marine ecosystems. It aims to increase financial and technical capacity to manage marine protected areas, including management planning, and to strengthen the overall resilience of the protected area network. The project's newly proposed marine protected areas augment the representation of ecosystems within the national system of protected areas and provide new habitats for species forced to migrate as a result of climate change. The project is also coordinating activities with a national adaptation pilot project. New monitoring data from detected changes in sea level and sea surface temperature are incorporated into the management plans and strategies of the marine protected area network as they become available.

Best practice 7: Incorporate ecosystem services into management planning

One of the most important protected area ecosystem services is the provisioning of water. Several authors have identified specific management opportunities to improve climate adaptation actions that help to sustain the quantity, quality and security of freshwater and improve the resilience of freshwater ecosystems.[125,126,127] Specific recommendations from these authors include:

- Identify and protect ecosystems that are the source of water supplies, such as headwaters, through zoning and other measures
- Include freshwater systems, processes and biodiversity as explicit features within protected area management plans
- Restore freshwater habitats to reduce threats and to regulate water flows
- Create riparian reserves to maintain ecological processes, including flooding
- Plan and manage water demand to ensure appropriate water allocations among different water users
- Adopt freshwater ecoregions as units for conservation planning, and ensure a representative distribution of protected areas within those units
- Ensure adequate aquatic connectivity within and between protected areas by establishing and maintaining riparian corridors with natural vegetation, ensuring the connectivity of free-flowing undammed rivers and streams, and maintaining hydrological regimes within acceptable levels
- Protect sites likely to provide freshwater refugia and freshwater resilience under climate change scenarios.

Coastal xeric matorral, Cuba © UNDP/GEF Sabana Camaguey Project

Case study: Incorporating ecosystem services into management plans in Cuba

A UNDP/GEF-funded project, *Protecting Biodiversity and Establishing Sustainable Development of the in Sabana-Camaguey Region,*[128] aims to enhance biodiversity conservation by providing equipment and resources, assisting with rapid ecological inventories, and addressing multiple threats facing the Sabana-Camagüey Ecosystem of Cuba. With the key elements of an ecosystem-based management plan firmly in place, the project is now working outside of the protected areas, promoting changes in the key economic production sectors within the region. This component includes working with the fisheries sector to promote sustainable fishing practices within the ecosystem so that fish populations and marine ecosystem functions are maintained and/or restored.

Best practice 8: Incorporate sustainable livelihoods into management planning

Because the issue of sustainable livelihoods requires an intimate understanding of how individuals and communities use and depend upon protected area resources, one of the most important aspects in incorporating sustainable livelihoods into protected area management planning is to engage in participatory planning. Nearly all aspects of management planning can benefit from a participatory planning approach, but the following participatory activities can be particularly important when incorporating sustainable livelihoods into management plans:

- Identifying protected area objectives for sustaining livelihoods
- Identifying zones within the protected area management plan that are important for sustaining livelihoods
- Developing appropriate regulations and policies for the use and management of natural resources
- Identifying specific natural resources and areas that are important for sustaining livelihoods
- Identifying threats to livelihoods as well as threats to biodiversity
- Developing socio-economic indicators for monitoring sustainable livelihoods

Drying shrimp in Tonle Sap Biosphere Reserve © Joseph D'Cruz

Case study: Integrating sustainable livelihoods into management plans in the Tonle Sap Biosphere Reserve of Cambodia

UNDP, with funding from the GEF, provided support for a project in Cambodia called the *Tonle Sap Conservation Project*.[129] The project focused on providing technical assistance to the Tonle Sap Biosphere Reserve in order to prepare management plans for three core areas. The highly participatory preparation process involved local villages and communes, with the aim of improving rural incomes and human development, while simultaneously reducing negative impacts on the environment within the core areas of the reserve. The management plans include provisions for floating gardens, aquaculture and ecotourism to sustain local livelihoods, and the project also supported the formation of 22 community savings groups, a pilot vehicle for promoting rural enterprises.

Research and monitoring

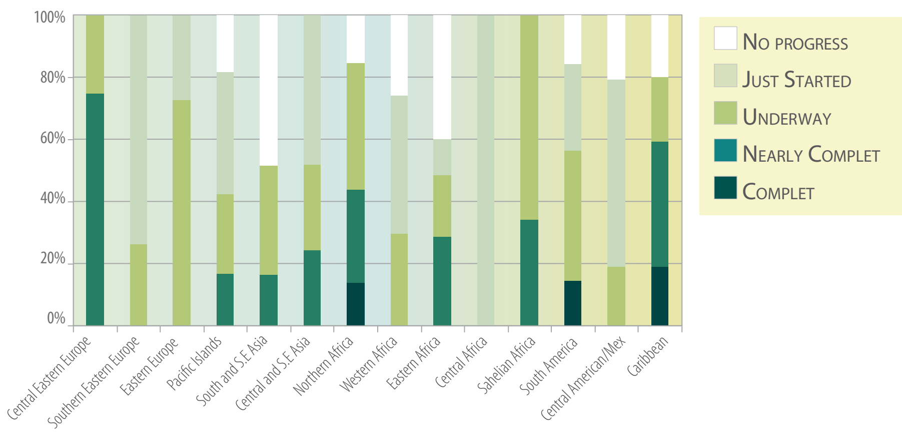
Introduction and analysis

An integral part of management planning is research and monitoring; these are the mechanisms that drive the iterative process of adaptive management. This section focuses on research and monitoring within protected area sites and systems, themes that are related to Goals 4.3 and 4.4 of the Programme of Work on Protected Areas. These two goals state that governments should assess and monitor protected area status and trends, and ensure that research and scientific knowledge contributes to the establishment and effectiveness of protected areas and protected area systems. Specific activities related to these two goals include:

- Implement programs to monitor and assess the status and trends of biodiversity within protected area systems and sites
- Measure and report progress toward protected area targets
- Improve national and regional databases on protected areas
- Participate in the World Database on Protected Areas
- Encourage the use of geographic information systems and remote sensing
- Improve technical and scientific cooperation related to protected areas
- Promote interdisciplinary research
- Encourage studies to improve knowledge on the distribution, status and trends of biodiversity
- Encourage collaborative research between scientists and communities

Research and monitoring are both major management weakness – several comparative studies have found that research and monitoring are among the weakest aspects of management.[130,131] Research and monitoring have traditionally been among the lowest priorities in protected area management because more pressing needs – such as law enforcement, wildlife management, infrastructure planning, and financial and business planning – have taken precedence. Where they do exist, research and monitoring programs are often funded and staffed by external research agencies and universities, and frequently do not link directly to the critical management needs of the protected area, but rather link to researchers' agendas. However, effective research and monitoring programs are critical; they are second only to effective communication programs for correlation with overall management effectiveness.[132] Figure 4 shows global progress on research and monitoring efforts across more than 100 countries.

FIGURE 4: SUMMARY OF GLOBAL PROGRESS ON ASSESSING RESEARCH AND MONITORING NEEDS[133]



Best practice 9: Focus research and monitoring efforts on key gaps related to climate change, ecosystem services, and sustainable livelihoods

Research and monitoring programs, if they are to remain relevant, must be targeted at the most pressing issues and challenges facing protected areas. In particular, robust research monitoring programs can help in developing baselines for ecosystem services provisioning and climate change, developing predictive models, calculating impacts from climate change, and testing hypotheses for adaptation.

Specific research and monitoring gaps related to climate change and ecosystem services, drawn from recent literature,[134,135] include gaps on how to:

- Determine the potential magnitude and rate of climate change impacts on protected area systems, and how to predict subsequent impacts on biodiversity
- Predict ecosystem structures and functioning, productivity and delivery of goods and services under different climate scenarios
- Assess the effects of temperature and enhanced CO_2 levels on vegetation growth, carbon sequestration, and methane emissions in various ecosystems
- Conduct cross-sectoral research on the impacts of climate change on human wellbeing, and on relationships between climate and poverty
- Assess vulnerability to natural hazards
- Develop general climate adaptation principles that could be applied locally
- Determine resilience thresholds for a variety of ecosystems
- Estimate the cascading effects and negative synergies of multiple threats
- Assess the impact of climate change on large-scale migration patterns

Primula farinosa, Slovakian fens © Tomáš Dražil

Monitoring of halophyte-wormwood ecosystem * © Ivashenko Anna

Case study: Monitoring and restoring the ecosystem services of the Carpathian rich fens of Slovakia

Carpathian rich fens are a unique and diverse ecosystem which have their center of distribution in Slovakia. The project *Conservation, Restoration and Wise Use of Rich Fens in the Slovak Republic*[136] focuses on implementing strategic interventions in selected pilot sites to restore this ecosystem and improve the hydrological regime. The project has established a robust monitoring system, including 68 groundwater probes and 44 plots that are regularly evaluated for vegetation changes. Additionally, the project enhanced the GIS capacity for the national peatland database, which now includes over 1,500 peatland sites—nearly twice the number of sites in the database before the project began.

Case study: Monitoring desertification from climate change in the steppe ecosystems of Kazakhstan

The UNDP/GEF project *Steppe Conservation and Management*[137] aims to expand the country's protected area system in order to improve the protection of steppe ecosystems, one of the most threatened and under-protected ecosystems in the world. One of the project's aims is to develop a comprehensive monitoring system of the steppe ecosystem, including monitoring desertification and other impacts of climate change. A similar UNDP/GEF project in Kazakhstan, called *Integrated Conservation of Priority Globally Significant Migratory Bird Wetland Habitat,*[138] focused on assisting the government of Kazakhstan in addressing the underlying causes and main threats to wetland sites important for long-term biodiversity conservation. The project implemented a biodiversity and habitat monitoring program aimed at supporting critical habitats and populations of species by promoting climate resilience and adaptation. Monitoring of terrestrial and aquatic ecosystem biodiversity components at stationary sites helped to predict climate impacts, and focus management responses. The analysis of long-term data was entered into the monitoring system, and the identification of trends of changes in the ecosystems from climate change will help to set priority objectives for risk management.

* Monitoring of halophytic and absinthial ecosystems in the dry steppe zone of lakeside plains for Levant wormseed (Artemisia pauciflora) and Oahu wormwood (Artemisia austriaca), indicator plants for desertification.

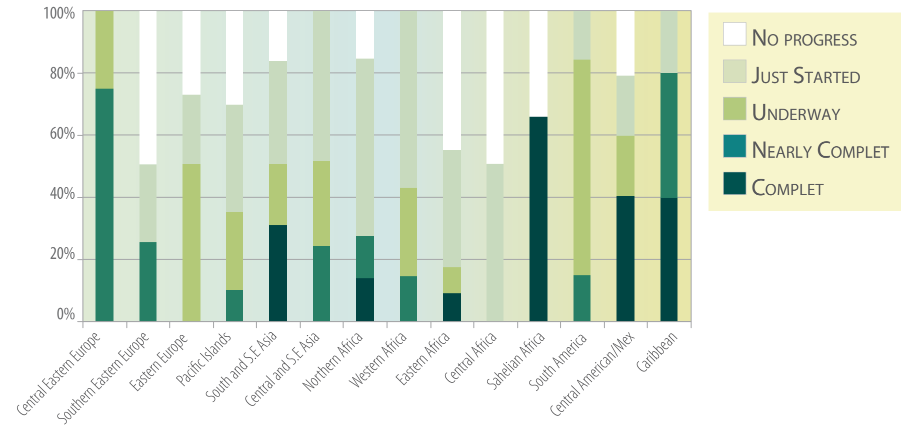
Protected area management effectiveness assessments

Introduction and analysis

Assessments of management effectiveness are evaluations of the degree to which protected areas fulfill their objectives. Management effectiveness assessments began in earnest in the early 2000s, with the development of several methodologies that were widely implemented across a large number of protected areas,[139] as well as the development of a global framework for assessing management effectiveness.[140] Since then, governments and non-governmental organizations alike have assessed the management effectiveness of over 10,000 protected areas around the world.[141] (See Figure 5 for a summary of global progress on assessing management effectiveness.) This section focuses on the assessment of protected area management effectiveness, a theme that is related to Goal 4.2 of the Programme of Work on Protected Areas. This goal states that governments should evaluate and improve the effectiveness of protected areas management. Specific activities related to this goal include:

- Develop and adopt methods and indicators for evaluating management effectiveness and governance
- Implement management effectiveness evaluations of at least 30 percent of protected areas
- Include resulting information in national reports
- Implement key recommendations as an integral part of adaptive management strategies

Figure 5: Summary of global progress on assessing management effectiveness[142]



For the most part, the management effectiveness assessments are very similar to one another;[143] they generally focus on most or all of six main elements outlined in a global framework for management effectiveness developed by the World Commission on Protected Areas:[144]

- Context – protected area significance, threats and policy environment
- Planning – protected area design and planning
- Inputs – resources needed to carry out protected area management
- Processes – way in which management is conducted
- Outputs – implementation of management programs, actions and services
- Outcomes – extent to which objectives have been achieved

The indicators within most management effectiveness assessment methodologies are scored relative to the protected area objectives. In a general sense, therefore, management effectiveness assessments could incorporate issues related to climate change, ecosystem services, and sustainable livelihoods, if these aspects are clearly part of the management objectives. However, even with this adjustment, most existing assessment methodologies are quite broad, and are often used more as a snapshot to gauge general problem areas than as a set of measurable indicators for adaptive management.

Because protected areas are increasingly expected to do more ecologically, economically and socially, the tools with which planners and managers evaluate effectiveness must also evolve and become more sophisticated. They will likely need to become more specific, and specifically incorporate a wide set of issues, including climate change, ecosystem services, and sustainable livelihoods. The following best practice highlights the need to account for broader issues within management effectiveness assessments.

↘Best practice 10: Account for issues related to climate and ecosystem services within management effectiveness assessments

Many practitioners have found that traditional management effectiveness assessments, while providing them with a snapshot of key issues, are too broad for adaptive management purposes. Managers frequently require a specific set of management effectiveness indicators relative to specific threats within protected areas, such as the management of invasive species,[145] the management effectiveness of freshwater resources,[146] or the management of fire within protected areas.[147] Protected area practitioners would likely benefit from a more detailed set of management effectiveness indicators in order to gauge how well they are managing for climate change resilience, mitigation and adaptation (see Table 9). Similarly, they would also likely benefit from a more detailed set of indicators related to sustainable livelihoods (see Table 10).

Table 9: Potential management effectiveness indicators for climate change resilience, mitigation and adaptation[148]

Threats	» Degree of impacts on key ecosystems (e.g., forest fragmentation, marine acidification and bleaching, peat lands clearing) » Degree of impacts on key processes (e.g., hydrological regimes, fire regimes, invasive species) » Degree of impacts on key species (e.g., changes in connectivity, habitat ranges, and spatial and temporal migration patterns)
Relative importance	» Existing threats will exacerbate the effects of climate change, such as fire, fragmentation and invasive species » Area is prone to drought » Area is susceptible to rising sea levels » Area contains species and assemblages that are particularly susceptible to increased climatic variation » Area contains a high number of species with highly localized range distributions that are vulnerable to climate change (i.e., natural communities and ecosystems at high altitudes) » Surrounding area is highly fragmented and does not allow free movement of species » Area is susceptible to chemical changes associated with climate change (e.g., acidification) » Area includes vital ecosystem services (e.g., water) that are likely to be diminished by climate change » Area provides a key function in the conservation of species under climate change scenarios

Planning	» Protected area employees and administrators understand the importance and implications of climate change adaptation » Climate-related conflicts (e.g., water scarcity) are understood and proactively addressed » Design and layout of protected area minimize climate-related impacts » Design and layout optimize and enhance species and ecosystem adaptation » Surrounding land use enables effective adaptation to climate change
Inputs	» Staff members have adequate skills and knowledge to manage for climate change adaptation and mitigation » Existing data on the potential impacts of climate change are adequate for management planning » There is adequate communication about the role of protected areas in climate adaptation and mitigation » Equipment and facilities are adequate to monitor climate change impacts » Area makes use of appropriate climate-related financial mechanisms (e.g., REDD+, mitigation funds)
Processes	» Management plan explicitly incorporates likely impacts of climate change » There is an analysis of, and strategy for addressing, threats related to climate change » Decisions related to the trade-offs in managing for biodiversity and climate are transparent » Impacts from climate change are clearly recorded, and compared against baseline information » Research on key climate issues is consistent with the impacts of climate change on the protected area
Outputs	» Actions to prevent climate threats by minimizing related threats, such as invasive species and fire, are sufficient » Actions to restore key ecosystems in order to minimize climate impacts and increase resilience are sufficient » Wildlife and habitat management outputs and actions are sufficient to minimize potential climate impacts » Education activities on the importance of the protected area in climate change mitigation and adaptation are adequate » Visitor and tourist management accounts for and minimizes climate-related impacts » Infrastructure development actions do not increase or exacerbate climate-related impacts » Management planning actions are sufficient to address existing and likely impacts from climate change » Staff monitoring, supervision and evaluation include climate-related objectives and activities » Staff training and development outputs related to climate change have been sufficient to achieve key objectives » Research and monitoring outputs on climate change have been consistent with the level of climate threats
System-level indicators	» The protected area system is integrated into national climate adaptation and mitigation plans » There are appropriate climate-related funding mechanisms to support protected area establishment and management » Natural resource laws and policies promote climate resilience and adaptation across the landscape/seascape » Overall protected-area system design incorporates results from an assessment of climate-related gaps » Overall system design incorporates potential climate-related changes to ecosystem services

TABLE 10: POTENTIAL MANAGEMENT EFFECTIVENESS INDICATORS FOR ECOSYSTEM SERVICES AND SUSTAINABLE LIVELIHOODS[149]

Threats	» Degree and extent of impacts from various threats on the viability of sustainable livelihoods and the provision of ecosystem services
Planning	» Protected area employees and administrators understand the importance of the protected area in maintaining livelihoods sustaining ecosystem services » Protected area employees and administrators understand the implications of management plans and actions on sustainable livelihoods and ecosystem services
Inputs	» Staff members have adequate skills and knowledge to manage for simultaneous benefits between biodiversity, sustainable livelihoods and ecosystem services » Existing data on resource-dependent livelihoods and ecosystem services within the protected area are adequate for management planning » There is adequate communication between and among protected area staff and local communities about the role of protected areas in sustaining livelihoods and providing ecosystem services
Processes	» The management plan explicitly incorporates resource-dependent livelihoods and ecosystem services within and around the protected area » There is an analysis of, and strategy for addressing, threats to sustainable livelihoods and ecosystem services » Decisions related to the trade-offs in managing for biodiversity, sustainable livelihoods and ecosystem services are fully transparent » Impacts from a variety of threats on sustainable livelihoods and ecosystem services are clearly recorded, and compared against baseline information » Research on key issues related to livelihoods and ecosystem services is consistent with the degree of threat to these services within the protected area
Outputs	» Actions to prevent and address threats to livelihoods and ecosystem services are sufficient » Actions to restore key ecosystems in order to sustain and enhance livelihoods and maintain key services are sufficient » Education activities on the importance of the protected area in sustaining local economies and livelihoods and provide key services are adequate » Visitor and tourist management accounts for and minimizes impacts to resources upon which livelihoods depend and ecosystems from which services are provided » Infrastructure development actions do not negatively affect livelihoods or ecosystem services » Management planning actions are sufficient to address existing and likely impacts from a range of threats on livelihoods and ecosystem services » Staff monitoring, supervision and evaluation include objectives and activities related to the maintenance and enhancement of ecosystem services and sustainable livelihoods » Staff training and development outputs related to livelihoods and ecosystem services have been sufficient to achieve key objectives » Research and monitoring outputs on sustainable livelihoods and ecosystem services have been consistent with the level of threat within the protected area
System-level indicators	» Natural resource laws and policies recognize and promote the value of protected areas in providing ecosystem services and maintaining livelihoods » Overall protected-area system design incorporates results from assessments of ecosystem services and sustainable livelihoods

Virgin forests of Komi, Russia © Adriana Dinu

Case study: Assessing the effectiveness of carbon management in the Komi Republic of Russia

The UNDP/GEF project *Strengthening Protected Area System of the Komi Republic to Conserve Virgin Forest Biodiversity in the Pechora River Headwaters Region*[150] aims to achieve the social, financial and institutional sustainability of the protected areas system of the Republic of Komi by demonstrating effective conservation practices and resource use in two protected areas of the Upper Pechora Basin and their buffer zones. In assessing the effectiveness of the existing protected areas, the project looked not only at conservation effectiveness, but also at the effectiveness of managing carbon, especially in forest and peatland ecosystems. In the Komi Republic, virgin protected forests store around 71.5 million tons of carbon. In an undisturbed state, the annual build-up of sequestration from these forests exceeds 2.7 million tons of carbon. When disturbed by fires and inappropriate management, these forests lose up to 280,000 tons of carbon per year. Therefore, the project specifically targets climate change mitigation and adaptation as part of its assessment.

Issues, challenges and solutions in protected area management planning, research, monitoring and assessment

In improving protected area management planning and practice

» Developing a resource inventory for biodiversity is often an expensive, time-consuming, data-intensive process. Incorporating inventories of areas and resources important for climate adaptation, ecosystem services and sustainable livelihoods will add to the expense and complexity of this process. Planners may be able to overcome some of these complexities and challenges by incorporating these aspects into existing planning processes, such as rapid rural appraisals[151] and ecological gap assessments.[152]

» Developing protected area management plans is a high priority for many countries, yet the development of such plans typically requires significant staff resources. There is an urgent need to develop and use good examples of streamlined processes,[153] to create simplified templates for management planning, and to develop and share best examples of management plans that incorporate climate adaptation, ecosystems services, and sustainable livelihoods.

» A management plan provides overarching directions, objectives and guidance for a protected area. Often they are written for a 3- or 5-year timeframe. For the implementation of day-to-day management activities and decisions, however, an annual work plan is much more important. Therefore, planners will want to be sure that the elements of the management plan that address climate change, ecosystem services, and sustainable livelihoods are translated into specific actions and objectives within the annual work plan.

In conducting research and monitoring

» Developing a baseline for monitoring can be very difficult, especially in highly degraded ecosystems. The phenomenon of "shifting baselines"[154] – in which planners view the current baseline of an ecosystem against recent conditions rather than long-term historical baselines – can lead researchers to develop management thresholds based on an ever-degrading ecosystem. One way planners can avoid this trap is to focus not only on historical and present baselines, but also on the distance of those baselines to resilience thresholds – on those tipping points where the ecosystem is likely to shift from one regime to another.[155]

» Even with a robust research and monitoring system in place within a protected area or protected area system, there is no guarantee that the results will be fully incorporated into future decisions. Planners can promote an adaptive management cycle by establishing clear mechanisms, such as instituting and making publicly available annual reports and scorecards on the health of the ecosystem, and by tying annual performance reviews to whether or not research and monitoring results were incorporated into management plans and priorities.

In assessing management effectiveness

» There is a balance between assessing overall management effectiveness with broad indicators (such as staff capacity to conduct critical management activities) and assessing specific management effectiveness relative to a set of specific issues (such as staff capacity to develop an invasive species management plan). Planners could easily become overwhelmed with an unending set of effectiveness indicators on a wide range of issues. They can manage this complexity, however, by first undertaking a general management effectiveness assessment, and then applying a relatively small set of indicators for those key issues that are identified through the broader, more general assessment.

» In most protected areas, there is a range of social and biodiversity objectives. Explicitly including the provisioning of ecosystem services and the maintenance of sustainable livelihoods may shift the balance between social and biodiversity objectives, potentially causing conflict between biodiversity advocates and social development advocates. By being explicit about the potential benefits and trade-offs, protected area planners can address some of these concerns directly. Planners may also want to more fully explore the role of buffer zones and sustainable use zones within their protected areas, to allow for more diverse uses within the protected area, while still fulfilling the biodiversity objectives.

African Elephants Drinking At Water Hole, Savuti, Botswana, Africa © SRstock

Yellow Leucospermum at Flower Valley © Claudio Vasquez Rojas UNDP-GEF Photo Library

Theme 3

Protected Area Threat Assessments and Restoration

Overview

The phenomenon of a "paper park" – where the level of threats and pressures within a protected area prevent the area from achieving its objectives – has long been recognized by protected area practitioners, policy makers, and researchers alike.[156,157,158] Numerous authors have catalogued the extent of threats within protected areas worldwide,[159] and threat assessments are a major theme of most management effectiveness assessments.[160] Partly as a result of increased awareness of the scope and extent of threats to protected areas globally, planners are increasingly focusing on ecosystem restoration. This section focuses on both threats within, and restoration of, protected areas.

Protected area threats and threat assessments

Introduction and analysis

Protected areas face an array of threats, including habitat conversion; invasive species; pollution; over-harvesting of resources; alteration of natural regimes; infrastructure for transportation, energy and recreation; and impacts from climate change. This section focuses primarily on threat assessments, a theme that is related to Goal 1.5 of the Programme of Work on Protected Areas, which states that governments should prevent and mitigate the negative impacts of key threats to protected areas. Specific activities under this goal include:

- Apply environmental impact assessments to plans or projects affecting protected areas
- Restore and rehabilitate the ecological integrity of protected areas
- Control risks associated with invasive alien species in protected areas
- Assess key threats to protected areas
- Develop policies and ensure enforcement to halt illegal resource exploitation

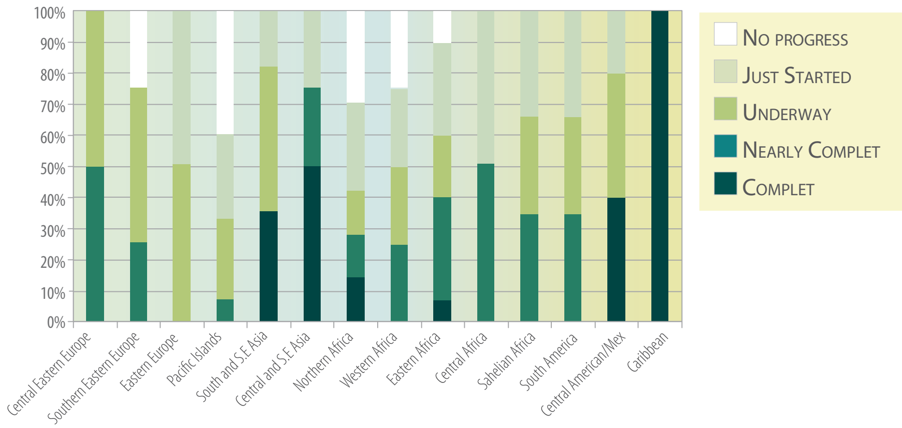
Threat assessments occur at multiple scales. Broad-scale threat assessments are typically conducted as part of systematic conservation planning, or as part of an ecological gap assessment, across broad areas that include not only protected areas and buffer zones, but also the full array of other land uses. The purpose of broad-scale threat assessments is generally to identify ecosystems most threatened and in need of protection, and to assess broad patterns of threats within protected area systems.[161]

System-level protected area threat assessments are typically conducted as part of system-level management effectiveness assessments, and focus on threats to protected areas within a national or sub-national system. The purpose of protected area system-level threat assessments is generally to identify the most prevalent threats and the most threatened protected areas across the entire system[162].

Site-level protected area threat assessments are usually carried out either as part of a management planning process or management effectiveness assessment. At their most basic, site-level threat assessments simply include a list of threats within the protected area. More detailed threat assessments rank the scope and severity of each threat, based on their overall impact on biodiversity within the protected area.[163] The most detailed site-level threat assessments include a ranking of the scope and severity of a range of threats based on their impact on a subset of key biodiversity features.[164] The purpose of site-level threat assessments is generally to identify which threats are having the biggest impacts on biodiversity within a particular protected area.

All three of these scales can provide useful information as part of a protected area threat assessment. Figure 6 shows global progress in assessing protected area threats across more than 100 countries.

Figure 6: Summary of global progress on assessing threats[165]



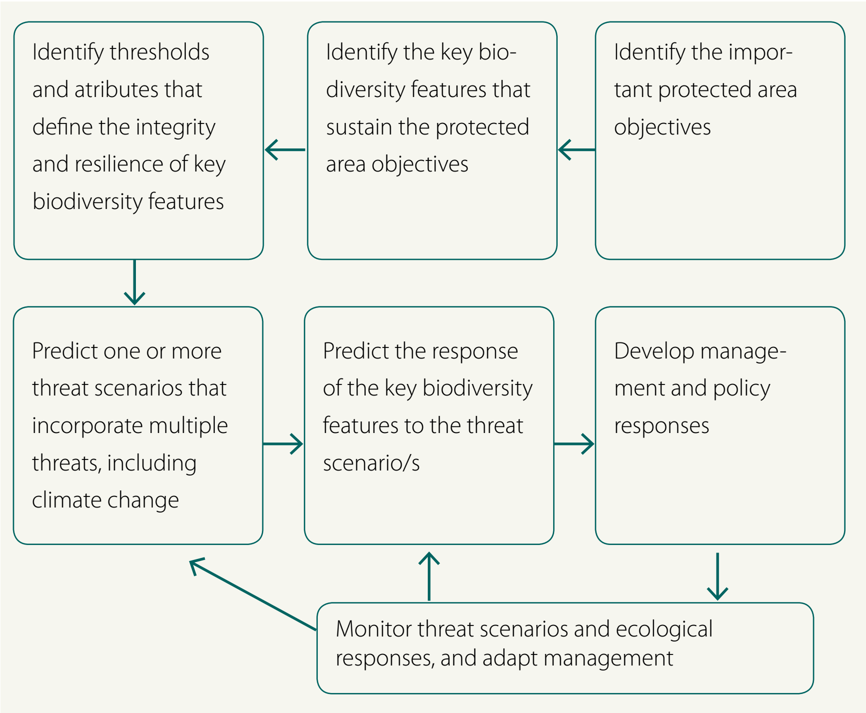
In a large number of protected area sites and systems, threat assessments are simply a general description and sometimes ranking of threats within a protected area system. They also typically share a set of weaknesses, including: they do not specify which threats are affecting which attributes of key biodiversity features; they do not assess the impacts of threats on social values, such as livelihoods, or on ecosystem services, such as water provisioning; they consider each threat individually, rather than consider the potential synergies with other threats, particularly climate change; and they focus on current species and ecosystem distribution patterns, rather than focus on how these patterns will shift under different climate change scenarios.

In order to assess threats to a broader array of protected area values, including livelihoods, ecosystem services and climate adaptation and resilience, planners will need a new conceptual model that goes beyond assessing threats to biodiversity[166] (see Figure 7). In this model there are seven steps:

1. Identify the full suite of protected area benefits, including sustaining livelihoods, maintaining ecosystem services, and promoting climate adaptation and resilience
2. Identify the key biodiversity features that sustain these benefits (e.g., forest headwaters sustain water flows, mangroves sustain fisheries)
3. Identify thresholds and attributes that define the integrity and resilience of key biodiversity features. These may include resilience thresholds and tipping points (e.g., temperature extremes, resistance to drought and floods); inherent vulnerability factors (e.g., sensitivity to size, distribution or ecological processes); or integrity attributes (e.g., size, condition, landscape context)
4. Develop one or more scenarios that include the full range of potential threats over time (e.g., a 5-year and 20-year prediction of the interactions between forest harvesting, invasive species, and fire)
5. Predict the ecological response of the key biodiversity features, including changes to resilience thresholds and tipping points (e.g., closer to a regime shift, closer to extinction); impacts on inherent vulnerability factors (e.g., range issues become more acute); and changes in integrity indicators (e.g., smaller population sizes, degraded condition, fragmented landscape)
6. Develop management and policy responses (e.g., harvesting practices and limits, protection and conservation measures, restoration measures, incentives and policies)
7. Monitor the threat scenarios and ecological responses, and adapt management and policy responses

In order to assess threats to livelihoods, ecosystem services and climate resilience, planners need a new conceptual model that goes beyond simply assessing threats to biodiversity.

Figure 7: Conceptual model for incorporating livelihoods, ecosystem services, and climate resilience into protected area threat assessments



Best Practice 11: Incorporate climate change as an integral component of threat assessments

Protected area threat assessments typically address climate change by including it as one of many threats.[167] However, in order to more fully integrate and incorporate climate change into protected area threat assessments, planners will need to adopt more sophisticated approaches to assessing the threat of climate change. Table 11 highlights some considerations for better incorporating climate change as an integral component of threat assessments, consistent with the conceptual model outlined in Figure 7.

Nairobi National Park © Jamison Ervin

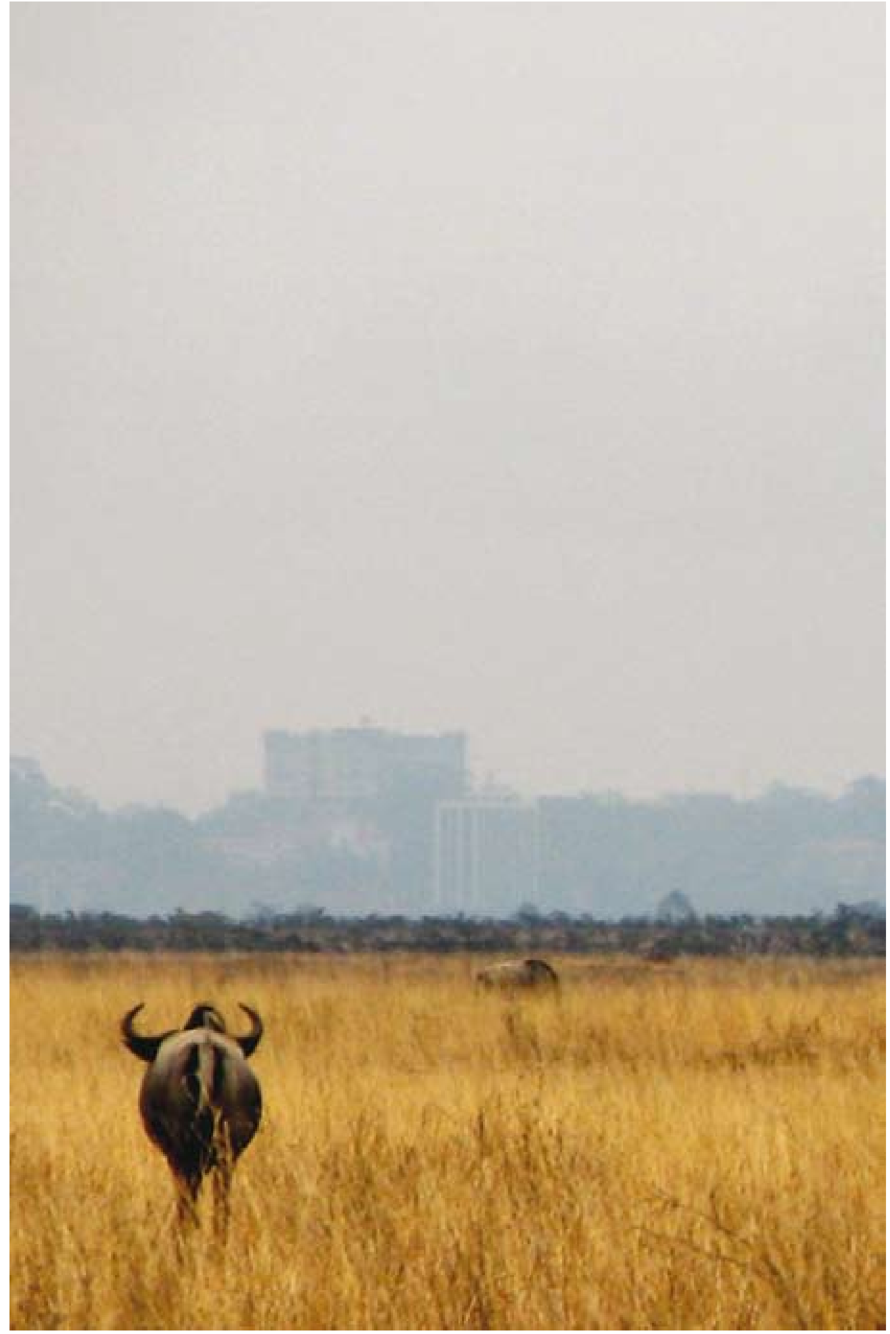


Table 11: Recommendations for incorporating climate change resilience principles into protected area threat assessments

RECOMMENDATION	DESCRIPTION
1. Explicitly identify climate change adaptation, mitigation and ecosystem resilience as a protected area objective	By explicitly identifying climate adaptation, mitigation and resilience as a protected area objective, planners are more able to incorporate these values into management planning, practices, monitoring and funding.
2. Explicitly identify the key biodiversity features that enable climate adaptation, resilience and mitigation	It is not enough simply to identify climate change adaptation and mitigation as a protected area management objective; planners must also specifically identify the key biodiversity features – the species, ecosystems and processes – that are fundamentally important to enabling climate adaptation and mitigation. For example, wild crop relatives, large blocks of intact forests, primary grassland grazers, corridors along important gradients, and sea grass beds might all be considered key biodiversity features for climate adaptation.
3. Incorporate climate resilience thresholds into threat assessments	Most protected area threat assessments use a simple gradient, such as low to high, or 0 to 1, to assess the relative degree of threats within a given area. This does not provide planners with the information that they need to know whether threat levels are likely to reach serious thresholds that would result in a regime shift, and thereby reduced resilience of the system to climate change impacts. Therefore, planners should measure not only the relative severity of impacts from threats, but also the resulting distance from key thresholds and tipping points.[168]
4. Assess the synergies between a variety of threats, including climate impacts, and develop time frames consistent with climate change scenarios	Many threats have negative synergies with one another, and many of these have negative synergies with climate change.[169] Nearly all protected area threat assessments, however, use a simple additive approach to combine threats. A synergistic look at threats, particularly one that includes climate impacts, provides managers with a more accurate view of the true status of threats, and would help in gauging distance to critical thresholds. In addition, there are many uncertainties in any prediction of the impacts of climate change. A threat assessment should acknowledge these uncertainties by incorporating multiple future climate scenarios, and consider how threats would affect biodiversity under these different scenarios.[170] Finally, many protected area threat assessments focus on short time horizons (e.g., 3 to 5 years), consistent with the timeline for management planning. However, many authors suggest a timeline of 20 to 30 years for climate change, in order to adequately be able to plan for and adapt to future impacts.[171]
5. Incorporate climate change vulnerability assessments into threat assessments, and include predicted range shifts of species and habitats under different climate scenarios	Protected area threat assessments typically do not include a species-by -species accounting of their sensitivity to specific threats.[172] However, incorporating a vulnerability assessment into a threat assessment by looking at how vulnerable species and systems are to climate change would provide planners with much richer, informative and actionable results, targeting those species most vulnerable to climate change impacts.[173] Furthermore, protected area threat assessments typically look at how threats affect current patterns of biodiversity. Planners should incorporate predicted shifts in species and habitats as part of their prediction of ecological response.[174]

The amphitheatre, Drakensburg © Anthea Stephens

Case study: Assessing the negative impacts of climate change in South African grasslands

The UNDP/GEF project *National Grasslands Biodiversity Program*[175] focuses on ensuring that production sectors are directly contributing to the achievement of biodiversity conservation priorities within the grasslands biome. As part of this project, the South African National Biodiversity Institute is assessing the negative impacts of climate change in South Africa, particularly on grasslands. The negative impacts of climate change include the spread and growth of invasive alien species, alteration of fire regimes, and disruptions in water flows in critical watershed areas. For its monitoring and evaluation reports, the National Grasslands Biodiversity Program is using remote sensing and national land cover data to monitor key biodiversity areas in order to reveal emerging climate change patterns and their effects on grasslands.

Best practice 12: Address threats that exacerbate climate change impacts

Numerous authors have explored the synergistic relationship of a variety of threats with climate change.[176] These multiple threats combine to create greater impacts with climate change than they would simply added together, because of negative feedback loops. For example, draining of peat lands accelerates the drying process likely to take place in a warmer climate, converting these areas from carbon sinks to carbon sources.[177] Therefore, planners should consider simultaneously targeting, preventing and mitigating those threats that exacerbate the impacts of climate change. Table 12 identifies several of these threats, and highlights their potential interactions with climate change.

Table 12: Threats that exacerbate the impacts of climate change

THREAT	INTERACTIONS
Acidification	Climate change will likely accelerate the acidification of streams, soils and oceans, thereby negatively affecting the recovery process of lakes that have acidified from pollution,[178] reducing the vigor for forests evolved to grow on calcareous soils,[179] and reducing the resilience of coral reefs to other stresses such as pollution,[180] among other impacts.
Eutrophication	Warmer temperatures will lead to higher levels of stream eutrophication, exacerbating other threats to stream systems, such as agricultural runoff and siltation from logging.[181]
Land cover alteration	Headwaters, those higher elevation cradles for river and stream systems, will be especially vulnerable to land cover alterations, especially when such areas face increased drought and/or increased flooding. As a result, they will be less able to regulate the flow of water.

Fire	Increased frequency and intensity of fire regimes can lead to permanent regime shifts, further reducing resilience to climate change impacts. For example, fires in Australia in the early 200s burned more intensively than they have in over 500 years, leading to long-term and perhaps permanent changes in the ecosystem.[182]
Invasive species	Invasive alien species typically out-compete native species, resulting in changes in population structures and dynamics. Such changes reduce the resilience of species and systems to climate change, and increase the likelihood of a regime shift. For example, *Chromolaena odorata*, an invasive alien species in South Africa, has transformed large expanses of grasslands within national parks into scrublands, reducing habitat for grassland-dependent species.[183]
Forest fragmentation	Fragmentation can interact with climate change by amplifying the difficulties that species face in shifting their ranges to cooler areas,[184] increasing local temperatures,[185] and providing pathways for invasive species,[186] which further reduces the overall vigor and resilience of ecosystems.
Draining and mining of peatlands	Peatlands are one of the planet's major carbon pools, containing about one-third of global soil carbon. Peat bogs drained for agriculture emit about 3,000 kg of carbon per ha per year. The effect of peat mining in boreal areas is similar to that of burning fossil fuels: the peat carbon store is largely transformed into CO_2. Both in Europe and Asia, emissions from degraded peatlands are projected to increase in coming decades, and the melting of permafrost peatlands in Russia as a result of degradation is predicted to release methane comparable to the emissions of carbon from burning fossil fuels.
Overharvesting of biological resources	Overharvesting of biological resources can change community structures and dynamics, leading to ecological systems that are less resilient to vulnerable from climate change impacts, and more likely to experience regime shifts and population crashes.

Mother and child, Côte d'Ivoire © Jamison Ervin

Case study: Addressing multiple threats in the national parks of Tanzania

The UNDP/GEF project *Strengthening the Protected Area Network in Southern Tanzania: Improving the Effectiveness of National Parks in Addressing Threats to Biodiversity*[187] focuses on supporting Tanzania's efforts to improve the representation of biodiversity protection within southern Tanzania, and to buffer and reduce threats to national parks. Although Tanzania's national park estate is relatively effective at buffering biodiversity from threats, it is not entirely immune. Unlike many other protected areas in Southern Africa, the protected areas in Tanzania are not fenced, and therefore support large numbers of wildlife during periods of seasonal migration. However, this also leads to numerous threats, including human-wildlife conflicts; unplanned conversion of forest, woodland and grassland to agriculture; poaching of wildlife; and farming and settlements in migration corridors and dispersal areas. Climate change will exacerbate these pressures, and could lead to changed distributions of biodiversity components, as well as to changes in community and private sector demands on wildlife and forest resources. To manage these changing conditions, and to buffer the national parks from these multiple threats, the project focuses on a landscape scale instead of small patches, and focuses on developing sufficient buffer zone protection against short-term change. Additionally, with project support, the Tanzanian National Parks Authority is predicting the medium- and long-term impacts of climate change, and developing management and policy responses.

Best practice 13: Determine the effects of threats on livelihoods and ecosystem services

Nearly all protected area threat assessments focus on threats to biodiversity. However, the multiple threats facing protected areas have an impact on more than just biodiversity – they affect the livelihoods and ecosystem services upon which communities depend. Therefore, threat assessments should also incorporate indicators and metrics for gauging the impact of threats, including climate change, on livelihoods and ecosystem services. Planners can do so by treating these issues in the same way they treat key biodiversity features – by identifying key parameters, by setting measurable goals and objectives, by mapping their extent and distribution, and by developing indicators for their vulnerability to threats.

Efforts to assess and manage threats and to restore degraded areas are vital to ensuring that protected areas are able to fulfill increased societal expectations.

Kure Mountains National Park © Yildiray Lise

Case study: Confronting the threats facing livelihoods and ecosystem services in Turkey

Turkey's forests are expected to meet the collective needs of Turkish society by supporting ecological functions—such as providing water, purifying air, and protecting soil—while also providing economic benefits and employment for local communities. However, Turkey's forests face several threats, including overgrazing, cutting and encroachment, and a root cause behind these threats is the poverty in forest villages. To address this, the UNDP/GEF project *Enhancing coverage and management effectiveness of the subsystem of forest protected areas in Turkey's national system of protected areas*[188] is preparing a livelihood strategy for those villagers who live near forest protected areas in order to create alternative incomes, support ecotourism activities in the area, increase the level of participation in protected area management planning processes, and increase their access to renewable energy resources. The project applies ecosystem-based biodiversity conservation through integrated forest management planning.

Protected area restoration

Introduction

The need to restore ecosystems and critical habitats within protected areas has been well recognized. Driven in part by an increasing understanding of the role of viable and functioning protected area networks in enabling climate change adaptation, the global protected area community has begun to place a strong emphasis on the restoration of protected areas. At a recent intergovernmental meeting, for example, the world's governments repeatedly noted the importance of restoration within protected areas, and agreed to "…increase the effectiveness of protected area systems in biodiversity conservation and their resilience to climate change, and other stressors including invasive alien species, through increased efforts in restoration of ecosystems and habitats," among many other restoration commitments.[189]

Traditionally, protected area restoration has focused on improving the overall condition of degraded habitats as part of species management and recovery plans. Restoration activities include, for example, prescribed burning, removal of invasive species, reintroduction of top predators and other key species, barrier removal (such as fencing and dams), and afforestation on deforested lands.[190]

Efforts to assess and manage threats and to restore degraded areas are vital to ensuring that protected areas are able to fulfill the increased societal expectations placed upon them. However, if protected areas are to be effective in meeting new expectations related to climate change, ecosystem services and sustainable livelihoods, then efforts to restore ecosystems must be updated and reconsidered.

↘Best practice 14: Plan restoration efforts around resilience and climate change

Because of the urgent need to develop landscapes that are resilient to the impacts of climate change, and that enable human and natural communities to adapt to these changes over time, the practice of restoration needs to evolve from a practice that focuses primarily on repairing damaged ecological structure (replanting forests, stream bed repair, species introduction, artificial coral habitat), to a practice that focuses on repairing ecological structure, repairing and strengthening existing ecological functions and processes, and anticipating changes in ecological structure and function.

To do so would require some subtle changes in how restoration projects are planned, executed and assessed. Some of these changes are:

- » Focusing restoration efforts on thresholds of resilience under anticipated scenarios from climate change, in addition to thresholds based on historical ranges and acceptable range of variation[191]
- » Focusing restoration efforts on those areas most likely to have negative synergies with multiple threats, including climate change
- » Focusing restoration efforts on areas important for species adaptation, including ecotones, altitudinal, latitudinal and in some cases longitudinal gradients, and riparian and connectivity corridors
- » Focusing restoration efforts on refugia and areas important for climate resilience, including large and intact habitat patches, particularly areas with a history of resilience and resistance to stressors
- » Focusing restoration and species recovery projects on those species most vulnerable to the impacts of climate change

Bulev mokh peatland in Belarus, one year after restoration © Alexander Kozulin

Case study: Restoring damaged peatlands in Belarus

The majority of protected areas in Belarus contain peatland ecosystems. The hydrological regimes of many of these peatlands were heavily disturbed by channels dug for past forestry activities or for peat extraction. Recessed water levels and frequent droughts in these damaged mires often resulted in frequent peatland fires, further exacerbating the damage. To address this problem, a UNDP/GEF project called *Catalyzing Sustainability of the Wetland Protected Areas System in Belarusian Polesie through Increased Management Efficiency and Realigned Land Use Practices*[192] focuses on rehabilitating damaged peatlands. As a result of water being raised to natural levels, emissions from the peatland fires were eliminated, and the processes of restoration of mire vegetation and biological diversity has begun. Nesting of such bird species as black-tailed godwit, greater spotted eagle, and bittern serve as an indicator of the restoration of the mire ecosystems. The stabilization of water levels made it possible to ensure the long-term sustainability of the mire ecosystems even in changing climatic conditions such as droughts and floods.

Issues, challenges and solutions in protected area threat assessments and restoration

- To date, there is no simple, comprehensive, user-friendly approach to rapidly assess threats to biodiversity, ecosystem services, and sustainable livelihoods within protected areas, nor is there a methodology that accurately gauges the relative impact on key biodiversity features from a range of threats and incorporates threat synergies under different climate scenarios. The development of such a system should be a priority among universities, donors, non-governmental organizations, and park agencies.

- Synergies between threats, while generally acknowledged in the literature, are not typically quantified or measurable, making it difficult to incorporate threat synergies into threat assessments. However, planners can develop rules of thumb, and incorporate simple metrics (such as low, medium, high, very high) in order to identify systems likely to face negative synergistic effects.

- Unless stakeholders can see the immediate and tangible benefits, restoration is typically not a high-priority activity. It is often costly, and may take years to be able to yield measurable results. Planners can build support for restoration by encouraging full cost-benefit analyses that clearly show how the costs of restoration are more than offset by future benefits.

- Planners and planning agencies typically plan in 5-year or at most 10-year timeframes. It will likely be a challenge to plan on a 20- or 30-year timeframe. Planners can overcome this challenge by developing a detailed plan for 3 to 5 years, a less detailed plan for 10 years, and a general plan for 20 to 30 years that outlines general directions, goals and objectives, rather than attempt to develop 30-year management plans with specific activities and budgets. They can then periodically review and update progress on shorter-term plans in light of these longer-term objectives.

The practice of protected area restoration needs to evolve to focus on building resilience to climate change.

Indigenous People: Shavante Indians of Mato Grosso, Brazil © UN Photo/Joseane Daher

Karakalpakstan women with watermelons in the proposed Tugai Biosphere Reserve © Adriana Dinu

Theme 4

Protected Area Governance and Participation

Overview

In the vast majority of protected areas worldwide, local communities are an integral part of protected areas. Whether they live within or adjacent to the protected area or buffer zone, depend upon protected area resources for their subsistence and/or livelihood, or have a suite of rights and/or responsibilities in management decisions and/or resource use, stakeholders have a pivotal role to play in protected area design, management and assessment.[193] This section addresses two key themes related to stakeholders: protected area governance, and stakeholder participation.

Protected area governance

Introduction and analysis

Protected areas have traditionally been viewed as primarily government-run enterprises.[194] As a result of increasing awareness of different protected area management categories,[195] governance types,[196] and other conserved areas,[197] and a better understanding of the benefits of these different types and categories,[198] there has been increased government, donor and community interest in promoting a wider array of protected area governance systems. This section focuses on assessing, recognizing and promoting a broad set of protected area governance types within protected area systems, a theme related to Goal 2.1 of the Programme of Work on Protected Areas. Goal 2.1 states that governments should promote equity, benefits sharing, and diverse governance types within their protected area systems. Specific activities under this goal include:

- Assess the costs, benefits and impacts of establishing and maintaining protected areas
- Recognize and promote a broad set of protected area governance types
- Establish policies and mechanisms to legally recognize indigenous and local community conserved areas
- Use protected area benefits to reduce poverty
- Engage indigenous and local communities in participatory planning
- Establish and strengthen policies to address fair and equitable benefits from access to genetic resources

Recent advances in governance include the development of a governance matrix that includes categories developed by the IUCN (World Conservation Union) on one axis, and a range of public, private, community and co-managed types on the other[199] (see Table 13).

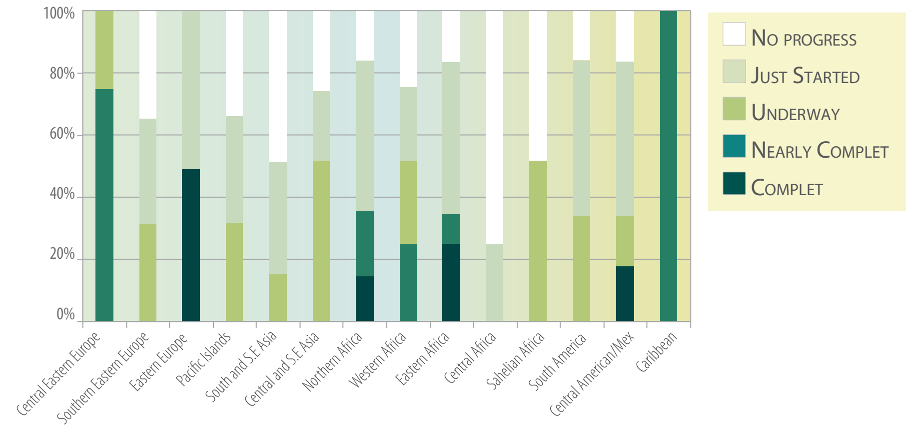
Even with an increased recognition of the role of indigenous reserves, private areas and community conserved areas, the idea persists that protected areas are synonymous with government parks.

Table 13: Matrix of IUCN protected area categories and governance types

GOVERNANCE TYPES / PROTECTED AREA CATEGORIES	A. GOVERNANCE BY GOVERNMENT			B. SHARED GOVERNANCE			C. PRIVATE GOVERNANCE			D. GOVERNANCE BY INDIGENOUS PEOPLES & LOCAL COMMUNITIES	
	Federal or national ministry or agency	Sub-national ministry or agency (e.g., province, state)	Government-delegated management (e.g., to an NGO)	Transboundary management	Collaborative management	Joint management	Declared and run by individual landowner	Declared and run by non-profit organization	Declared and run by for profit corporations	Indigenous territories and conserved areas	Community conserved areas
I a. Strict Nature Reserve											
Ib. Wilderness Area											
II. National Park											
III. Natural Monument											
IV. Habitat/ Species Management											
V. Protected Landscape/ Seascape											
VI. Managed Resource Protected Area											

Even with an increased recognition of the role of indigenous reserves, private areas and community conserved areas, the idea persists that protected areas are synonymous with government parks. As a result, governments often do not consider private, community and indigenous protected areas to be an integral part of their nation's protected area network, and governance assessments have lagged behind many other key assessments. Figure 8 shows global progress in completing assessments of governance types across more than 100 countries.

Figure 8: Global progress in assessing governance types worldwide[200]



In a recent review of over 100 articles, the single most frequently cited measure for climate adaptation is the expansion of the number and coverage of protected areas.[201] Many studies advocate the protection of a significant percentage of terrestrial and marine areas in order to mitigate the impacts of climate change, and ensure that critical ecosystem functions are maintained.[202] Yet the total coverage of terrestrial protected areas is less than 14 percent, and of marine areas it is less than 2 percent. Even if the total extent of areas with alternative forms of governance – community, private and indigenous protected areas – were fully accounted for, the total terrestrial area under some form of protection would still be far short of what is needed. Without adding substantial new investments in establishing protected areas of all kinds, we will likely face a continued decline and loss of biodiversity, the unraveling of ecosystems and the services they provide, and the crossing of irreversible tipping points and natural thresholds.

Best practice 15: Promote the widest possible array of protected area governance types

A shift in thinking about the assessment and promotion of protected area governance is required – one that embraces the widest possible range of protection and conservation options, and that looks beyond IUCN categories to include other types and forms of conservation.[203] Table 14 shows a range of different types of "other conserved areas," defined as those lands and water that are managed for multiple objectives that may or may not include biodiversity conservation, but they still provide conservation benefits.[204] Only by fully promoting such options locally, nationally, regionally and globally, along with promoting the widest possible range of governance types, will there be a hope of increasing the protected area estate required to create climate-resilient landscapes.

Table 14: Examples of other conserved areas[205]

Agriculture:	» Legally established agricultural reserves » Third-party organic certification (e.g., International Federation of Organic Agricultural Movements)[206] » Voluntary agreements on sustainable agricultural practices
Forest management:	» Legally established forest reserves » Third-party forest certification (e.g., Forest Stewardship Council) » Voluntary forest management practices and codes of best practice
Marine fishing	» Legally established marine reserves » Third-party certification (e.g., Marine Stewardship Council) » Community no-take zones » Voluntary easements of seagrass beds

Freshwater fishing	» Legally established fish management practices and areas » Third-party certification of organic aquaculture » Voluntary landowner agreement for stream management
Ecosystem services	» Legally established systems, such as those for avalanche control » Third-party certification, such as forests managed for water quality » Voluntary agreements such as the retention of mangroves for fish and storm surge protection » Areas designated as carbon storage areas » Areas designated specifically for maintaining ecosystem services
Wildlife protection areas and managed hunting areas:	» For-profit private hunting and game reserves » Private protected areas

It is clear that an array of governance types and protected area categories will need to be established in order to create a landscape and seascape resilient to climate change, and to maintain key ecosystem services over time. However, the preconditions and enabling environment that are required to promote and sustain innovative forms of governance are less clear. Planners should consider the following questions when considering ways to create an enabling environment for the promotion of innovative forms of governance:

- What are the most feasible and appropriate types of governance for the country?
- Are there precedents for alternative governance types that could be expanded upon, adapted and replicated?
- What laws and policies would be required in order to be able to establish innovative forms of governance?
- What laws and policies are constraining alternative forms of governance from developing and flourishing?
- What positive and negative financial incentives might be created that could help foster innovative forms of governance?
- What perverse incentives are inhibiting innovative forms of governance from flourishing?
- How receptive are existing agencies to collaborating with alternative forms of governance and exploring co-management arrangements within and between protected areas and other conserved areas?
- What steps might be needed at local, national and regional levels to promote acceptance of, and integration with, alternative forms of governance?

An array of governance types and protected area categories will be needed to create a landscape and seascape resilient to climate change.

Guatemala - High Plateau © UNDP Photo Library

Case study: Exploring and supporting governance options for municipal regional parks in Guatemala

The UNDP/GEF project *Consolidating a System of Municipal Regional Parks in Guatemala's Western Plateau*[207] strengthens municipal-community partnerships in Guatemala. By enabling communities to manage and operate municipal regional parks, the project helps to showcase the viability of municipal-community partnerships. Initially the project envisioned consolidating the municipal regional parks into a sub-system of the national protected area system. In the course of implementation, however, the project developed a new concept—to replace the idea of a sub-system with a broader regional alliance that will provide the support necessary to effectively manage the municipal regional parks. The project proved that municipal regional parks can be established under a governance category that enables local decentralized management of protected areas. This is of particular importance in the Guatemalan context, where centralized institutions have many limitations in providing effective oversight and management of all protected areas within the national system.

Humboldt penguins - Chile © SRstock

Case study: Innovative coastal and marine governance in Chile

A UNDP/GEF project in Chile called *Conserving Globally Significant Biodiversity along the Chilean Coast*[208] focuses on assisting the Chilean government in conserving and sustainably managing marine and coastal biodiversity. The primary conservation tool is the establishment of multiple-use marine coastal protected areas in critical areas along the Chilean coast. The project has supported the legal establishment, demarcation and implementation of three multi-use coastal and marine protected areas, each with restricted use and core zones, and effective funding and governance structures in place. This new governance model was created during the project's preparatory phase based on joining existing laws from multiple zones into a single legal instrument. The project includes the establishment of a multi-institutional regional commission and a multi-stakeholder corporation composed of public, private and community representatives. This new model demonstrates the potential for inter-institutional and multi-stakeholder modes of governance for the use and conservation of Chile's coastal and marine resources.

Protected area participation

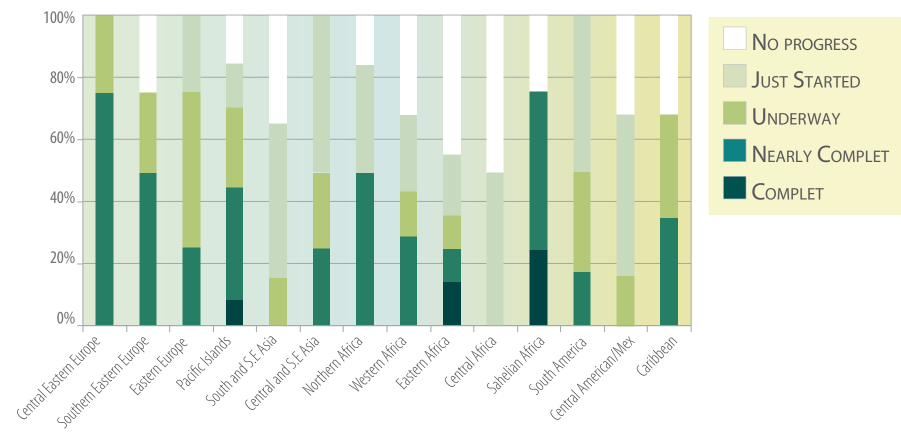
Introduction and analysis

Public participation has long been viewed as an important strategy for gaining community support for protected areas. This section focuses on the participation of diverse stakeholder groups in protected area planning and management, a theme related to Goal 2.2 of the Programme of Work on Protected Areas. Goal 2.2 states that governments should promote effective participation, diverse governance types, and equity and benefit-sharing within their protected area systems. Specific activities related to this goal include:

- Review mechanisms for involving stakeholders
- Implement plans to effectively involve indigenous and local communities
- Support participatory assessment exercises to identify societal knowledge, skills and resources
- Promote an enabling environment for the involvement of indigenous and local communities in decision making
- Ensure that resettlement only takes place with prior informed consent

Typically defined as "a process through which stakeholders influence and share control over development initiatives, decisions and resources which affect them," the traditional emphasis in participation has been on identifying representative groups of stakeholders who may be directly or indirectly affected by protected area policies and management practices and including them in management planning and decision-making processes.[209] Figure 9 shows global progress in assessing the participation of indigenous and local communities across more than 100 countries.

Figure 9: Summary of global progress in assessing participation needs[210]



Given the emerging model of protected areas (described in the Introduction of this report), it is natural that precepts about participation are also evolving. Effective participation is increasingly recognized as being important for far more than gaining community support for management objectives; participation is increasingly viewed as a vital component in identifying and sustaining protected area benefits and services, identifying and reducing protected area threats, and adapting to the impacts of climate change.

Best practice 16: Effectively engage stakeholders in issues related to climate change adaption and threat reduction, ecosystem services, and sustainable livelihoods

In order to effective engage stakeholders in the issues of climate change, ecosystem services and sustainable livelihoods, planners may need to explore new questions and issues related to participation. For example, the concept of "biocultural diversity," defined as the full array of biological, cultural and linguistic diversity which are interrelated within a complex socio-ecological adaptive system,[211] may be particularly helpful in reevaluating who participates and why in protected area planning, management and assessment, since human adaptation to climate change requires an intimate understanding of the interrelationships between humans and nature.[212] Table 15 includes a suite of issues protected area planners may need to consider as they update their approaches to participation.

TABLE 15: POTENTIAL STAKEHOLDER CONTRIBUTIONS TO CLIMATE CHANGE, ECOSYSTEM SERVICES, AND SUSTAINABLE LIVELIHOODS

	CLIMATE CHANGE ADAPTATION, RESILIENCE AND THREAT REDUCTION	ECOSYSTEM SERVICES	SUSTAINABLE LIVELIHOODS
Potential ways that various stakeholders can contribute	» Contribute to the formulation of local climate adaptation plans, especially those involving the protected area » Provide an early detection and warning system for climate-related and climate-exacerbated threats, such as invasive species » Identify localized impacts of climate change and assist in monitoring local weather and phenological changes » Where agro-biodiversity systems exist, share traditional knowledge on farming practices that maintain crop and genetic diversity, and participate in agricultural trials with species resistant to drought, flooding and higher temperatures, higher salinity levels	» Contribute to the formulation of water management policies and monitor and regulate water use » Participate in payment for ecosystem services schemes in buffer areas, riparian areas, headwaters, and other areas important for ecosystem services » Participate in market incentive schemes for sustainable forest management, such as independent certification bodies in key areas within and adjacent to protected areas	» Identify the suite of potential options for developing sustainable livelihoods » Establish guidelines and limits to sustainable resource use and develop harvesting best practices based on traditional knowledge » Identify zones for resource use within protected areas, corridors and buffer zones » Help determine access and benefit-sharing policies related to sustainable livelihoods » Participate in economic development projects within and near protected areas, such as ecotourism
Key questions for planners to consider	» Who will likely be most negatively affected by climate change? » Who has the ecological and agricultural knowledge needed to contribute to climate change resilience? » Who is best placed to detect climate change impacts on the ground, monitor impacts and provide early detection services?	» Who will, could and should benefit from ecosystem services that are generated? » Who manages resources that are likely to have an impact on the maintenance of ecosystem services? » Who has traditional knowledge about maintaining key ecosystem services?	» Who is most critically dependent upon protected area resources for their livelihoods? » Who might benefit most from new alternatives for sustainable livelihoods? » Who might be adversely affected by the creation of new livelihood alternatives?

Peru - Titicaca © UNDP Photo Library

Case study: Encouraging sustainable agro-forestry livelihoods for indigenous communities in Peru's Central Andes

The Yungas region on the eastern slope of Peru's Central Andes, inhabited by 32,000 indigenous inhabitants, is a region of globally significant biological and cultural diversity. The project *Sustainable Development in Asháninka Lands*[213] aims to establish sustainable agro-forestry production systems in all native communities by the end of the project. Through these agro-forestry systems, villagers identify the most valuable and representative species within the micro-ecosystems present in Asháninka lands. Each agro-forestry production system is associated with a variety of crops, plants and trees, which will collectively allow the conservation of valuable species in terms of genetic diversity, and will simultaneously serve a range of nutritional, medicinal, commercial and biocide purposes.

Philippines © UNDP Photo Library

Case study: Developing sustainable livelihoods in Samar Island Nature Park, Philippines

Samar Island is one of the most impoverished regions of the Philippines, with as much as 45 percent of the population living below the national poverty line. Creating sustainable livelihood opportunities based on the island's natural resources has therefore been a major focus of this project. A UNDP/GEF project called *Samar Island Biodiversity Project: Conservation and Sustainable Use of the Biodiversity of a Forested Protected Area*[214] aims to promote livelihood options, develop a biodiversity-based livelihood framework, and identify feasible livelihood activities for 62 local communities in the core and buffer zones of Samar Island Nature Park. Specifically, the project is developing sustainable livelihoods in three primary sectors—the collection of non-timber forest products, ecotourism and agriculture—each of which were identified through market assessments and feasibility studies.

Issues, challenges and solutions

In promoting alternative governance types

- New laws and incentives are difficult and time-consuming to create, especially when the benefits are untested and unproven. Planners can look to other neighboring or similar countries for models of governance they are trying to promote, and for examples of legal frameworks and incentives.

- The cultural milieu in some countries may not allow a very wide range of governance types. Planners should carefully delineate which types may be feasible in their particular context, and work within this range.

- Protected area and other resource agencies may not have experience in working with other conserved areas and alternative forms of governance. Pilot studies in a particular site or region can help planners understand the challenges and opportunities, and learn what might work at a national level.

In improving protected area participation

- One of the major costs of protected area management is the engagement of stakeholders in participatory processes. The cost of travel and meetings can be significant, especially when planners must also incorporate aspects related to climate change adaptation, ecosystem services, and sustainable livelihoods, each of which may require different sets of stakeholders. Planners may want to find efficient and streamlined means of promoting participation, including streamlining with other participatory biodiversity planning processes, such as developing National Biodiversity and Strategy Action Plans and National Adaptation Programmes of Action. They may also want to explore alternative technologies, including cell-phone technologies, in order to reduce the costs and carbon footprint of traditional meeting-intensive participatory processes.

- Promoting increased participation in order to adapt to climate change, sustain ecosystem services, and promote alternative livelihoods will invariably involve discussions regarding access to, and sharing the benefits of, natural resources within protected areas. This may raise the likelihood of conflicts within local communities, between local and distant stakeholders, and between protected area staff and local communities. Planners should proactively anticipate conflicts by adopting best practices related to access and benefit sharing from within protected areas,[215] and by developing transparent and effective dispute resolution mechanisms.

One of the fundamental tenets of the Programme of Work on Protected Areas is that in order to be effective, protected area networks must achieve financial sustainability.

Park Guide: Nyungwe National Park, Rwanda © Nik Sekhran

Theme 5

Protected Area Capacity

Overview

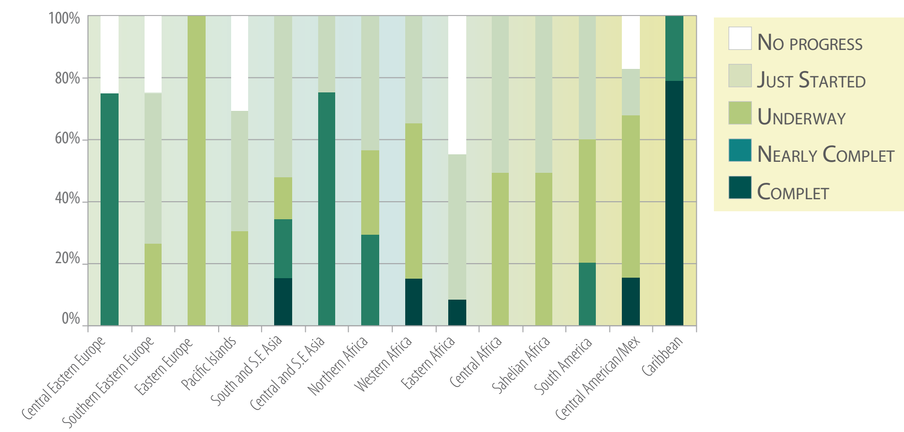
Protected area capacity is defined as the skills, knowledge and resources needed to implement key management actions at individual, systemic and institutional levels.[216] Protected area capacity is a cornerstone of effective management – staff numbers have a direct correlation with high ecological integrity, community relations, management planning and other factors of management effectiveness.[217] Inadequate protected area capacity is one of the most limiting factors in effective management – in some countries, there is only an average of one permanent staff person per protected area, and the average number of hectares per staff person in Latin America, for example, is 83,000.[218] Therefore, protected area capacity is a critically important issue.

Introduction and analysis

A capacity needs assessment is a fundamental need across all protected areas – it goes hand in hand with management planning, to ensure that the management team has the skills, knowledge and resources required to implement the plans. Traditionally, protected area capacity needs assessments have focused on the skills needed for staff to manage biodiversity, reduce threats, manage visitors, and more recently, to engage stakeholders.[219] Figure 10 shows global progress in assessing protected area capacity needs across more than 100 countries. This section focuses on assessing capacity needs and strengthening capacity building efforts, themes that are related to Goal 3.2 of the Programme of Work on Protected Areas. This goal states that governments should build capacity for the planning, establishment and management of protected areas. Specific activities under this goal include:

» Complete national protected area capacity needs assessments and establish capacity building programs
» Establish mechanisms to document existing knowledge on protected area management
» Exchange lessons learned among countries
» Strengthen the capacity of institutions to establish cross-sectoral collaboration for protected area management
» Improve the capacity of protected areas institutions to develop sustainable financing

FIGURE 10: GLOBAL SNAPSHOT OF PROGRESS IN ASSESSING CAPACITY NEEDS[220]



↘Best practice 17: Focus capacity-building efforts on capacities needed to address climate, ecosystem services and livelihoods issues

Across every protected area theme, the emerging issues of climate change resilience, mitigation and adaptation; ecosystem services; and sustainable livelihoods will require new capacities. Table 16 identifies general areas of knowledge and skills that will be most important for implementing the changes recommended in this guide.

Table 16: Examples of key capacities needed to address climate, ecosystem services, and livelihoods issues

TOPIC	DESCRIPTION OF CAPACITIES NEEDED TO ADDRESS EMERGING ISSUES
Protected area policy environment and sectoral integration	Knowledge and skills on how develop appropriate policies, laws and incentives that will better address and promote climate change resilience, ecosystem services, and sustainable livelihoods; how to develop policies that safeguard natural resources between conflicting social and biodiversity objectives; and how to work with new sectors (e.g., with development agencies, disaster relief agencies, etc.) to integrate protected area issues relating to sustainable livelihoods, ecosystem services, and climate change resilience planning into sectoral plans and strategies
Protected area valuation	Knowledge and skills on how to incorporate emerging themes related to climate change, ecosystem services, and sustainable livelihoods into protected area valuation studies, including developing quantifiable indicators for these issues
Management planning	Knowledge and skills on how to incorporate key issues on climate change resilience, ecosystem services, and sustainable livelihoods into management planning, and on how to balance competing interests when setting management objectives
Management effectiveness assessments	Knowledge and skills on how to develop management effectiveness indicators for climate change resilience, ecosystem services, and sustainable livelihoods
Monitoring and research	Knowledge and skills on how to develop baseline data for climate change resilience, ecosystem services, and sustainable livelihoods, and on how to design robust monitoring schemes for each
Threat assessment and restoration	Knowledge and skills on how to better assess and predict threats from climate change, how to assess and quantify threats to ecosystem services and sustainable livelihoods, and how to incorporate threat predictions into restoration efforts
Governance	Knowledge and skills on how to identify, assess and promote a broader range of governance types, and an understanding of the policy environment needed to promote these various governance types
Participation	Knowledge and skills on how to engage new groups of stakeholders in participatory planning processes, including knowledge of how to identify and engage a wider range of beneficiaries of ecosystem services, beyond local communities
Sustainable finance assessments and plans	Knowledge and skills on how to develop and promote a wide range of sustainable finance mechanisms, particularly those related to payments for ecosystem services and REDD and REDD+ mechanisms, and how to develop appropriate benefits-sharing programs for such systems
Protected area ecological gap assessment	Knowledge and skills on how to identify, spatially map, and quantify the relative importance of the contribution of specific areas to climate change resilience, ecosystem services, and sustainable livelihoods
Land/seascape connectivity and transboundary protected areas	Knowledge and skills on how to incorporate climate change resilience, ecosystem services, and sustainable livelihoods into the design and management of connectivity corridors and transboundary protected areas

Oryx and Namibia desert dune © Midori Paxton

Case study: Strengthening the capacity of Namibia's protected area system to manage climate change

The UNDP/GEF project *Strengthening the Protected Area Network*[221] is building capacity for park management in Namibia by removing existing barriers hindering effective management. The country is expected to be hit hard by climate change; predictions include increasingly erratic climate patterns causing severe droughts in some areas and floods in others. The project focuses on building the capacity for park management by improving protected area management effectiveness and by establishing new protected areas in ecologically strategic areas. A recent project assessment of climate change vulnerability and adaptation[222] revealed several areas for improving management, including: promoting activities that reduce bush encroachment, increasing water supply and reducing water demand, diversifying rural livelihoods, and reducing park-neighbor conflicts, among others. Recommendations for adapting to climate impacts by improving the protected area network included increasing the size and representativeness of the network, increasing protection of climate refugia such as mountainous areas with south-facing slopes, and increasing connectivity through the establishment of corridors and the removal of fences.

Rhodope Mountains - Bulgaria © Phil Edwards

Case study: Conserving habitat and maintaining ecosystem services through capacity development in Bulgaria

The project's activities have prevented the deterioration of forest and grassland ecosystems. The project and its partners have improved the capacity of the institutions responsible for the Western Rhodope, particularly activities targeting critical ecosystems. The project promotes forest certification practices that open the market for Forest Stewardship Council (FSC) certified timber. By June 2009 over 20000 ha of forests were certified. While providing the opportunity for higher timber prices, forest certification requires the application of sustainable forestry practices, which are expected to lead to the conservation of important species and habitats, and maintenance of ecosystem services.

Winnowing of "conservation-friendly" rice © Eleanor Briggs

Case study: Strengthening capacity by integrating sustainable livelihoods in Cambodia

A UNDP/GEF project called *Establishing Conservation Areas Landscape Management in the Northern Plains* [223] focuses on developing a landscape-level conservation program through a "Living Landscapes" approach. In this approach to conservation, the project aims to strengthen the capacity of local families by developing a range of livelihood activities, and by integrating these activities within the provincial planning process of Cambodia. For example, the project has a community-based ecotourism component that provides income to 150 families. Based on the income from this ecotourism program, the protected area agency has also been able to create local jobs for a new community wildlife monitoring program. The project is also working to improve household incomes by developing and marketing a line of "conservation-friendly" rice.

Issues, challenges and solutions in improving protected area capacity

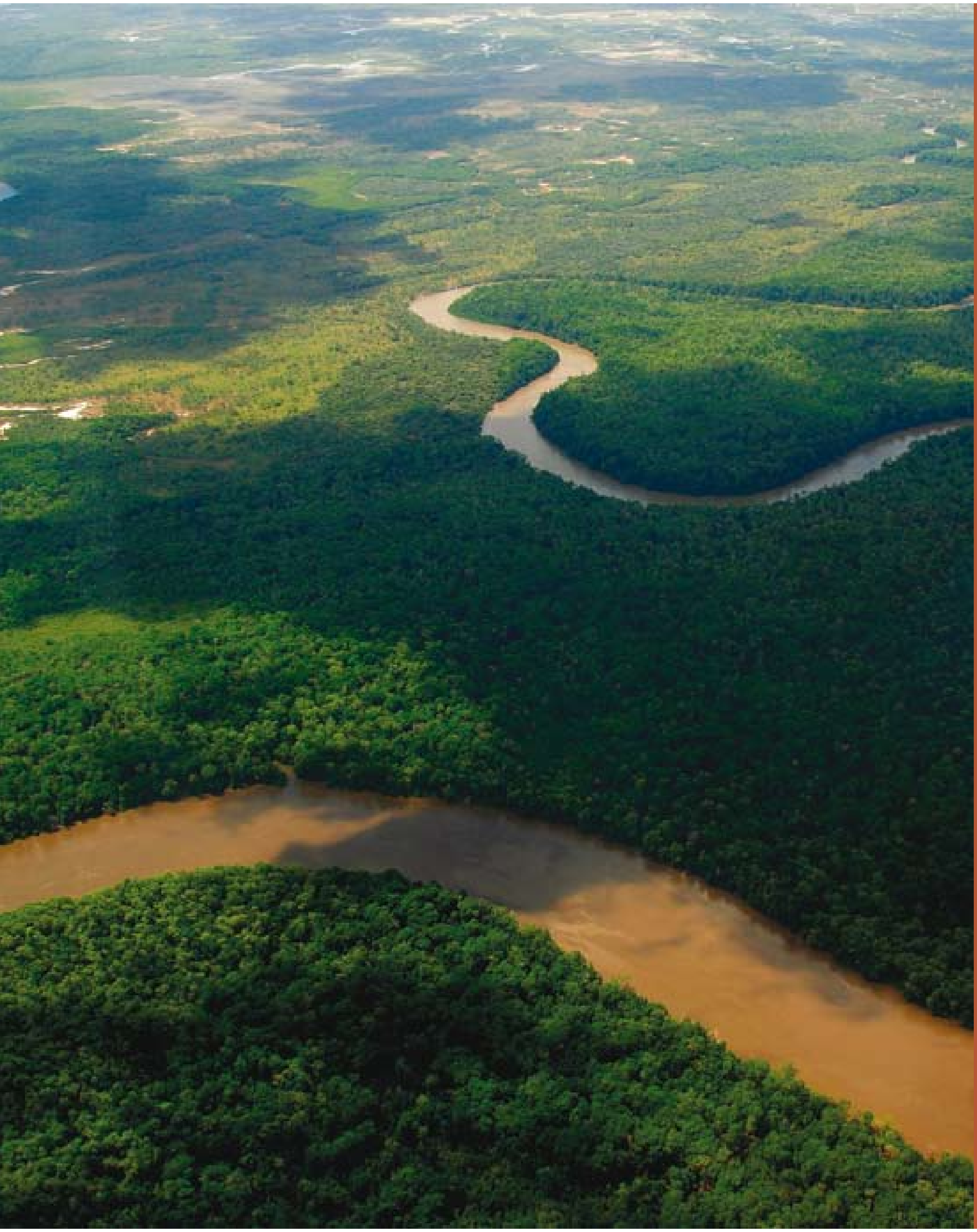
» The skills and knowledge required to implement the recommendations in this guide are not yet fully developed; there are both national and global capacity gaps in a number of key areas. In order to fill these gaps, planners should seek effective means of identifying and sharing innovative practices both globally and regionally, in order to quickly disseminate new practices.

» Many capacity-building projects are a one-time training event, and are not embedded in a national or regional program of long-term capacity building. In the absence of such a system, planners can create partnerships with universities to help conduct critical research, and develop tools and methodologies.

Inadequate capacity is one of the most limiting factors in effective protected area management.

Fishing in a local lake © Eleanor Briggs

AMAZON AERIAL PHOTO © SRSTOCK



Theme 6

Sustainable Finance

Overview

Establishing and managing protected areas requires a significant investment of financial resources: three separate studies estimated that the total annual cost for effective management of existing protected areas in developing countries ranges from US$ 1.1 billion to US$ 2.5 billion per year, and the total funding shortfall is estimated at between US$ 1 billion and US$ 1.7 billion per year.[224] This funding gap is expected to continue to grow as countries increase the number of protected areas, while maintaining or even decreasing levels of funding.[225] Investments in designing and creating a comprehensive protected area network, strengthening capacity, and improving the enabling environment must be coupled with adequate financing measures if protected areas are to be sustained into the future.

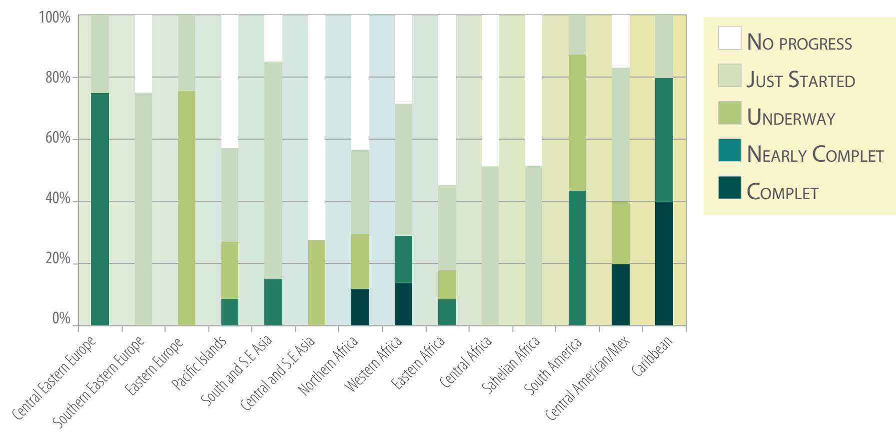
Introduction and analysis

One of the fundamental tenets of the Programme of Work on Protected Areas is that in order to be effective, protected area networks must achieve financial sustainability – that is, be able to secure stable and sufficient long-term financial resources, and cover the full direct and indirect costs associated with establishing and managing protected areas.[226] This section focuses on two of the major elements of Goal 3.4 of the Programme of Work on Protected Areas – assessing financial needs and developing a sustainable finance plan. This goal states that governments should ensure financial sustainability of protected areas and national and regional systems of protected areas, and specific activities related to this goal include:

- Assess financial needs and identify options for meeting these needs
- Establish and implement national sustainable financing plans
- Support international funding programs to support protected area systems in developing countries
- Collaborate with other countries to develop and implement regional sustainable financing programs
- Provide information on protected area financing to relevant institutions
- Encourage the integration of protected area needs into national development and finance strategies

In the past, protected area funding derived largely from annual government budget allocations.[227] Despite the growing global gap in protected area financing, few countries have completed an assessment of their financial needs (see Figure 11), and even fewer have developed a comprehensive sustainable finance plan.[228] A sustainable finance plan is a plan to attract sufficient and sustainable financial resources to effectively manage the protected area system, and it identifies and prioritizes strategies to fill funding gaps through diverse funding mechanisms. Achieving financial sustainability often requires major changes in the way that funding is conceptualized, captured and allocated, and relies on a diversified set of funding sources, ranging from the conventional (e.g., national budgetary allocations, overseas development assistance, entrance fees) to the innovative (e.g., payments for ecosystem services, trust funds, green taxes). By diversifying their funding portfolio, countries can achieve stable and sufficient long-term financial resources.

Figure 11: Summary of global progress on assessing financial needs[229]



The three issues discussed in this document – climate change, ecosystem services, and sustainable livelihoods – all have a direct bearing on protected area finance. Global concerns about the impacts of climate change have spurred efforts to create financing mechanisms for carbon sequestration, including within protected areas. Financial flows for the reduction of greenhouse gas emissions from REDD+ could reach up to US$ 30 billion a year, and the Copenhagen Accord[230] provides an opportunity for nations and agencies looking for ways to fund protected area systems to explore funding opportunities under REDD+. Growing awareness of the value of ecosystem services from protected areas will increasingly be coupled with interest in monetizing and capturing those benefits. The expectation that protected areas should sustain local livelihoods also has major financial implications for protected area managers and stakeholders – the implication is that protected areas will not only fund themselves, but also enhance local livelihoods and boost local economies.

↘Best practice 18: Create sustainable protected area finance plans with diverse finance mechanisms

Because of the substantial and growing gap between protected area finance needs and available funding, and because of the increased expectations of and demands on protected areas, planners will need to develop finance plans with diverse finance mechanisms. Such plans, which can include mechanisms that are applied to individual sites or to the entire system, should incorporate a wide range of financial mechanisms in order to create long-term financial stability. Table 17 highlights a range of protected area sustainable finance mechanisms that planners could consider.

Table 17: Examples of sustainable finance mechanisms for protected area sites and systems

Taxes and surcharges	» Taxes and surcharges from gas, oil, mining, coal » Hotel surcharges » Airport surcharges for tourists » Value-added taxes
Permits, fees and licenses	» Protected area entrance fees (including park 'passports' and direct entrance fees » Compensatory legal fees » Bioprospecting » Permits, licenses and surcharges for energy » Recreational permits » Use of logo by corporations » Payments for ecosystem services (e.g., water, carbon) » Concession fees,
Government funds	» National budgets » Multi-lateral donors » Bi-lateral donors » Debt-for-nature swaps » Trust funds
Donations, volunteers and cost sharing	» Personal donations » Corporate donations » Drop-box donations (both on site and off site) » Volunteer work to reduce staff costs » Cost-sharing, including co-management with NGOs » Voluntary surcharges (e.g., voluntary guest contributions at hotels) » Lottery proceeds
Direct sales	» Sale of products, goods and services from the protected area

The floodplain of the Stokhid River in Ukrainian Polesie © UNDP Photo library

Case study: Tapping the tourism sector for financial sustainability in Ukraine

In 2008, the government of Ukraine decided to extend its protected area estate to cover an area of more than 6 million ha. However, the financial resources available through the Nature Reserve Fund are far from adequate to facilitate this expansion in the immediate term. The UNDP/GEF project *Strengthening Governance and Financial Sustainability of the National Protected Area System*[231] aims to address this issue by improving Ukraine's financial sustainability and institutional capacity to establish, manage and finance these new areas. The project focuses on a) developing a comprehensive national strategy for protected area financing; b) establishing a set of regulations governing revenue generation and implementation of feasible revenue-generating options; c) introducing business planning as a standard practice in protected areas; and d) testing of private-public sector partnerships as a model for maximizing and fairly sharing revenues across protected areas. For example, within the project's demonstration sties, Pripyat-Stokhid National Park is visited by about 3,000 tourists annually, while Shatsk National Park is visited by more than 130,000 tourists annually. Part of the project is establishing tourism infrastructure, such as visitor centers, across many protected areas, and finding ways to share revenues across the system.

Sierra Nevada - Venezuela © Lila Gil

Case study: Diversifying the portfolio of financial mechanisms in Venezuela

Venezuela is a mega-diverse country with an impressive protected area estate, including national parks, natural monuments, wildlife reserves and wildlife sanctuaries. These protected areas face an enormous range of threats, including logging, hunting, mining and forest conversion. One of the principal underlying problems that prevent threats from being adequately addressed is the limited level of financial resources available for protected area management. For example, there are only 400 park guards for an area equivalent to 16 percent of the national territory. A UNDP/GEF project called *Strengthening the Financial Sustainability and Operational Effectiveness of the Venezuelan National Parks System*[232] aims to diversify and expand the income sources of the Venezuelan national parks system. Opportunities for generating income include donations from tourism, oil, gas and mining industries; payments for the commercial use of natural benefits generated by the national parks system; concessions; environmental taxes; payments for commercial use of the image of the protected areas; fines for transgressions of environmental law; and payments from tourists.

↘Best practice 19: Systematically assess the financial sustainability of protected area systems

UNDP has developed a scorecard for gauging the financial sustainability of a protected area system.[233] This scorecard identifies four core components of sustainable finance: assessing annual financial gaps; developing legal, regulatory and institutional frameworks for generating revenue; developing a business plan and associated financial management tools; and generating revenue from a diversified portfolio of mechanisms (see Table 18).

Table 18: Elements in UNDP's Financial Scorecard

1. **Annual finance gap –** financial gap between protected area annual budgets and protected area needs to conduct critical management activities
2. **Legal, regulatory and institutional frameworks**
   a. Policy support for generating revenue within protected areas
   b. Policy support for sharing revenue between protected areas
   c. Enabling conditions for establishing trust fund
   d. Arrangements to reduce government cost burden
   e. National protected area financing strategies
   f. Economic valuation of protected area system
   g. Improved government budgeting
   h. Clearly defined institutional responsibilities
   i. Sufficient staffing requirements and structures
3. **Business plans and financial management**
   a. Site-level management and business planning
   b. Transparent accounting procedures
   c. Financial monitoring system
   d. Effective budget allocation methods
   e. Effective financial training and support
4. **Revenue generation**
   a. Variety of revenue sources
   b. User fees established across the system
   c. Effective fee collection systems in place
   d. Communication strategy to increase awareness
   e. Operational payment for ecosystem services schemes
   f. Concessions operating within protected areas
   g. Training programs on revenue generation mechanisms

Vietnam © UNDP Photo gallery

Case study: Assessing barriers to sustainable finance in six countries

A UNDP/GEF-supported study conducted in Panama, Ecuador, Bulgaria, Vietnam, Thailand and Gabon[234] used the UNDP Financial Scorecard to systematically assess strengths and weaknesses. The study identified the following barriers for achieving system-level financial sustainability:

Lack of political support. Government budget allocations are far below the estimated needs. Conservation programs attract low levels of political support and the environmental sector is generally in a weak bargaining position relative to other sectors in getting budgetary allocations, as finance ministries tend to favor investment in economic development and export-led growth.

Institutional barriers. Protected areas are poorly integrated into national development policies, and are prevented or discouraged from generating or retaining revenues from alternative sources. At the same time, institutional systems and structures are overly bureaucratic and not conducive to cost-effective operations, such as co-management arrangements. The division of responsibilities between different institutions is often poorly defined with burdensome administrative procedures and with ineffective processes of participation, governance and accountability.

Absence of planning. Protected area managers are ill equipped and poorly motivated to diversify funding sources or adopt cost-effective operations. In most cases, protected areas do not have strategic financial plans to support their management plans. In addition, protected area planners have not put in place a set of long-term financing mechanisms to adequately meet the needs of their protected area systems. Over reliance on a few funding mechanisms leaves them vulnerable to fluctuations in donor priorities. Furthermore, managers lack financial planning frameworks that would enable them to assess financial needs, develop viable new revenue sources, and develop system-wide financing strategies. Absence of financial information and business plans makes it more difficult to engage donors, the private sector, and ministries of finance, all of whom are key actors in addressing resource allocation issues across protected area systems.

Lack of technical capacity. There is limited technical knowledge on how to screen, assess, formulate and implement new finance mechanisms and on how to fully exploit market opportunities, including, for example, payments for ecosystem services.

Guinea fowl in Etosha National Park © Adriana Dinu

Issues, challenges and solutions in improving protected area sustainable finance

- As managers explore different funding avenues, including those that would depend upon natural resources from the protected area, they may experience increased conflict over resource use. Such situations will require development of clear policies with safeguards to prevent revenue mechanisms from compromising biodiversity conservation and social development objectives.

- Many protected area managers do not have the skills or experience required to develop an effective business plan for their protected area. Developing partnerships with business schools may be one way to bring in expertise in business planning.

- In some cases, funding may be available (e.g., through the Global Environment Facility), but the country either does not fully utilize these funds, or does not target them toward addressing key financial gaps. Having a strategic action plan with clear priorities for implementing the Programme of Work on Protected Areas is a country's first and most important step toward effective use of available funding from all sources.

- Protected area managers may find it difficult to compete with other governmental agendas for funding. However, since protected areas play an important role in addressing climate change through ecosystem-based adaptation and mitigation, and contribute to achieving the social and developmental goals of many countries, managers should consider exploring funding opportunities that focus on climate change, REDD+ and ecosystem services.

Los Llanos - Venezuela © Lila Gil

Loiseleuria procumbens in Ural Mountains © Adriana Dinu

Theme 7

Protected Area Networks and Ecological Gap Assessments

Overview

A protected area network is defined as the total amount and configuration of land and water under some form of protection. This network includes the full range of IUCN Categories and governance types, as well as all forms of buffers, stepping stones, connectivity corridors, and other conserved areas, and is the physical foundation for all work related to protected areas.

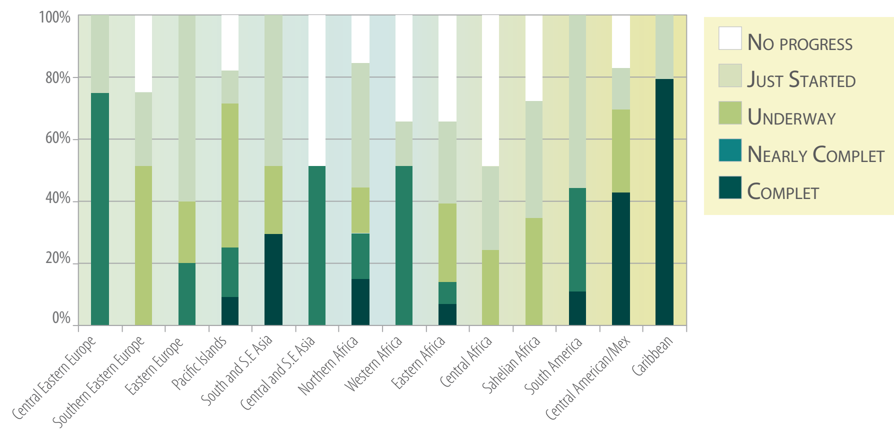
Introduction and Analysis

A protected area gap assessment is a comparison between a country's biodiversity and its protected area network. Protected area gap assessments have traditionally been defined in terms of representativeness, or the extent to which a protected area network represents the full breadth of biodiversity within a country.[235] Numerous authors have written about biases in the representativeness of global and national protected area networks,[236] and the majority of national gap assessments have focused on how well biodiversity is represented within their national protected area networks. To date, a fairly large number of gap assessments – at least 25 – have been completed worldwide (see Figure 12).

This section focuses primarily on assessing and filling ecological gaps within the protected area network, and is related to Goal 1.1 of the Programme of Work on Protected Areas, which states that governments should create comprehensive and representative networks of protected areas. Specific activities under Goal 1.1 include:

- Establish measurable and time-bound targets and indicators
- Protect large, intact areas and areas under high threat
- Address the under-representation of marine and inland water ecosystems
- Review existing and potential forms of conservation and promote innovative types of governance
- Complete an ecological gap assessment
- Designate protected areas to fill ecological gaps
- Encourage protected areas that benefit indigenous and local communities.

Figure 12: Summary of global progress on assessing ecological gaps[237]



Given the increasing expectation that protected area networks will enable climate change adaptation and promote resilience, ensure connectivity across the landscape, and maintain key ecosystem services, governments will need to begin to incorporate these issues into their ecological gap assessments. However, including climate change, connectivity and ecosystem services in ecological gap assessments has not yet become the norm (see Table 19), and relatively recent gap assessment guides[238] pay scant attention to these issues.

TABLE 19: SURVEY OF ELEMENTS IN PROTECTED AREA GAP ASSESSMENTS

COUNTRY OR REGION	TRADITIONAL ELEMENTS OF GAP ASSESSMENT			EMERGING ELEMENTS OF ECOLOGICAL GAP ASSESSMENTS			
	Includes a range of biodiversity elements	Assesses how representative the system is	Includes specific goals and targets	Includes issues related to climate change	Includes connectivity	Accounts for ecosystem services	Includes a wide range of governance types
Maputaland, Mozambique[239]	√	√	√	—	—	—	—
Ontario, Canada[240]	√	√	√	—	√	—	—
Ecuador[241]	√	√	√	—	√	—	—
St. Vincent and the Grenadines[242]	√	√	√	—	√	—	—
Grenada[243]	√	√	√	—	—	—	—
Jamaica[244]	√	√	√	—	√	—	—
Papua New Guinea[245]	√	√	√	√	—	√	√
St. Lucia[246]	√	√	√	—	√	√	—
Ecuador[247]	√	√	√	—	—	—	—
Belize[248]	√	√	√	—	—	—	—
California, USA[249]	√	√	√	—	—	—	√
Peru[250]	√	√	√	—	—	—	√
Bahamas[251]	√	√	√	—	—	—	—

Governments must continue to assess the representativeness of their protected area networks. The vast majority of gap assessments indicate that there are profound gaps and major biases in how well biodiversity is protected. Mexico's gap assessment, for example, shows that 11 entire ecoregions lack any kind of protection at all,[252] and in Grenada, their gap assessment highlighted an almost complete lack of protection of freshwater bodies.[253] There are repeating trends in gap assessments that show a dearth of protected freshwater ecosystems, grassland ecosystems, and coastal and near-shore marine areas, while there is an abundance of protected areas located on mountains, deserts and permanently frozen areas.[254] Assessments that provide critical analyses of the representativeness of biodiversity will continue to pressure policy makers to expand the protection of under-represented species and ecosystems. However, to stay relevant and to adapt to changing expectations and pressures, gap assessments must move beyond simply assessing representativeness to include broader issues such as climate change, connectivity, ecosystem services, and diverse governance types. Each of these topics is explored below.

↘Best practice 20: Incorporate climate change into ecological gap assessments

It is clear that gap assessments must begin to incorporate climate change, but the mechanics of how to do so is less clear. A survey of recent authors provides some initial principles for planners to consider when integrating climate change into their gap assessments.

- **Focus on the stage, not the actors:** By focusing on the underlying enduring features of biodiversity, such as soil and bedrock types, slope, aspect, altitude and rainfall, planners can be sure that their protected area networks will continue to be robust and representative even as species and ecosystems shift over time in response to climate change.[255]

- **Include species and ecosystems most vulnerable to climate change:** Some species are more sensitive to the impacts of climate change than others. By explicitly including in the gap assessment key biodiversity features whose habitat ranges are likely to shift significantly, or whose viability is likely to be compromised by climate change impacts, planners may be able to strengthen the ability of the most vulnerable species and ecosystems to persist and adapt.[256]

- **Include species and ecosystems most resistant to climate change:** Some species and ecosystems are more robust and can weather and adjust to the likely impacts of climate change. Such locations may offer refugia for species with narrow environmental ranges, provide source populations for future colonization, provide temporary habitat for dispersers, and serve as platform sites on which new community assemblages may develop.[257]

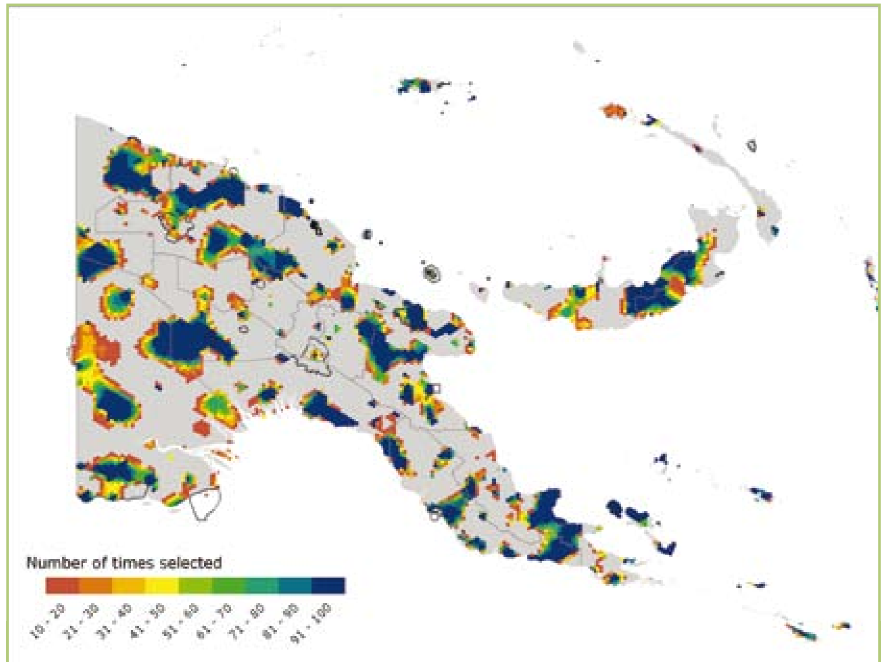
- **Incorporate predictive climate model scenarios:** Nearly all gap assessments focus on existing patterns of biodiversity, rather than on predicted patterns of biodiversity under future climate change scenarios. Many authors suggest that planners look at historical, current *and* future distribution scenarios using predictive climate models.[258] For example, planners in some coastal areas are anticipating how rising sea levels will change coastlines in the future, and are actively planting mangroves where they are likely to occur in 30 to 40 years – hundreds of feet inland.[259]

- **Incorporate concepts of ecological resilience:** The concept of ecological resilience is generally defined as the ability of an ecosystem to persist in the face of disturbance extremes without a regime shift.[260] Resilience is especially important in ensuring that species and ecosystems can withstand the impacts of climate change. Planners can include the concept of resilience by explicitly incorporating a few basic principles in their gap assessments (see Table 20).

Table 20: Principles of resilience and their implications for gap assessments[261]

RESILIENCE PRINCIPLE	IMPLICATIONS FOR GAP ASSESSMENTS
» Common pathways of regime shifts include grazing, nutrient changes, temperature changes, invasive species, and removal of keystone species	» When assessing the viability and threats status of key biodiversity features, explicitly include in gap assessments threats that drive regime shifts
» Resilience is defined and measured by a range of thresholds along key variables	» Identify the key variables and the thresholds that trigger regime shifts, and include these thresholds in gap assessments
» Regime shifts do not occur along a linear, incremental timeline, but rather occur suddenly and unexpectedly	» Include in the gap assessment different scenarios and models of ecosystem changes, including non-linear and sudden changes, that could result in regime shifts
» An ecosystem's position in an overall successional cycle will affect its resilience (e.g., whether it is in a phase of major disturbance, colonization, recovery, or maturity)	» When ranking occurrences of key biodiversity features, include within the gap assessment a ranking of where ecosystems are in an overall successional cycle, and include ecosystems from a range within this cycle
» A key point in understanding resilience is scale – the landscape scale is critical for maintaining resilience across different ecosystems	» Within the gap assessment, set goals not only for the number and quality of occurrences of key biodiversity features, but also for distribution and stratification across the landscape

"Climate-friendly" gap assessment © Department of Environment and Conservation, Papua New Guinea



Case study: Incorporating climate change into Papua New Guinea's gap assessment

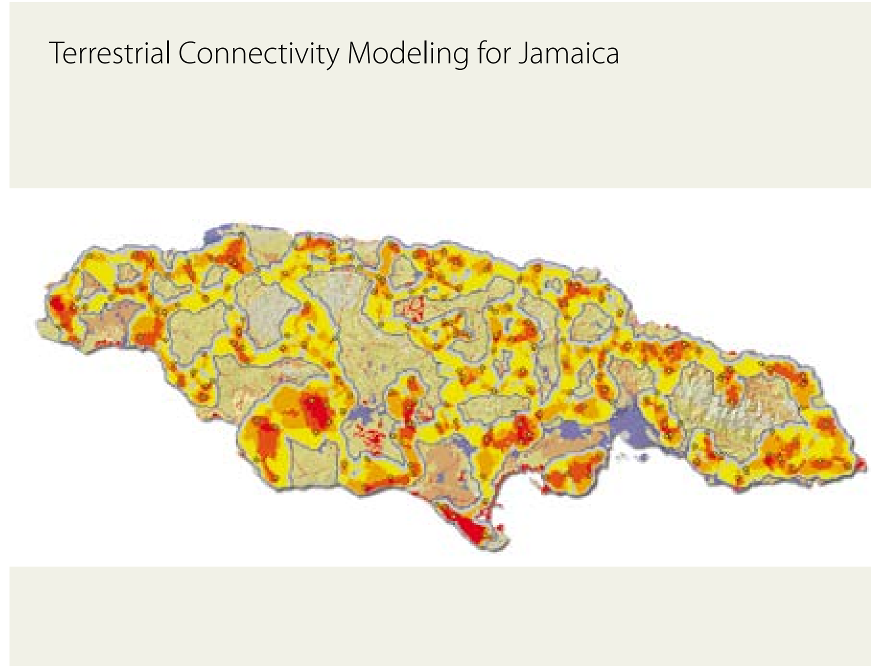
With the support from a UNDP/GEF project, the government of Papua New Guinea has recently completed an ecological gap assessment for their protected area system. In addition to issues of representativeness, the government also incorporated issues related to climate change into the gap assessment.[262] By overlaying existing protected areas, key biodiversity features, and projected climate impacts, the gap assessment team was able to identify areas that would increase the protection of under-represented species and ecosystems, while at the same time addressing features that were most vulnerable to climate change and features most likely to be resilient to climate change. This strategy has been referred to as "protecting the strongest of the weak, and the weakest of the strong."[263]

Best practice 21: Incorporate connectivity into protected area ecological gap assessments

Connectivity between protected areas is widely recognized as important for providing sufficient habitat for wide-ranging species, maintaining the genetic viability of small populations, enabling seasonal migration and, more recently, for allowing species to shift their ranges in response to climate change.[264] However, most gap assessments only include connectivity indirectly as an element of "landscape context" when assessing the viability of specific occurrences of key biodiversity features.[265]

Planners typically include a wide range of key biodiversity features within their gap assessments, such as species, natural communities, ecosystems, and ecological processes. These features serve as the unit by which planners can measure the representativeness of the protected area network. As shown in Table 19, the majority of gap assessments do not adequately address connectivity. However, improving connectivity is one of the most widely recommended actions for enabling climate change adaptation.[266] Therefore, by explicitly including the connectivity needs for key species as an important biodiversity feature within the gap assessment process, planners can ensure that their gap assessments better address landscape functionality and resilience, particularly in response to climate change.[267] In Figure 13, for example, the gap assessment explicitly included the connectivity needs for a range of species under various climate scenarios, and developed a sum total of the most cost-effective and efficient scenario for a landscape that has high levels of connectivity, and therefore of likely resilience to climate change.

FIGURE 13: EXAMPLE OF INCLUDING AREAS OF HIGH CONNECTIVITY VALUE IN A GAP ASSESSMENT IN JAMAICA[268]



Improving connectivity is one of the most widely recommended actions for enabling climate change adaptation.

Summer in Ergaki Park, Altai Sayan, Russia ©Adriana Dinu

Case study: Improving the connectivity in Altai Sayan Ecoregion

The vast 1 million sq km Altai-Sayan ecoregion lies in the center of Asia, at the crossroads between Russia, Mongolia, Kazakhstan and China. It is one of the world's largest, least disturbed and least transformed forest and steppe tracts, home to flagship species such as the snow leopard, the Altai argali sheep and the saiga. Three UNDP/GEF projects – in Russia *(Improving the Coverage and Management Efficiency of Protected Areas in the Steppe Biome of Russia*[269]*)*, in Kazakhstan *(Conservation and Sustainable use of Biodiversity in the Kazakhstani Sector of the Altai-Sayan Mountain Ecoregion*[270]*)*, and in Mongolia *(Community-based Conservation of Biological Diversity in the Mountain Landscapes of Mongolia's Altai Sayan Ecoregion*[271]*)* – work in tandem to improve the ecological connectivity between existing and planned protected areas across the entire ecoregion. A previous gap assessment of the region identified five large and critically important unprotected territories, as well as a range of connectivity gaps. The government of Kazakhstan, with UNDP/GEF funding and support from Germany's International Climate Initiative, has established its first ecological corridor, which will protect the migration routes for globally threatened species and protect carbon pools estimated at 34 million tons of carbon. The Kazakh government also adopted a regulation on green corridors connecting the western part of the Kazakh Altai-Sayan Ecoregion with Zapadno Altai State Zapovednik, Lower-Turgussun Zakaznik, and Katon Karagai National Parks.

↘Best practice 22: Incorporate ecosystem services into ecological gap assessments

Conservation planners and policy makers increasingly recognize that investments in protected areas must deliver more than biodiversity benefits. By including only biodiversity features in an ecological gap assessment, however, planners lose out on the opportunity to capitalize on one of the primary benefits of protected areas – the maintenance of a wide range of ecosystem services. As efforts to map ecosystem services such as carbon sequestration and water become increasingly common, it will likely become the norm to simply include these data layers into the mix of other data layers already included in a gap assessment. Below are a few specific approaches for incorporating ecosystem services into gap assessments.

» **Include carbon storage and sequestration in gap assessments:** Carbon is fast becoming a common currency in economic and resource management decisions. It is likely that protected area planners will soon be expected to assess the amount of carbon currently stored within their protected area networks, and to incorporate carbon issues into their decision-making process regarding the expansion and reconfiguration of the protected area network. Several innovative and interactive tools allow planners to include a carbon data layer, enabling them to analyze potential changes in carbon storage, for instance as part of possible REDD or REDD+ schemes.[272]

» **Include water-related ecosystem services in gap assessments:** Water-related ecosystem services include storage, recharge and distribution of water for municipal drinking water, agricultural irrigation, river functioning, hydropower and flood control. Planners can include areas important for water quantity (e.g., headwaters), water quality (e.g., wetlands, riparian areas), and water control (e.g., flood plains) as key biodiversity features in their gap assessments.[273] By explicitly including areas important for water-related ecosystem services, planners can make more informed decisions and trade-offs between priority areas for protection and ecosystem services provisioning; they can identify and prioritize areas that provide efficient options for both biodiversity and ecosystem services; and they can be better equipped to communicate the full benefits of protected areas to national and local policy makers, donors, the private sector, and the public.

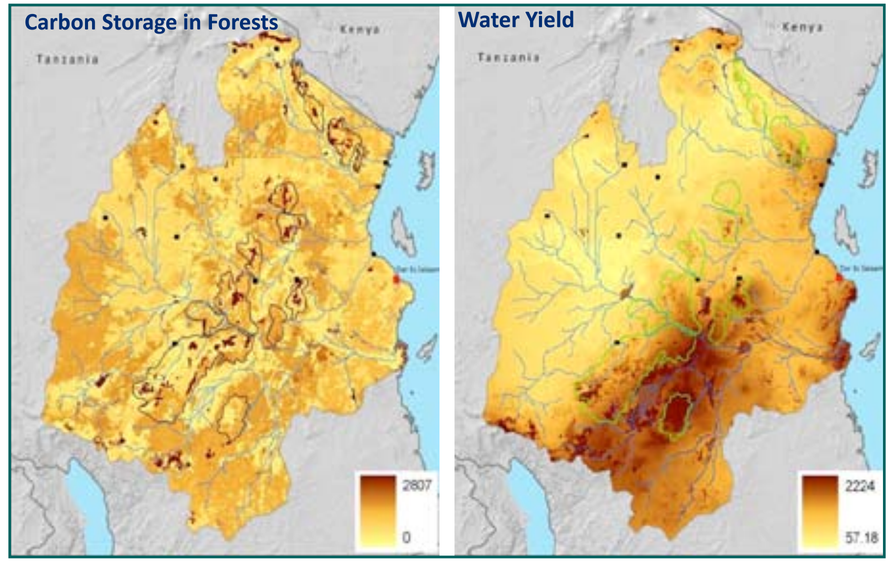
» **Include fisheries in gap assessments:** Gap assessments that account for freshwater and marine biodiversity invariably include a range of fish species as key biodiversity features. However, these are typically selected based on such factors as rarity, vulnerability and degree of threat, rather than on their importance as a source of food security for humans. By explicitly identifying spawning and aggregation areas for economically and socially important fish species, planners can build societal and financial support for taking action on the results of the gap assessment, particularly if the fish species are an important factor for alleviating poverty and sustaining local livelihoods.

Loveridge's sunbird - Lukwangule Plateau, Uluguru Nature Reserve © Neil Burgess

Case study: Mapping water and carbon services in Tanzania's protected area system

The Eastern Arc Mountains of Tanzania are part of a globally important biodiversity hotspot, but they are also economically significant for providing water and climate-related services. An international, collaborative research program called "Valuing the Arc" mapped carbon storage and sequestration, flow regulation, provision of clean water, provision of timber and non-timber forest products, opportunities for nature-based tourism, and pollination of crops by wild bees and other insects. This work was in conjunction with work financed through a UNDP-GEF project to develop a conservation strategy for the Eastern Arc Mountains of Tanzania, called "Eastern Arc Forest Conservation and Management." The two maps in Figure 14 show an overlay of carbon-related and water-related ecosystem services with Tanzania's protected area network. The carbon storage in protected areas is up to 155 tons per hectare, compared to 80 tons per hectare for unprotected land, and 35 percent of the carbon is stored within protected areas. The map of water yield clearly shows the value of protected areas compared with other lands, and planners can use these figures to demonstrate the value of protection for carbon storage, water yield and biodiversity conservation.

Figure 14: An overlay of ecosystem services with protected areas in Tanzania[274]



Best practice 23: Include the widest possible array of governance types in gap assessments

Although there are hundreds of different categories and governance types of protected areas around the world, many ecological gap assessments include only IUCN Categories I through IV, and focus primarily or exclusively on government-run protected areas. Because there is such a wide array of protected and other conserved areas, and because many of these areas can play an important role in protecting biodiversity, enabling climate adaptation, sustaining livelihoods, and providing ecosystem services, planners should consider incorporating these areas into their protected area ecological gap assessments. For example, in post-Soviet countries, many forest concession areas are excluded from logging because they provide habitat to endangered species. While not officially acknowledged as part of the protected area estate, these areas nonetheless provide significant conservation benefits. Including a wide range of governance types would likely yield a much richer and more robust gap assessment, and would better enable planners to identify conservation opportunities, determine management gaps, and develop appropriate strategies.

Issues, challenges and solutions in improving protected area gap assessments

Identifying how protected area gap assessments could be improved is relatively easy; making these changes is much harder. The following are some of the potential issues and challenges that protected area planners may consider as they attempt to incorporate climate change, connectivity, ecosystem services, and more diverse protected area categories and governance types into their gap assessments.

- Reliable information on ecological thresholds, particularly those related to climate change resilience, is scant, and specific tipping points for regime shifts are rarely known. To overcome this challenge, planners can use best available information on existing ecological thresholds to develop rules of thumb for climate-related thresholds.

- Although there is wide agreement on the general impacts of climate change, there is much less agreement about specific impacts within a particular area within a country. Data sets are typically very coarse and highly variable. However, a few online resources exist that can help planners get a clearer picture of potential climate impacts in their countries.[276]

- The concept of anticipating future biodiversity patterns as a result of climate change and then investing in "advance restoration" activities, such as mangrove establishment along inland areas, is likely to be viewed with skepticism. Planners who advocate spending today's

Buffalo in Southern Tanzania © Nik Sekhran

Case study: Including a broader array of governance types in Tanzania's planning process

Protected areas in Tanzania, particularly national parks, do not adequately represent the complex biodiversity across the country. At the same time, existing protected areas face an array of threats, including isolation from other protected areas. A UNDP/GEF project in Tanzania, *Strengthening the Protected Area Network in Southern Tanzania: Improving the Effectiveness of National Parks in Addressing Threats to Biodiversity,*[275] aims to strengthen the protected area network by expanding the protected area estate to be more representative. However, national parks alone will not be sufficient to achieve these objectives. Instead, the Tanzanian government is initiating a process that looks across a broad array of protected area categories and governance types, including buffer zones, private game reserves, village conservation areas, forest reserves, and wildlife management areas. By taking a landscape-level approach to assessment and planning, the government stands a much greater chance of achieving its aim of a more representative and comprehensive protected area network.

resources on an unknown future with unpredictable outcomes, versus spending today's resources on today's urgent and pressing needs, will undoubtedly face opposition. A clear financial analysis of the costs and benefits of investing in a climate-resilient landscape, including the costs of *not* investing, will equip planners with the information they need to make their case effectively to policy makers.

» When attempting to incorporate species that are vulnerable to climate change, planners must often make difficult decisions. At what point, for example, do planners give up on a species that is likely to become extinct because of climate change? These decisions will be especially prevalent where species are close to the extent of their range and have nowhere else to go (e.g., plant species within the Cape Floristic Region in South Africa, high-elevation species such as marmots in the Rocky Mountains of the U.S.). As planners tackle these difficult choices, they can help by making trade-offs explicit in their assessment results, and they can factor in risk- and cost-benefit assessments to guide their decisions.[277]

» Identifying and mapping areas important for connectivity is an inherently complex process, especially when added to the already complex task of conducting a gap assessment. Planners much first answer the question of connectivity of what, to what and for what, and the answers may be clear only in areas with high degrees of fragmentation and conversion. Protected area planners may want to avoid the easy but potentially erroneous solution of simply identifying contiguous patterns of land cover when incorporating connectivity into gap assessments, and instead create summative maps that combine the connectivity needs for multiple species and ecosystems, to find the most efficient and effective scenario.

» Other conserved areas may be difficult to identify and map. Some countries have yet to map their national system of government-managed protected areas; it is unlikely that they will easily be able to map community-conserved areas, which often lack clear boundaries. However, the World Conservation Monitoring Centre recently established a global registry specifically for community-conserved areas, which may help countries include these areas in their gap assessments.[278,279]

In a recent review of over 100 articles, the single most frequently cited measure for climate adaptation is the expansion of the number and coverage of protected areas.

Rhodope Mountains, Bulgaria ©Philip Edwards

Ring – tailed lemurs, Madagascar © SRstock

Theme 8

Connectivity Corridors and Transboundary Protected Areas

Overview

Protected areas are increasingly viewed not as islands of biodiversity, but as the building blocks of regional networks that will sustain ecological processes over time and space. Whether in marine systems,[280] freshwater systems,[281] forests,[282] grasslands[283] or mountains,[284] the concepts of connectivity, regional networks, and trans-boundary protected areas have become commonplace in conservation planning.[285] This section focuses on two issues: 1) connectivity corridors and integration into wider landscapes and seascapes, and 2) transboundary protected areas and regional networks, related to Goals 1.2 and 1.3 of the Programme of Work on Protected Areas.

Connectivity corridors and integration of protected areas into wider landscapes and seascapes

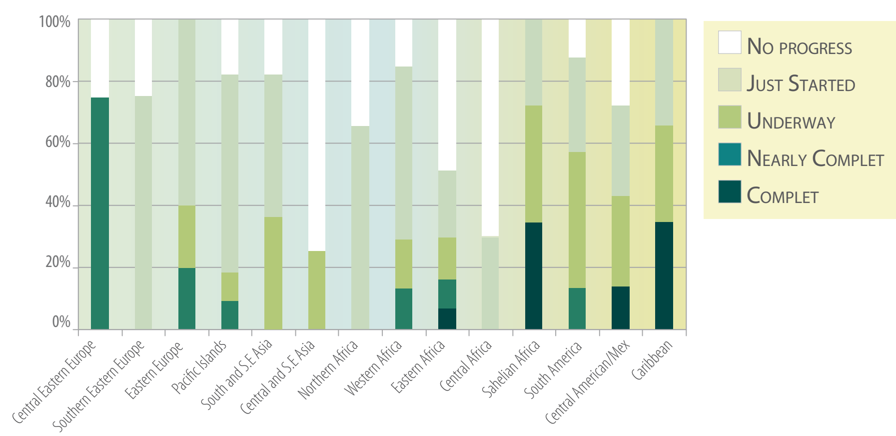
Introduction and analysis

Connectivity is the extent to which the physical relationships between landscape (and seascape) elements enable the full range of natural processes, such as species migration, across a regional scale. A connectivity corridor is a physical element of a landscape (e.g., a band of forested land cover, or a series of wetlands in a migratory flyway), that enables species to move across the landscape in order to migrate, disperse, feed and breed. Connectivity corridors can occur at multiple scales, ranging from very small, site-specific corridors to mega-corridors such as the Mesoamerican Biological Corridor. Goal 1.2 of the Programme of Work on Protected Areas states that governments should improve connectivity between protected areas, and should integrate protected areas into wider landscapes and seascapes. Specific activities under this goal include:

- Evaluate lessons learned in integrating protected areas
- Identify and implement steps for improving protected area integration
- Establish and manage ecological networks, ecological corridors, and buffer zones
- Develop ecological corridors to link protected areas
- Restore habitats and degraded ecosystems to strengthen networks, corridors and buffer zones

Although there is a large number of regional networks and large regional corridors around the world,[286] many governments have yet to systematically assess and act upon opportunities for establishing connectivity corridors and integrating protected areas into the wider landscape and seascape. Figure 15 shows a summary of the global implementation of Goal 1.2 of the Programme of Work on Protected Areas, indicating the extent of protected area integration into wider landscapes, seascapes and sectoral plans and strategies.

FIGURE 15: GLOBAL PROGRESS IN ASSESSING PROTECTED AREA INTEGRATION[287]



The traditional emphasis in planning for connectivity has been on identifying and establishing "connectivity corridors" – linkages in the landscape that expand habitats for wide-ranging species, enable species migration, and maintain the genetic viability of isolated populations.[288] Given that protected areas are increasingly expected to enable climate change adaptation and promote resilience, maintain ecosystem services, and sustain local livelihoods, it would be natural to assume that these expectations would also extend to connectivity corridors. However, in two recent publications[289] on connectivity conservation, covering a total of 49 case studies and articles on connectivity in different biomes from around the world, only a handful specifically mention the role of connectivity in enabling climate adaptation, maintaining ecosystem services, and sustaining local livelihoods.

As the trend toward habitat fragmentation and isolation continues around the world, the need to improve protected area connectivity will only increase in importance. However, in addition to enabling species to survive over the short term, corridors must also function as a lifeline for climate change adaptation over the long term. Connectivity corridors must also help to sustain ecosystem services and local livelihoods if they are to remain relevant to broader societal goals.

↘Best practice 24: Incorporate social and economic benefits into connectivity corridors

Connectivity corridors can provide an array of ecological benefits, and indeed that has been their primary purpose. However, corridors are frequently embedded in a complex matrix of land uses, typically involving community, indigenous, private and corporate owners. Such areas may or may not have legal designation as a protected area, but the use of natural resources within these areas is typically limited through various partnerships and agreements. If managed well, these corridors can provide significant benefits to local communities, while still serving their ecological purpose of allowing the free movement of species and the maintenance of key ecological processes. If managed poorly, their success in achieving either objective is limited. Below are some recommendations for effective management of corridors to simultaneously achieve ecological and social benefits.

» **Involve local communities in the designation of connectivity corridors:** One of the basic tenets of protected area establishment is obtaining free and informed consent of those living in potential new protected areas, and the same principle would naturally apply to the designation of corridors. However, because corridors have a much higher degree of human and wildlife interaction, involve many more actors, and allow many more uses, planners should pay particular attention in involving local communities in the designation of connectivity corridors.

» **Involve local communities in determining the use of resources within connectivity corridors:** Connectivity corridors typically allow a wider variety of human uses than protected areas; involving local communities in determining the use of resources within the corridors can help build support, and ensure that corridor supplies both ecological and social benefits.

» **Mitigate and prevent threats by providing alternative livelihoods:** In many cases, connectivity corridors are designated in areas where communities have been living for hundreds and even thousands of years. If natural resource uses are restricted, it is incumbent on planners to identify livelihood alternatives.

» **Predict and manage human-wildlife conflicts:** Because corridors are typically designed to allow wildlife movement, and because these areas are typically narrower than other protected areas and have larger human populations, human-wildlife conflicts are much more likely. Planners should predict these conflicts, and actively develop mechanisms for reducing them, such as developing funds for compensating farmers for livestock predation.

Local market, Western Terai, Nepal © Doley Tshering

Case study: Sustaining livelihoods in Nepal's Western Terai Complex

The UNDP/GEF project *Landscape Level Biodiversity Conservation in Nepal's Western Terai Complex*[290] was based on the premise that the long-term viability of efforts to conserve globally significant biodiversity hinges on managing habitats within a wide ecological landscape, beyond the confines of individual protected areas. This project aims to reorient existing land and resource management institutions in the production sector to integrate and mainstream biodiversity management. The project provided incentives to local communities to reduce exploitative pressures on natural forests and associated biodiversity resources by strengthening their capacities for biodiversity-friendly and sustainable land and resource use practices, by increasing their livelihood development options, and by raising their awareness about the tangible benefits of biodiversity conservation. The project promoted the management of genetic crop diversity among local farmers in order to create and increase opportunities for sustainable management of agro-biodiversity, which in turn reduced poverty and improved the livelihoods of resource-poor and marginal people. Through the project, 795 local people – particularly women, poor and marginalized community members – received seed grant support, and started income generation activities consistent with their capacities and interests.

FANAMBY: Smallholder farming - Madagascar © UNDP photo library

Case study: Participatory community-based conservation in the Anjozorobe Forest Corridor

The UNDP/GEF project *Participatory Community-based Conservation in the Anjozorobe Forest Corridor*[291] aims to conserve the globally significant highland forest corridor of Anjozorobe, Madagascar by promoting a model of sustainable community-based management. The success of the project is measured not only in ecological terms (e.g., protection of endemic wildlife, forest cover maintained) but also in social terms, including the degree of participation of local communities in developing the management plan and zoning of the corridor, the number of partnerships established to promote sustainable agricultural techniques, and the number of sustainable livelihoods generated by the corridor.

↘Best practice 25: Incorporate climate change considerations into corridor design and management

Connectivity corridors are typically located where they will provide maximum benefits for the movement of species. In a fragmented landscape, there may be very few options for creating new corridors. In an intact landscape, however, planners will have more options for locating corridors. When these options exist, planners should seek ways to incorporate climate change into connectivity planning, and where they do not, planners should strategically focus their restoration efforts on enhancing connectivity.

The vast majority of connectivity initiatives focus on connecting species and ecosystems under current climate patterns. However, the distribution of a large number of species and ecosystems will likely shift over the next few decades – radically so in some places.[292] Planners can begin to incorporate future scenarios into connectivity planning and management by taking the following steps.

» **Incorporate predictive models of species and habitat ranges:** Planners can incorporate predictive models of species and habitat ranges into their planning process for connectivity. They can compare analyses with different time horizons to identify options that allow for gradual shifts in habitat ranges over time, while maintaining landscape and seascape connectivity.

» **Use enduring features when planning connectivity:** The "enduring features" within a landscape, such as underlying geology, topography, slope, aspect and altitude, may be a much better indicator of future biodiversity under climate change than species and ecosystems under existing climate regimes.[293]

» **Choose species most vulnerable to climate change when planning connectivity options:** In selecting key biodiversity features for what to connect, planners should identify those species that may be most vulnerable to climate change[294] and those species with poor dispersal rates.[295]

» **Identify bottlenecks that would be exacerbated by climate:** Identifying bottlenecks in species movement is a key component of connectivity planning,[296] and this is especially true when planning connectivity for climate change. Planners should identify those existing and potential bottlenecks in species dispersal that would be exacerbated by climate-related impacts.

» **Orient corridors to facilitate climate-related connectivity:** The orientation of corridors can be particularly important in building a climate-resilient landscape, such as north-south gradients, riparian corridors, topographical gradients, and other microclimate areas.[297]

» **Locate corridors in areas of ecotones and environmental transitions and at the margins of species and ecosystem ranges:** Capturing ecotones and range limits within corridors is especially useful for building landscape resilience because they allow for gradual shifts in species and ecosystem ranges over time.[298]

» **Include resilient ecosystem patches within corridors:** Within any landscape, there will be patches of ecosystems that are likely to be more resilient than others by virtue of their high levels of ecological integrity. Incorporating such patches into corridors will help improve the overall functioning of the corridor even under a changing climate regime.

» **Link national corridors with large-scale regional corridors:** One of the main tenets of planning for landscape resilience to climate change is to plan at multiple scales.[299] Therefore, planners should strive to link sub-national corridors to national and even regional corridors, such as the Mesoamerican Biological Corridor.

Succulent flowers in the Sperrgebiet National Park, Namibia © Midori Paxton

Case study: Managing landscape conservation areas in Namibia with climate change in mind

The UNDP/GEF project *Namibia Protected Landscape Conservation Areas Initiative*[300] focuses on ensuring that land uses in areas adjacent to existing protected areas are compatible with biodiversity conservation objectives, and that corridors are established to sustain the viability of wildlife populations. The project focuses on the creation of five protected landscape conservation areas, totaling more than 15,000 sq km. Each landscape conservation area includes an existing national park at its core, and adjacent community and private reserves operating with shared management objectives and frameworks. The areas and corridors are managed to maintain wildlife populations at the landscape level and reduce threats, but are also managed to cope with predicted impacts of climate change, including strategies for managing fire and hydrological regimes.

↘Best practice 26: Plan and manage corridors to sustain key ecosystems services

Many studies suggest climate change could wreak havoc on major life support systems.[301] For example, the climate change effects on hydrological systems include early snowmelt, increased flooding and droughts, with impacts such as asynchronous life histories, flood mortality, channel erosion, shrinking habitat, and stream fragmentation. These impacts are very likely to compromise the potential of hydrological systems to purify water, process contaminants, control floods, supply water, sequester carbon and nitrogen, regulate temperatures, and provide erosion and soil control.[302]

Ecosystem services are best maintained by large, interconnected networks of protected areas. Therefore, planners should aim to plan and manage corridors to sustain key ecosystem services. They can do so by taking several simple steps, including:

- Incorporate areas that are particularly important for ecosystem services into the corridor selection process
- Design corridors to maximize ecosystem services, for instance, planning along riparian areas in order to sustain water flows
- Ensure that management plans for corridors account for the protection and maintenance of ecosystem services, such as policies for forest harvest
- Prioritize threat abatement activities on threats to ecosystem services, as well as on threats to biodiversity

Just born saiga calves in Altyn dala steppe, Kazakhstan © Adriana Dinu

Case study: Maintaining healthy grasslands through saiga conservation

The saiga is an antelope that originally inhabited the vast Eurasian steppe area from the Carpathians and Caucasus to Mongolia. Their range is now limited to five populations, their numbers have decreased 95 percent in less than 15 years, and they continue to be threatened by poaching, disease and the loss and fragmentation of key habitat. The UNDP/GEF project *Steppe conservation and management*[303] in Kazakhstan aims to establish ecological corridors linking key saiga habitats. The project has combined field research, annual censuses, and satellite tracking to locate the most significant ecological corridors, with a particular emphasis on linking ecotones (e.g., between desert, desertified steppe, and steppe semi-desert), as these are likely to shift in a warmer climate, and on linking existing protected areas to conserve genetic interactions between populations. The benefits of the project, however, extend far beyond securing the fate of the saiga. Saiga herds are critical to maintaining the health and integrity of the steppe grassland ecosystem, and healthy grasslands are critically important for the large number of communities who depend on them for grazing their horses and other cattle.[304]

Transboundary areas and regional networks

Overview

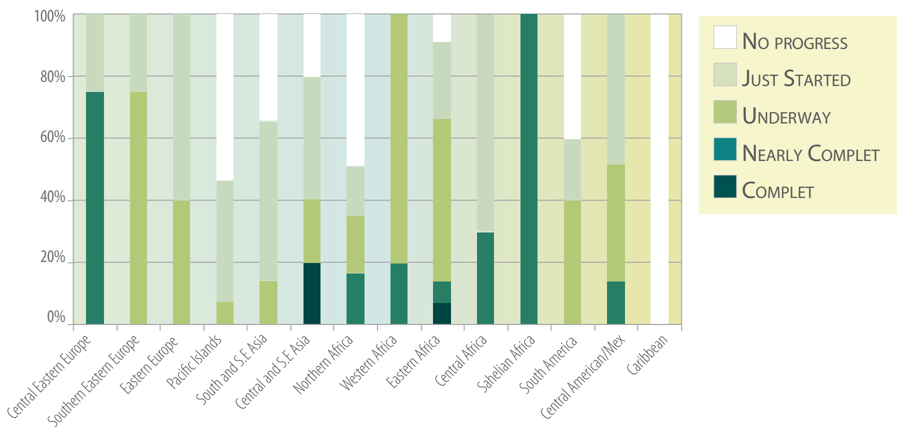
Regional networks are defined as large areas of continuous and connected natural cover with ecological processes relatively intact. Transboundary protected areas are defined as an area of land or sea that spans the boundaries of one or more countries or sub-national entities, and where there are legal or other arrangements for joint management. A profusion of regional networks and transboundary protected areas has emerged over the past two decades; the Global Transboundary Protected Areas Network, a project of the IUCN, estimates that there are over 225 transboundary protected areas worldwide.[305]

Introduction and analysis

For the majority of countries, protected area networks that are designed exclusively at a national or sub-national scale are unlikely to be effective in maintaining large-scale processes such as migration. Creating large regional networks and establishing transboundary protected areas can help governments maintain ecological processes, as well as improve international relations. This section relates to Goal 1.3 of the Programme of Work on Protected Areas, which states that governments should create regional networks, establish transboundary protected areas, and collaborate between neighboring protected areas across national boundaries (see Figure 16 for a summary of global progress on establishing transboundary protected areas and regional networks). Specific activities under this goal include:

- Collaborate with other parties and partners to establish effective regional networks
- Establish and manage protected areas in marine areas beyond the limits of national jurisdiction
- Establish new transboundary protected areas
- Promote collaboration between protected areas across national boundaries

Figure 16: Summary of global progress on establishing transboundary protected areas and regional networks[306]



Traditionally, countries have developed regional networks and established large, contiguous protected areas primarily for the purpose of creating core habitat for wide-ranging species, and for protecting biological sources that can replenish surrounding areas.[307] Efforts to establish large regional-scale corridors have mostly focused on protecting seasonal species migration patterns and maintaining meta-populations.[308] In addition, efforts to support and encourage the creation of transboundary protected areas have largely focused on the promotion of peace and harmonious international relations and reducing conflicts between countries.[309]

The predominance of the issues of species connectivity and harmonious international relations can be seen in a short but representative literature review on ecological networks and transboundary protected areas (see Table 21). From this review it is clear that climate change, ecosystem services, and sustainable livelihoods have not yet become part of the discourse on ecological networks and transboundary protected areas.

Table 21: Review of literature on ecological networks and transboundary protected areas, and their treatment of climate change adaptation and maintenance of ecosystem services

Source	Treatment of climate change adaptation and maintenance of ecosystem services
The Continuum Project[310]	Although climate change is briefly mentioned as a potential concern of ecological connectivity in this review of four approaches to developing ecological networks in the Alps, none of the four approaches reviewed actually included climate change as a specific goal or issue.
The Development and Application of Ecological Networks[311]	In a study of 38 ecological networks around the world, 18 included sustainable development as an objective, but not one included climate change adaptation or maintenance of ecosystems services as an objective.
Ecological Networks Experience in the Netherlands[312]	This short working paper, which highlights the goals and successes of establishing an ecological network in the Netherlands, simply mentions climate change as an emerging issue to consider in the future.
Review of Experience with Ecological Networks, Corridors and Buffer Zones[313]	In this review of 30 ecological networks from around the world, only two of the case studies even mention climate change adaptation, and none of them include it as an explicit objective.
Beyond Boundaries: Transboundary natural resource management in sub-Saharan Africa[314]	This report briefly mentions a range of potential benefits of transboundary collaboration at the beginning, including improving connectivity to adapt to climate change, securing land tenure, and enabling sustainable development. However, the subsequent chapters focus on stakeholders, agreements, capacity, communication and enabling context, with no specific guidance on incorporating climate issues or ecosystem services.

There is some evidence, however, that planners and academics are beginning to recognize that large regional networks and transboundary protected areas provide benefits far beyond sustaining species meta-populations, maintaining migration corridors, and promoting peaceful relationships. For example, recent studies show that large regional networks and transboundary protected areas are critical in enabling climate adaptation at large scales,[315] maintaining overall landscape resilience,[316] maintaining ecosystem services,[317] and enhancing local livelihoods.[318] As countries continue to create new transboundary protected areas and participate in the establishment of large regional and even continental networks, they should consider explicitly recognizing and incorporating these multiple benefits and values into the design and management of these areas.

Best practice 27: Design and manage transboundary protected areas and regional networks to enable climate change adaptation and maintain ecosystem services

Large-scale conservation, including regional networks and transboundary conservation, is critical to promoting resilience across large landscapes.[319] Therefore, planners should consider incorporating specific goals for improving resilience, enabling climate adaptation and maintaining ecosystem services into their plans for developing and managing transboundary protected areas and large regional networks. Table 22 shows some guidelines for planners to consider.

Table 22: Guidelines for incorporating climate resilience principles into transboundary protected areas

Assessing climate impacts and vulnerability	» Conduct vulnerability assessments and develop regional-scale species and ecosystem distribution scenarios under climate change » Identify transboundary areas that are especially important for climate change adaptation and resilience (e.g., large, intact areas; areas of refugia and with a history of demonstrating resilience; areas important for migration and areas of shifting ecotones under climate change) » Identify regional-level thresholds for resilience and system regime shifts
Developing climate adaptation plans	» Share national adaptation plans across boundaries, and where appropriate develop regional adaptation plans and strategies » Adopt medium-term (i.e., 20- to 30-year) time horizons to adequately plan for climate impacts » Plan corridors, regional networks, and transboundary protected areas at multiple scales (including at site, landscape, national, sub-regional and regional) and along gradients likely to be important under climate scenarios
Incorporating the maintenance of ecosystem services into transboundary management	» Identify and protect large, intact areas that span boundaries and also provide key ecosystem services to one or both countries » Consider how the design, location and management of protected areas in one country may affect ecosystem functioning and the provision of ecosystem services within another country » Manage cross-boundary protected areas for the maintenance of key ecosystem services, as well as for biodiversity
Taking action to adapt to climate change	» Take joint action to tackle regional threats that exacerbate the impacts of climate change, such as illegal logging and invasive species » Promote sustainable management of the matrix surrounding transboundary protected areas » Promote multiple and redundant connections and pathways for species movement and ecological processes across the region » Collaborate in restoring areas critical to regional climate adaptation (e.g., bottlenecks) » Collaborate on translocation of species across boundaries as necessary

Market day in Ghana © UNDP Photo library

Case study: Establishing transboundary protected areas in the Minkebe-Odzala-Dja region to maintain ecosystem services

One of the last major intact forest areas in Central Africa lies in the intersection between southeastern Cameroon, northeastern Gabon, and northwestern Congo. Although five protected areas already exist in the region, these are not managed collaboratively, there are no provisions for managing the entire region as a single unit, and there are no conservation projects between the protected areas. A UNDP/GEF project, *Conservation of Transboundary Biodiversity in the Minkebe-Odzala-Dja Interzone in Gabon, Congo, and Cameroon,*[320] aims to conserve biodiversity and maintain key ecosystem services by creating transboundary corridors, encouraging local community participation in transboundary management, and coordinating transboundary reserve management across the entire forest ecosystem in this region. By improving and coordinating the management of protected areas within and across boundaries, the project is helping to protect critical forest ecosystem services, including the maintenance of water flows and hydrological regimes, the protection of transboundary migration for a wide number of species, and the provisioning of forest-based livelihoods, including sustainable forest management.

↘Best practice 28: Design and manage transboundary protected areas and regional networks to sustain and enhance local livelihoods

In addition to improving landscape-level resilience and maintaining ecosystem services, transboundary protected areas and regional networks can also play a pivotal role in sustaining and enhancing local livelihoods. Planners can explicitly incorporate local livelihoods and human well-being into their plans for transboundary protected areas and regional networks by a) collaboratively identify areas and resources important to sustaining local livelihoods; b) collaboratively delineating zones for community resource use, especially where these areas span boundaries; c) collaboratively identifying relevant stakeholders who depend on protected area resources for their livelihoods; d) jointly agreeing on resource use guidelines and limitations; e) collaborating on threat prevention, detection and control, particularly for those threats that impair local livelihoods; and f) conducting joint monitoring of the impacts of resource use.

Protected areas are increasingly viewed not as islands of biodiversity, but as the building blocks of regional networks that will sustain ecological processes over time and space.

Park signs in W-Arly Pendjari © G H Mattravers Messana

Case study: Transboundary protected areas and sustainable livelihoods in Burkina Faso, Benin, and Niger

The nexus of northern Burkina Faso, western Benin, and southeastern Niger, known as the W-Arly-Pendjari region, is the largest and most important continuum of terrestrial, semi-aquatic and aquatic ecosystems in the West African savannah belt as well as the most significant area for elephant conservation in all of West Africa. The UNDP/GEF project *Transboundary Conservation around the W-Arly-Pendjari Parks*[321] is assisting all three countries in working toward the sustainable use of ecological resources and alleviation of poverty and hunger. The project, which is aligned with each country's poverty reduction strategy, aims to improve local capacity, governance, quality of life, income, food security, and soil and water conservation. For example, the project aims to produce at least a 10 percent increase in economic benefits derived from biodiversity-friendly initiatives, such as village hunting areas, bee keeping and ecotourism, around the W-Arly Pendjari complex by the end of project.

Issues and challenges in connectivity corridors and transboundary protected areas

In promoting corridors and integrating protected areas into wider landscapes and seascapes

» There are almost always potential trade-offs in protected area management – trade-offs between ecological benefits and societal benefits. These trade-offs are likely to be exaggerated in connectivity corridors, since the risk of human and wildlife confrontation is likely to be higher. Planners should consider addressing the issue of human wildlife conflicts early on, in order to proactively reduce conflict and resolve potential problems.

» Understanding connectivity for different species is complex; understanding connectivity for species distribution patterns under climate scenarios is even more so. While scientists can test the effectiveness of traditional connectivity corridors in enabling species movement (e.g., through camera traps, sand traps, genetic testing), it is far more difficult to test whether or not a corridor would be effective in enabling the maintenance of ecological processes, species movement and ecosystem services under future climate scenarios. Planners should consider communicating the full range of benefits of connectivity corridors, both present and future, to agencies, donors and the public, rather than stressing one or two specific benefits of species connectivity.

In promoting regional networks and transboundary protected areas

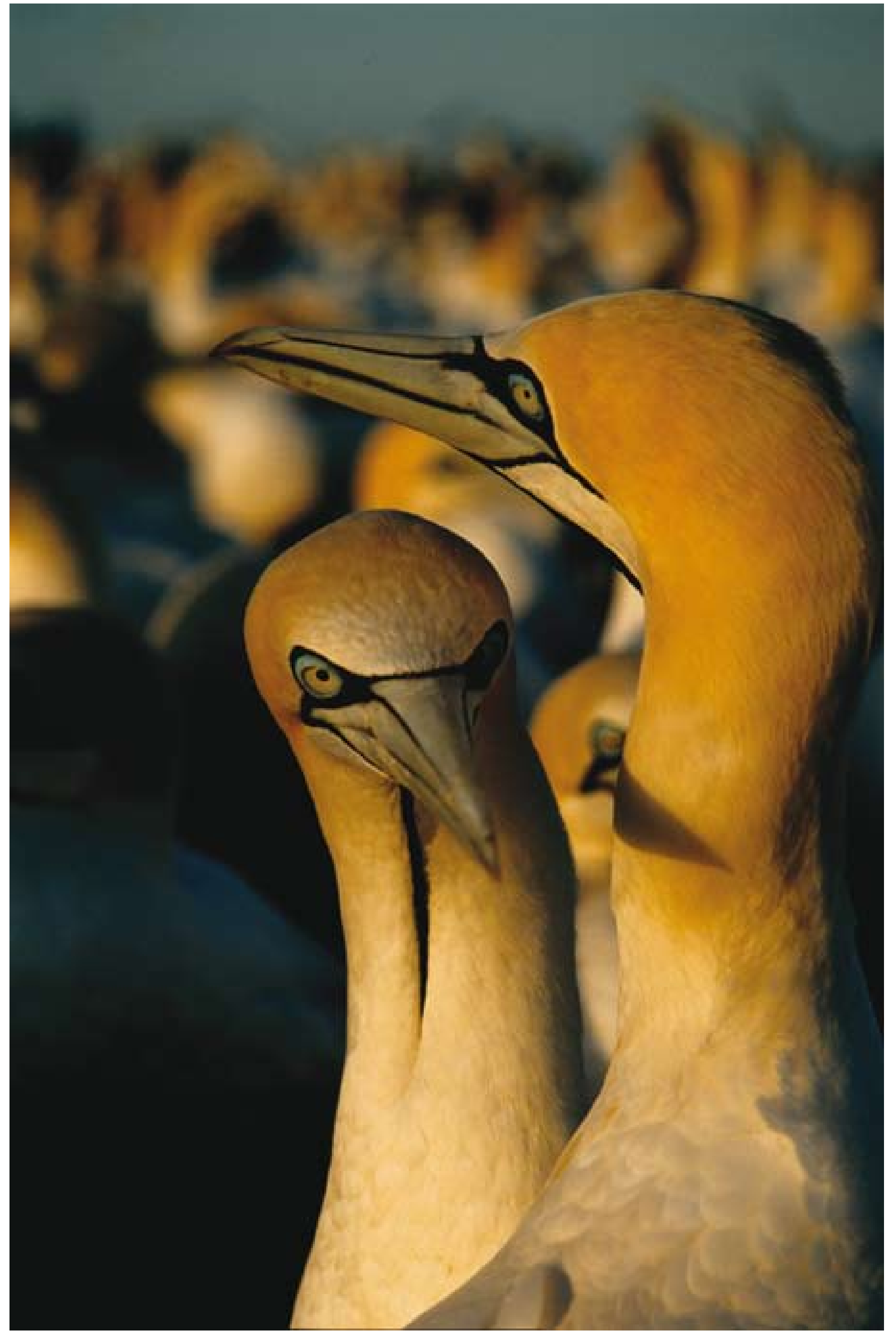
» Transboundary collaboration is an inherently complex process, involving many actors, issues and agendas. It may be difficult for multiple countries, or even two countries, to agree on a specific set of objectives for the designation and management of a transboundary area and/or a regional network. Planners can build national and international support for such networks and areas by stressing how the benefits extend far beyond species protection, and by stressing issues that are high on national agendas, such as alleviation of poverty, adaptation to climate change, and maintenance of key ecosystem services, such as water.

» Even large regional networks require compatible surrounding landscapes and seascapes. Ensuring that transboundary protected areas and regional networks are embedded within large-scale sustainable land use plans is vital to ensuring that such areas can provide key services and benefits.

» The effectiveness of a transboundary protected area in delivering a wide range of benefits is only as secure as the management of that area. Planners should periodically assess and improve the management effectiveness of individual areas within a transboundary conservation area, and within large regional networks, to ensure that they are providing the benefits and services for which they were established.

» Transboundary protected areas that protect migratory species should minimize physical barriers between countries. In the Altai-Sayan region, for example, the existence of border fences between Russia and China and between Russia and Mongolia is a recognized barrier to the migration of flagship species (e.g., Argali sheep, saiga). To be effective in such areas, transboundary areas require more than ministerial agreements; they require the high-level will of governments to remove physical fences and coordinate between border guards and security services.

Cape Gannets, Benguela Current Large Marine Ecosystem © Claudio Vasquez Rojas



Chobe National Park, Botswana © Nik Sekhran

Consequences and Conclusions

The global drivers of change outlined in the Introduction are not short-term trends; the importance of climate change adaptation and mitigation, poverty alleviation, sustainable livelihoods, and ecosystem services, and the dynamics of resource scarcity and governmental budget constraints, are long-term forces that will persist and strengthen in coming years. As governments, communities and individuals tackle these global issues, they face difficult decisions and trade-offs. The protected area decisions they make over the next 10 to 15 years will to a large extent dictate the future direction of protected areas and surrounding landscapes for the next 50 to 100 years and beyond.

This publication has identified some of the changes that need to take place in protected area design, management and assessment in order to address the global drivers of change of the 21st Century. This final section first explores some of the potential synergies, trade-offs and limitations in managing for climate change adaptation and mitigation, ecosystem services, sustainable livelihoods, and biodiversity conservation. Next, this section explores some of the potential scenarios likely to occur based on how society decides to view, invest in, and manage protected areas in the coming years. Finally, this section explores the preconditions and next steps required in order to fully release the potential of protected areas to address the global challenges of the 21st Century.

Trade-offs and synergies

In reading this publication, one could gain the impression that protected areas, provided they are properly planned and effectively managed, can simultaneously conserve biodiversity, alleviate poverty, enable human and natural communities to adapt to the impacts of climate change, and sequester carbon, all while maintaining a full suite of ecosystem services. Indeed, several authors have focused on the synergistic and complementary nature of managing nature for biodiversity conservation, climate change, ecosystem services, and sustainable livelihoods.[322] In this synergistic view, the benefits of managing for biodiversity have a cascading effect: managing for biodiversity leads to intact, functioning ecosystems, which in turn provide and sustain a wide array of ecosystem services, including climate adaptation and mitigation as well as provision of sustainable livelihoods. Improvements in the management of biodiversity automatically lead to improvements in associated benefits.

However, whenever biodiversity and natural resources are managed for more than a single objective, there are nearly always trade-offs as well as synergies. In this competing view, managing protected areas for biodiversity can decrease the flow of other benefits. Numerous authors have recently explored the various trade-offs inherent in managing biodiversity for multiple benefits, including trade-offs between carbon storage and livelihoods,[323] climate change and development,[324] biodiversity conservation and development,[325,326] and biodiversity and ecosystem services.[327] Some examples of potential synergies and trade-offs in managing biodiversity for multiple benefits are shown in Table 23.

Governments will view protected areas as efficient and high-return investments in the natural infrastructure needed to sustain humans in the face of unprecedented change.

TABLE 23: EXAMPLES OF SYNERGIES AND TRADE-OFFS IN MANAGING BIODIVERSITY FOR MULTIPLE OBJECTIVES

RELATIONSHIP	EXAMPLES OF SYNERGIES	EXAMPLES OF TRADE-OFFS
Biodiversity conservation and climate change management	» Managing for biodiversity often entails maintaining large tracts of intact ecosystems, such as grasslands and forests, which are ideal for climate change adaptation and mitigation because they are more likely to be resilient to climate impacts[328]	» Managing forests for climate change mitigation can involve practices that reduce biodiversity, for example managing forests for short rotations and favoring fast-growing, early successional species, at the expense of mature, climax species[329]
Biodiversity conservation and ecosystem services	» Managing biodiversity for conservation through restoration efforts, such as removing invasive species from grasslands and restoring fire processes, typically restores ecosystem services	» Managing a riparian system to sustain the volume of water flows may be inconsistent with the hydrological regimes needed to sustain key ecological processes (e.g., flooding)
Biodiversity conservation and sustainable livelihoods	» Intact, functioning ecosystems are much more likely to provide reliable and secure livelihoods than more vulnerable systems, reducing the vulnerability of resource-dependent communities	» Managing wild biodiversity for sustainable livelihoods, such as non-timber forest products, frequently leads to substitution, domestication or extinction,[330] particularly if safeguards are not in place
Climate change management and ecosystem services	» Managing biodiversity to maintain ecosystem services, such as maintaining water flows, provides a buffer to human and natural communities that are vulnerable to droughts, and promotes climate adaptation	» Managing biodiversity to maintain water flows by modifying the hydrological regime in a wetland, for example, can have negative impacts on the ability of the wetland to serve as a carbon sink, and could, under certain circumstances (such as peatlands) result in a carbon source[331]
Climate change management and sustainable livelihoods	» Managing large tracts of intact forests for carbon sequestration is likely to sustain livelihoods, provided there is effective governance in place[332]	» Managing forests for carbon sequestration may change the tenure system and disrupt access to local communities whose livelihoods depend upon the forest resource[333,334]
Ecosystem services and sustainable livelihoods	» Managing biodiversity to maintain ecosystem services disproportionately benefits the poor, who depend on natural resources and ecosystem services the most[335]	» Managing grasslands to sustain grazing through annual fires may harm important medicinal plants and thatch resources[336]

The synergies and trade-offs between managing biodiversity for conservation benefits, for climate change and carbon benefits, for livelihoods and for ecosystem services are complex, difficult to quantify and highly contextual.[337] In many cases, a win-win relationship is just as possible as a win-lose relationship, depending upon the exact circumstances.[338] For example, there is a strong association between carbon stocks and species richness, suggesting that synergies between managing for carbon and managing for biodiversity would be high. However, the distribution of these areas of congruence, even within protected areas, is variable and uneven. Some areas that are high in biodiversity would not benefit from carbon-focused conservation, and could fall under increased pressure if REDD+ activities area implemented.[339]

There is no single formula that will allow protected area planners to know whether their management practices are achieving the maximum possible benefits, or are achieving one benefit at the expense of others. However, there are some guiding principles and best practices that can help planners be clearer and more consistent in assessing the potential synergies and trade-offs between multiple objectives (see Table 24).

Table 24: Guiding principles and best practices in assessing potential synergies and trade-offs

Avoid harm: Planners should apply the precautionary principle when it comes to managing biodiversity, which states that in the absence of scientific consensus about risks, potentially harmful actions should be avoided.
Avoid negative synergies: In some cases, managing too intensively for ecosystem services or sustainable livelihoods without clear thresholds can lead to negative synergies, in which degraded ecosystems become more vulnerable and less productive, leading to further degradation. Planners should anticipate and avoid negative feedback loops and "vicious cycles."
Focus on small losses, big gains: Focusing on small trade-offs and large positive synergies can help planners optimize their management practices. For example, one study found that an 8 percent reduction in biodiversity resulted in 40 to nearly 60 percent increase in ecosystem services.[340]
Focus on areas of highest overlap: Planners should focus on those areas that will yield the maximimum benefits and the most positive synergies.[341]
Create resilience-based thresholds: Planners can develop thresholds based on climate resilience principles that can guide their decisions.
Conduct an integrated assessment of trade-offs and synergies: An integrated assessment of trade-offs, which looks at existing conditions and trends, potential scenarios, and potential human and ecological responses, will provide planners with a broader, more realistic picture of trade-offs.[342]
Be spatially explicit: Trade-offs between ecosystem services and other values cannot be calculated unless they are quantified and valued. One of the best ways to understand and assess trade-offs and synergies is to create a spatial overlay of biodiversity, carbon, ecosystem services, and livelihoods.[343]
Consider both direct and indirect relationships: Some relationships are direct (e.g., spatially overlaying water provisioning services with biodiversity maps), while others are indirect (e.g., indirect impacts on livelihoods when managing for biodiversity or ecosystem services); planners should consider both.
Consider resilience and integrity: Including an assessment of ecosystem resilience and integrity can help determine the extent to which an ecosystem can be managed for multiple competing benefits.
Use tools to calculate trade-offs: Several tools exist that can help quantify and monitor trade-offs;[344] using these tools can help planners be more consistent and explicit in the decisions they make.
Develop management triggers and safeguards: Planners should develop triggers that help them recognize when an ecosystem is moving closer to a tipping point, and establish safeguards for ensuring that these thresholds are not crossed.
Be explicit and transparent about trade-offs: Planners can be transparent about their decisions by carefully assessing trade-offs, and by communicating these decisions and their implications to the public.[345]

There are also a few points that protected area planners, managers and policy makers may want to keep in mind when thinking about trade-offs and scenarios.

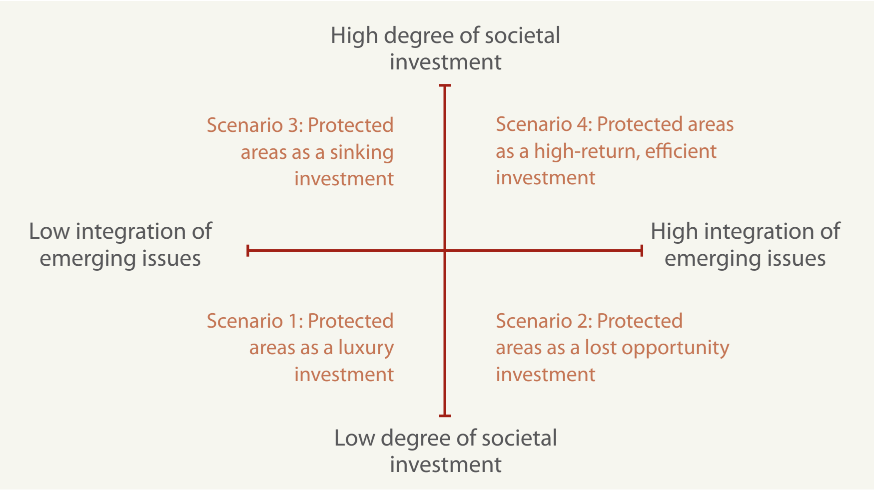
- The first is that no single strategy is likely to achieve any of society's objectives – protected areas are not a panacea for conserving biodiversity, much less a panacea for climate change adaptation and mitigation. However, by focusing on synergistic, integrated strategies that address multiple objectives, policy makers can be more efficient and effective in achieving more of society's objectives.
- The second is that not all protected areas can achieve all objectives equally. In some vulnerable areas, conservation objectives are the most critical, and any further demands are likely to imperil biodiversity. In other more robust protected areas, multiple objectives can be achieved with few, or even positive, impacts to biodiversity. The IUCN Categories[346] for protected areas can help in identifying potential areas for achieving multiple objectives. This cautionary note applies to corridors and buffer areas as well; policy makers will need to embed the protected area network into a comprehensive land use plan in order to determine which areas are more appropriate for seeking trade-offs and synergies.
- Finally, protected area managers can consider the use of zoning within protected areas to help identify areas appropriate for considering trade-offs and synergies.

Potential scenarios

A scenario is a prediction of how the future may develop based on assumptions, driving forces, and relationships between variables. Scenarios have become a frequently used tool for conservation planning because they help planners understand underlying drivers and variables of change, understand potential outcomes of their actions, and reduce surprises in the face of uncertainty.[347] Several recent publications have highlighted potential scenarios for biodiversity[348,349] and for protected areas.[350] These scenarios use variables such as trends in biodiversity loss and decline; broad socio-demographic trends such as population growth; trends in other threats such as pollution, nitrogen deposition, and climate change; and macro-economic trends such as globalization. The result is a set of scenarios such as "The triple bottom line," "The rainbow," "Buy your Eden," "Technogarden," "Order from strength," and "Global orchestration."

Given the drivers of change outlined in the Introduction, and the best practices described throughout this document, there are two variables from which protected area scenarios can be sketched. The first variable is the degree to which governments and decision makers recognize the value of, and heavily invest in, protected areas as a strategy to efficiently achieve the multiple objectives of conserving biodiversity, managing for climate change adaptation and mitigation, reducing poverty, and maintaining critical ecosystem services. The second variable is the degree to which governments and decision makers adapt their protected area planning and management practices to fully and effectively address the emerging trends and issues outlined in this document. Combined, these two variables create four potential scenarios that could develop over the next 10 to 15 years and beyond (see Figure 17).

Figure 17: Four potential scenarios for protected areas



- **In Scenario 1,** governments and communities do not acknowledge the fundamental role protected areas can play in achieving multiple objectives, and therefore invest low levels of resources in creating and managing protected areas. Where protected areas do exist, they are managed using traditional, business-as-usual approaches, and do not integrate the emerging issues of climate, livelihoods or ecosystem services. Governments that follow this scenario are likely to increasingly view protected areas as a luxury investment, and for countries struggling to address pressing issues of increased poverty, severe climate change impacts, and political and economic crises, protected areas will eventually be viewed as irrelevant to society.

- **In Scenario 2,** governments and communities acknowledge the fundamental role protected areas can play in achieving multiple societal objectives, but do not have the financial resources to properly invest in creating new, or managing existing, protected areas. Governments that follow this scenario fully integrate emerging issues into their management practices, and may see social, economic and ecological gains, but the low degree of investment means that the full benefits of comprehensive and effectively managed protected areas are unable to be realized. As the opportunities for creating new protected areas gradually decrease, protected areas are likely to be viewed as a lost investment opportunity.

- **In Scenario 3,** governments and communities recognize the full value of protected areas, and invest high levels of resources into their creation and management. However, because these areas are managed under outdated paradigms, and do not account for emerging issues, protected areas are unlikely to deliver the full range of expected benefits. As climate change impacts become more and more severe, and as society places more and more demands on them for a range of ecosystem services, protected areas may not be equipped to cope with these impacts and demands. Under this scenario, protected areas will increasingly be viewed as a sinking or failed investment.

- In Scenario 4, governments and communities recognize the full value of protected areas, and place a concomitant level of investment in the human and financial resources needed to create new protected areas and manage existing ones. Moreover, these areas are designed and managed to address a full range of emerging issues, including climate change, ecosystem services, and sustainable livelihoods, while still maximizing biodiversity conservation. In this scenario, the value of protected areas continues to grow; governments increasingly view them not only as investments in biodiversity conservation, but as efficient and high-return investments in the natural infrastructure needed to sustain humans in the face of unprecedented change.

Prerequisites and next steps

In the new model of protected areas that has begun to emerge, protected areas are viewed as a strategy to maintain critical life support systems and to enable human and natural communities to adapt to the impacts of climate change. This document outlines the technical steps needed to create, manage and assess protected areas in order to achieve this vision. However, technical knowledge is a necessary but not sufficient prerequisite for the kinds of changes required to fully realize the ecological, social and economic potential of protected areas. Additional policy and financial prerequisites are needed to ensure that the strategies outlined in this document take root.

First, governments, communities, corporations and other private entities must fully recognize, embrace and communicate the true value of protected areas. Local zoning boards, mining companies, tourism ministries, aid agencies, non-governmental organizations, family-owned farms and more – all must understand their relationship with protected areas, including the benefits they derive, and the impacts they create. Fully embracing the issues outlined in this document is likely to mean more than simple technical implementation; in most cases it will mean some form of policy and financial realignment. For example, governments may need to reconsider how they organize and manage their agencies, in order to ensure that there is true integration with various sectors. Donors and aid agencies may need to reconsider their programmatic priorities and financial allocations to increase support, particularly for the creation and management of protected areas to address emerging issues. Corporations may need to adjust their business approach, and develop tools for compensation, such as biodiversity offsets.

Second, there will be an unprecedented need for greater integration and sectoral collaboration. A recent intergovernmental meeting[351] called for the creation of multi-sectoral working groups in order to have a more integrated approach to implementing the Programme of Work on Protected Areas. More than 30 such groups have been established globally, but much more work is needed at all levels. If society is to fully embrace the emerging model of protected areas, multi-sectoral working groups will become critically important at regional, national, sub-national and community levels. These groups ensure that protected areas are mainstreamed into governmental policies, incorporated into private-sector practices, and fully integrated into land-use and resource plans and strategies.

Third, there must be an unprecedented level of financial commitment and political will. Investing in protected areas, particularly during economically challenging times, will be a difficult political decision. Governments are likely to face criticism from their constituents. Communities may be divided over land-use plans. Corporations may have strong disagreements between their boards and shareholders. Donors and aid agencies may be criticized for their choices. However, armed with information about the true value of protected areas, and equipped with effective communication strategies, these entities will need to learn how to convince their constituents, members and shareholders of the value of protected areas as an effective and efficient long-term investment.

Finally, governments will need to make full and strategic use of all available funding. The key question that governments must answer is: what sources of finance—including domestic finance, overseas development assistance, market-based mechanisms, and private philanthropy—will allow the country to address its protected area funding needs? A one-size-fits-all strategy for protected area finance does not exist. A feasibility assessment of the options available needs to be undertaken, looking at country-specific needs and circumstances. This assessment needs to look at the feasibility of different funding options, the policy interventions needed to make financing options viable, and the options for accessing, combining and sequencing different funding sources to meet the country's financing needs.

It is clear that the world faces unprecedented social, economic and ecological challenges in the coming decades. It is also clear that society's views toward protected areas are evolving as a result of these challenges. In the face of national economic, social and ecological crises, the political pressure for decision makers to succumb to short-term thinking is enormous. However, at the end of the first decade of the 21st Century, the options ahead for the coming decades are clear – protected areas are one of the most efficient and effective strategies available for simultaneously addressing the global challenges of alleviating poverty, adapting to and mitigating climate change, and maintaining a host of ecosystem services. Although the upfront investments in protected areas are high, the long-term ecological, social and economic dividends are enormous. By taking bold steps and by demonstrating firm political will, the world's leaders and decision makers can ensure that protected areas truly are for the 21st Century.

Best practices for protected areas in the 21st Century: Lessons from UNDP/GEF's portfolio

Enabling policy environment

Best Practice #1: Create a supportive policy environment to promote climate change mitigation, adaptation and resilience and to maintain ecosystem services
Best practice #2: Create a supportive policy environment to sustain livelihoods
Best practice #3: Incorporate climate, livelihoods and ecosystem services issues into protected area valuation studies
Best practice #4: Integrate protected areas into National Adaptation Programmes of Action and other national climate plans
Best practice #5: Integrate protected areas into food security planning

Management planning, research and monitoring, and assessment

Best practice #6: Incorporate climate change into management planning
Best practice #7: Incorporate ecosystem services into management planning
Best practice #8: Incorporate sustainable livelihoods into management planning
Best practice #9: Focus research and monitoring efforts on key gaps related to climate change, ecosystem services, and sustainable livelihoods
Best practice #10: Account for issues related to climate and ecosystem services within management effectiveness assessments

Protected area threats and restoration

Best practice #11: Incorporate climate change as an integral component of threat assessments
Best practice #12: Address threats that exacerbate climate change impacts
Best practice #13: Determine the effects of threats on livelihoods and ecosystem services
Best Practice #14: Plan restoration efforts around resilience and climate change

Governance and participation

Best practice #15: Promote the widest possible array of protected area governance types
Best practice #16: Effectively engage stakeholders in issues related to climate change adaption and threat reduction, ecosystem services and sustainable livelihoods

Protected area capacity

Best practice #17: Focus capacity-building efforts on capacities needed to address climate, ecosystem services, and livelihoods issues

Sustainable finance

Best practice #18: Create sustainable protected area finance plans with diverse finance mechanisms
Best practice #19: Systematically assess the financial sustainability of protected area systems

Protected areas networks and ecological gap assessments

Best practice #20: Incorporate climate change into ecological gap assessments
Best practice #21: Incorporate connectivity into protected area ecological gap assessments
Best practice #22: Incorporate ecosystem services into ecological gap assessments
Best practice #23: Include the widest possible array of governance types in gap assessments

Connectivity corridors and transboundary protected areas

Best practice # 24: Incorporate social and economic benefits into connectivity corridors
Best practice #25: Incorporate climate change considerations into corridor design and management
Best practice #26: Plan and manage corridors to sustain key ecosystems services
Best practice #27: Design and manage transboundary protected areas and regional networks to enable climate change adaptation and maintain ecosystem services
Best practice # 28: Design and manage transboundary protected areas and regional networks to sustain and enhance local livelihoods

Glossary

Biodiversity: The variation of life forms within a given ecosystem.

Climate adaptation: In species, climate adaptation includes changes in range, migration patterns, feeding and breeding patterns and phenological changes in order to adjust to the impacts of climate change. In humans, climate adaptation is the ability to understand, predict and appropriately respond to impacts of climate change.

Climate mitigation: The ability of an ecosystem to sequester and store carbon, and reduce the amount of greenhouse gas emissions into the atmosphere.

Climate resilience: The ability of an ecosystem to withstand climate-related pressures without having a regime shift

Connectivity: The extent to which the physical relationships between landscape (and seascape) elements enable the full range of natural processes, such as species migration, across a regional scale.

Connectivity corridor: A connectivity corridor is a physical element of a landscape (e.g., a band of forested land cover, or a series of wetlands in a migratory flyway), that enables species to move across the landscape in order to migrate, disperse, feed and breed.

Protected area gap assessment: An assessment of the degree to which a protected area network captures the full range of biodiversity within a given system, such as a national protected area system.

Ecosystem: A system formed by the interaction of a community of organisms with abiotic factors within their physical environment.

Ecosystem services: The products and services that humans receive from functioning ecosystems.

Ecotone: The transition area between two distinct ecosystems.

Enabling policy environment: The suite of policies, laws, legal frameworks, incentives and other mechanisms that either encourage or inhibit the establishment and effective management of protected areas.

Governance: The set of processes, procedures and practices that determines who manages a protected area and how decisions are made.

Key biodiversity feature: The species, ecosystems and ecological processes for which management goals and objectives are set.

Other conserved areas: Areas of land or water that, while not legally designated as protected areas, still provide some forms of biodiversity conservation.

Payment for ecosystem services: The exchange of financial incentives for practicing land or water management that provides some form of ecosystem service.

Protected area: A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.[352]

Protected area network: The sum of all lands and waters in a given region that have some form of legal protection.

Protected area system: The sum of all lands and waters in a given region with some form of protection, and the management and governance regimes of those lands and waters.

Refugia: An area that remains relatively unchanged during abrupt changes in climate.

Regime shift: A switch in an ecosystem from one relatively stable state to another, usually with less biodiversity and complexity, and often irreversible.

Regional network: Large areas of continuous and connected natural cover with ecological processes relatively intact.

Resilience: The ability of an ecosystem to withstand pressure (e.g., temperature extremes) without experiencing a regime shift.

Resilience thresholds: The point at which an ecosystem experiences a regime shift, or a switch from one stable state to another.

Sustainable livelihood: The means of earning a living without compromising the conservation of biodiversity.

Tipping point: A point in a continuum of pressure, such as temperature extremes, at which an ecosystem passes its resilience threshold, and changes from one stable state to another.

Transboundary protected area: An area of land or sea that spans the boundaries of one or more countries or sub-national entities, and where there are legal or other arrangements for joint management.

Vulnerability assessment: An assessment of the degree to which species are sensitive to the impacts of climate change.

African Penguins at Boulder's Beach, Table Mountain National Park © Adriana Dinu

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By taking bold steps and by demonstrating firm political will, the world's leaders and decision makers can ensure that protected areas truly are for the 21st Century.

Leopard Resting in a Tree, Moremi Game Reserve, Botswana, Africa © SRstock

Global Environment Facility

The GEF unites 181 countries in partnership with international institutions, NGOs, and the private sector to address global environmental issues while supporting national sustainable development initiatives. Today the GEF is the largest public funder of projects to improve the global environment. An independent financial organization, the GEF provides grants for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. www.thegef.org

United Nations Development Programme

The UNDP is the UN's global development network, advocating for change and connecting countries to knowledge, experience and resources to help people build a better life. The UNDP is on the ground in 166 countries, working with them on their own solutions to global and national development challenges. www.undp.org/biodiversity

The Convention on Biological Diversity (CBD)

Opened for signature at the Earth Summit in Rio de Janeiro in 1992, and entering into force in December 1993, the Convention on Biological Diversity is an international treaty for the conservation of biodiversity, the sustainable use of the components of biodiversity and the equitable sharing of the benefits derived from the use of genetic resources. With 193 Parties, the Convention has near universal participation among countries. In February 2004, the Parties to the Convention on Biological Diversity made the most comprehensive and specific protected-area commitments ever made by the international community by adopting the Programme of Work on Protected Areas (PoWPA).
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