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Securing Protected Areas in the Face of Global Change: Issues and Strategies

IUCN World Commission on Protected Areas

Securing Protected Areas in the Face of Global Change

Issues and Strategies

Edited by Charles Victor Barber, Kenton R. Miller and Melissa Boness

Kenton R. Miller, Project Director

A Report by the Ecosystems, Protected Areas, and People project

IUCN The World Conservation Union

WCPA World Commission on Protected Areas

The Nature Conservancy

World Resources Institute

IUCN

Global Environment Facility

UNEP

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2004

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Foreword

In more than 35 years as a conservation practitioner working with a diverse and committed cast of characters worldwide, I have had the opportunity to reflect upon the many challenges that face protected areas both then and now. Undoubtedly, much has changed. For those of us who were fortunate enough to have a hand in the early development of protected area systems in various countries, it is clear that the overall context within which protected areas are being managed has changed, in some cases dramatically.

In my own experience, for example, when I first began living and working in Costa Rica in 1964, the nation's population was around 1.5 million people, and coffee, one of the country's dominant crops, extended from the margins of the nation's capital, San José, to abut the runways of the international airport. As some of the country's first national parks were established in the early 1970s, most areas were intimate ecological components of greater wild landscapes. Today, the human population has doubled, and instead of coffee growing along the airport highway, one now finds industries and hotels. Over the past three decades, the landscapes surrounding – and in some cases even within – protected areas are rapidly being transformed by agriculture and timber harvesting. Some sites lie within the margins of towns and cities, or are bisected by roads, pipelines and industry. Very importantly, the private sector has established an impressive set of private nature reserves that feature ecotourism. Local communities are engaged in developing and operating small field hostels, making "trickle down" a reality for some neighbors to the protected areas.

These types of changes in the landscape, the economy, and the social and political institutions of many countries have had profound impacts on protected areas over the past decades. Looking forward, scientists and field practitioners alike are signaling that future types and rates of change (e.g., climate change, alien invasive species, and economic and policy transformations) will compound the challenges that face protected area managers, and will directly impact upon our capacity to protect wild nature and its supply of material and non-material ecosystem services (water, genetic materials, recreation, tourism, cultural and sacred site protection, etc.). Taken together, we call these changes "*global change*" because they either have global impacts, or are relatively ubiquitous across the face of the planet and the sweep of human society. While the detailed characteristics of each type of change are distinct from site to site, the general framework of each is similar worldwide.

During subsequent decades, my work, and in particular my role as Chair of the IUCN World Commission on Protected Areas (WCPA), has given me the opportunity to observe conservation and development activity on all continents including Antarctica. It has become clear to me and many of my colleagues that protected area managers, community leaders and policy makers will need to modify their current approaches to planning and management, or be swept away on the quickening currents of global change. We must understand and anticipate these changes, and take action as matter of urgency. The most fundamental action, however, needs to take place within our own heads. We live, all too suddenly, in a fundamentally new world, but we still

act all too often as if we – and the protected areas we are pledged to conserve – are still in a world that has, in fact, been largely swept away by accelerating forces of global change.

Some fundamental questions need our attention: Will protected areas be able to retain their capacity to secure major and significant areas of wild nature? Will they be able to meet humanity's growing demand for material and non-material environmental goods and services and still retain their ecological functions and integrity? Can parks contribute to poverty alleviation without compromising the commitment to nature conservation? You will find discussions of these and other issues in the chapters to follow.

In many countries, governments, universities, NGOs, and communities are already experimenting with options for adapting their management approaches to address some of these questions posed above. However, despite impressive strides forward in individual protected areas, existing mechanisms for sharing information and the lessons being learned are limited in their extent and scope. Many also lack adequate input and orientation from science and policy analysis. An interactive framework is required to foster and enable the exchange of knowledge and experience on specific areas of common interest, shift the scale of vision and activities to whole ecosystems and bioregions, and adapt plans and investments to a context of accelerating change.

With this in mind, members of WCPA and our partners[1] have established the *Ecosystems, Protected Areas, and People Project* (EPP), which aims to strengthen the capacity of the management community to care for protected areas in a world of rapid global change. Our purpose is to share knowledge and best practice with managers, policy makers, and stakeholders. What do we know? How can these actors launch adaptive approaches to management? Importantly, how can managers learn from one another?

This report represents an early exploration of the issues and options for protected areas management with respect to global change. Obviously, there are many types of change at play, and many approaches to apply and test. Within these chapters you will find discussions of impacts and options for addressing issues of biophysical, socio-economic, and institutional change. We have sought to bring together the key findings from other important works, and pair them with the results of our own experts and consultations. We hope that the reader will make full use of the extensive reference sections for each chapter, and pursue further information through the authors and centers of excellence listed therein. There will be more to come. WCPA will continue to present new findings, and the results of ongoing field testing.

Another component of the EPP project is the establishment of a network of *Field Learning Sites,* where managers and stakeholders are "learning by doing" in terms of dealing with changing biophysical, social, economic, institutional, and political factors. The lessons learned in these sites and others will be uploaded onto the *Protected Areas Learning Network* (PALNet) web site.[2] This interactive on-line service of IUCN/WCPA

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1 WCPA's partners in the EPP project include IUCN, UNESCO, The Nature Conservancy, Conservation International, World Resources Institute, WWF, with important support from UNEP/GEF.

2 www.parksnet.org

is expected to be operational late in 2004 and form part of IUCN's Knowledge Network.[3]

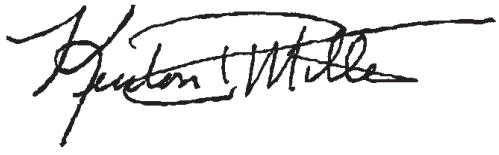
Through the use of networks such as PALNet, and the exchange of knowledge and best practices for managing for change, I am convinced that protected area managers can strengthen their capacity to secure biodiversity into the future. Allow me to share with you a sketch of my vision of the future of protected areas in a world of accelerating change. The management community will be led by a strong, well-informed cadre of people from a variety of backgrounds and institutions. These will include central and local government conservation departments, local community and indigenous groups, and NGOs. They will work through cooperative arrangements that feature the participation of stakeholders in planning, management, and implementation. Co-management approaches will become the norm, whereby local communities will take care of selected functions of area management. In some cases, local groups will assume primary authority and responsibility for particular areas, especially where they are located in or near traditional territories.

Future managers will be fully conversant in the practice of adaptive management, and have installed such methods in their most important biodiversity sites. Together with local universities and research centers, managers will incorporate a set of indicators and monitoring methods to signal changes that warrant attention and possible adaptation, for example, of a policy on visitor use, a modified strategy for habitat restoration, or a new practice on road and trail maintenance.

Initially, the conservation community will have debated exhaustively about the relationship between protection and sustainable use, with some constituents promoting more biocentric perspectives in which consideration of nature comes first, and others calling for a more anthropocentric approach which puts people first. Perhaps optimistically, a resolution will come out of science and practice, components of which are already emerging. Reconciling these two perspectives is largely a matter of defining shared or compatible objectives, based on better understanding of underlying ecological imperatives and human needs. Fundamentally, it is a matter of balance.

I trust that this report, as the first installment of this project, will be of value in achieving this vision. I would also like to invite all readers to join the PALNet network and provide their own lessons and case studies on managing for global change, so that we may increase our knowledge and learn from your experience. To exchange information or join our network, please contact the World Commission on Protected Areas (www.iucn.org/themes/wcpa/).

Respectfully,



Kenton Miller, Chair
IUCN World Commission on Protected Areas 2000–2004

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[3] PALNet will be closely linked with other IUCN knowledge management initiatives such as the Species Information System, and the ECOLEX Gateway to Environmental Law.

Acknowledgements

This report is the product of a global team effort initiated by the IUCN World Commission on Protected Areas (WCPA) and the World Resources Institute (WRI). Since 1999, a partnership of individuals, non-governmental organizations, foundations and bilateral agencies have supported the Ecosystems, Protected Areas, and People (EPP) project and its Protected Area Learning Network (PALNet).

Through the generous contributions of time, resources, and work of project partners, this endeavor has helped to bring the challenges and impacts of global change to the forefront of discussion and action in the protected area community. Specifically, we would like to thank the United Nations Environment Programme (UNEP), as the implementing agency for the Global Environment Facility (GEF), which has generously supported the EPP project through a medium-sized-project grant. In addition, critical contributions from The Nature Conservancy, Conservation International, the World Wildlife Fund (WWF), WRI, the UNESCO Man and Biosphere Programme, and World Heritage Centre, the Swedish International Development Authority (SIDA), the Netherlands Ministry of Foreign Affairs, and the Norwegian Ministry of Foreign Affairs (NMFA), have made this report and the preceding work of the project possible.

Bret Bergst (IUCN and WRI) coordinated the whole team effort, and organized regional workshops and project Steering Committee and team meetings. He has also contributed significantly to the development of Chapter 1, *Understanding Global Change*. Kishore Rao is the manager for that portion of the EPP project that is supported by the GEF through UNEP as the implementing agency. He was responsible for managing and leading three consultative and training workshops, as well as supporting the technical teams while working in South Asia. Aban Marker Kabraji, Director of the IUCN Asia Regional Office, facilitated the management of the project.

Special thanks are due to Rob Wolcott for his many hours of brainstorming and conceptual guidance on the overall concepts of the project.

Conservation International (CI) provided the services of Dr Mohamed Bakarr, who has served not only as Deputy Chair of WCPA, but also led, with his colleague Dr Gustavo Fonseca, the work on gap analysis and options for completing the world network of Protected Areas. Moreover, CI provided access to their most advanced research and interim findings on the design of protected area systems, and organized and led one of the major workshop streams at the Vth World Parks Congress in 2003. The Nature Conservancy supported the work of Dra. Julia Carabias and her team, and supported three regional workshops addressing the issue of capacity development. Dra. Carabias also organized and led a major workshop stream at the Vth World Parks Congress, and published the results of the three regional workshops on capacity building. WRI provided us house and home during the formative period of the project and the development of this report. Special thanks go to WRI President Jonathan Lash for his encouragement and support.

Additionally, we would like to thank IUCN Director General Achim Steiner, and David Sheppard, Head, IUCN Protected Areas Programme, for their encouragement and

support for the project. Mark Zimsky, Sheila Aggarwal-Khan, and Max Zieren provided helpful suggestions, support and encouragement from UNEP.

This report, and the project as a whole would not have been possible without the critical participation and contributions of our technical teams. As our project experts, their work has enabled us to base this report on solid, credible information and analysis, developed through five technical expert working groups. Each working group developed the substantive information and background documentation upon which each chapter has been based. Team leaders include: Rob Wolcott, U.S. Environmental Protection Agency, and Dr Joel Scheraga, U.S. Environmental Protection Agency, for Chapter 1, *Understanding Global Change*; Dr Mohamed Bakarr, ICRAF, and Dr Gustavo da Fonseca, Conservation International, for Chapter 2, *Designing Protected Area Systems for a Changing World*; Ashish Kothari, Kalpavriksh Environmental Action Group, and Dr Grazia Borrini-Feyerabend, IUCN Theme on Indigenous and Local Communities, Equity and Protected Areas (TILCEPA) for Chapter 3, *Parks and People in a World of Changes: Governance, Participation and Equity;* Dra. Julia Carabias, National Autonomous University of Mexico, and John Hough, United Nations Development Programme for Chapter 4*, Building Capacity to Manage Protected Areas in an Era of Global Change*; and Dr Marc Hockings and Fiona Leverington for Chapter 5, *Evaluating the Effectiveness of Protected Areas Management: The Challenge of Change.*

Each team of experts enlisted the assistance and contributions of many practitioners, scientists, and policy makers worldwide to develop the data, information, options and guidelines contained in this report, and to them we give special thanks and acknowledgements by chapter.

Chapter 1. ***Understanding global change***. This chapter is in large part a summary compilation of three draft reports commissioned by the World Resources Institute and the U.S. Environmental Protection Agency. Each report addresses the depth and breadth of global change issues that have present and future impacts on how we conceive and manage protected areas. These reports present in detail the findings and analyses of numerous experts on biophysical, socio-economic, and institutional change. The full individual reports are available online at www.parksnet.org. We would like to thank the authors and contributors for preparing and compiling such a vast and valuable array of knowledge and information. On biophysical change, we thank Dr Anthony Janetos, H. John Heinz Center for Science, Economics and the Environment; Bret Bergst, IUCN; Jim Titus, U.S. Environmental Protection Agency; Kheryn Klubnikin, USDA Forest Service; David Sievers and Aaron Weimann. On socio-economic change we thank Sara Scherr, Forest Trends; Amanda Sauer, World Resources Institute; Marta Miranda, World Resources Institute; Safia Agarwal, U.S. Agency for International Development; and June Taylor for her editorial assistance. On institutional change we thank Janis Alcorn, Center for Cultural Understanding, Field Museum; Andres Luque, Fulbright Fellow, Yale University; and Sandra Valenzuela, Fulbright Fellow, Ohio University.

Chapter 2. ***Designing protected area systems for a changing world***. This chapter is based in part on the work of Dr Mohamed Bakarr and Dr Gustavo Fonseca of Conservation International (CI), with input from an impressive list of conservation biologists. As noted above, CI sponsored, organized, and led a major workshop stream on this topic

at the Vth World Parks Congress. The Ad Hoc Technical Advisory Group (AHTEG) of the Convention on Biological Diversity (CBD) developed several fundamental background papers that were important inputs to this chapter, with support from The Nature Conservancy (TNC). Several consultative workshops were held during the drafting process, and further publications by CI, TNC, WWF, and other experts and organizations, on the issues of gap analysis, and the identification of sites of high priority for protecting biodiversity are being prepared, and will be cited on the WCPA web site (www.parksnet.org) as they become available.

Chapter 3. ***Parks and people in a world of changes: Governance, participation and equity***. This chapter has drawn on the advice and previous work of many individuals and consultative workshops. The chapter's approach to governance and equity issues has been shaped and informed by the ongoing work of the Theme on Indigenous and Local Communities, Equity and Protected Areas (TILCEPA), a joint task force of the IUCN World Commission on Protected Areas (WCPA) and the IUCN Commission on Environmental, Economic and Social Policy (CEESP). The chapter has drawn on nine regional reviews of co-managed protected areas and community conserved areas and several papers on the history of conservation carried out by TILCEPA members and partners in 2002 and 2003. These can be found at www.iucn.org/themes/ceesp/Wkg_grp/TILCEPA/community.htm. The final synthesis of these reviews has been published in the WCPA Guidelines series (Borrini-Feyerabend, G., Kothari, A. and Oviedo, G. 2004. *Indigenous and Local Communities and Protected Areas: Towards Equity and Enhanced Conservation –Guidance on policy and practice for Co-Managed Protected Areas and Community Conserved Areas.* IUCN, Gland, Switzerland and Cambridge, UK). The author would like to express his appreciation for these and other contributions of TILCEPA members, and particularly for the efforts and leadership of Dr Grazia Borrini-Feyerabend and Ashish Kothari, co-chairs of the Theme.

Chapter 4. ***Building capacity to manage protected areas in an era of global change***. An extensive consultation process was carried out to assess capacity needs and develop the guidelines outlined in this chapter. The process included establishing a global advisory group of 13 protected area and capacity specialists, conducting regional workshops in Africa, Asia, Latin America and the Caribbean, and working directly with 32 field learning sites in the same regions. The results of this consultative process were compiled and synthesized at a meeting of experts held in Costa Rica in February 2003. In addition to their presentation in this chapter, the results of this work were contributed to the Capacity Stream of the Vth World Parks Congress, held in 2003. The authors would like to acknowledge and thank the more than 100 participants in the regional workshops, the field learning site staff, and the members of the advisory group for helping to guide the outcomes and bring together a comprehensive set of needs and guidelines for protected area capacity in the 21st Century. The participation of such a large and diverse group has strengthened this chapter.

Chapter 5. ***Evaluating the effectiveness of protected area management: The challenge of change***. In 1996, WCPA formed a Taskforce on Management Effectiveness. This Taskforce sought examples of innovative work and thought on park management evaluation, and developed the evaluation framework and guidelines presented in Hockings *et al.* (2000). Building on this work, a diverse group of practitioners from around the world began preparing for a major workshop stream at the Vth World Parks

Congress in 2003. A focus of this preparation was a workshop held in Australia in February 2003, where the group presented and reviewed case studies and drew out from them the lessons they had learned in the field and office over the last decade. Most of the case studies referred to in this text and many of the recommended guidelines were contributed during that workshop.

The authors would like to thank the Taskforce members, workshop participants and other contributors for their creativity, practicality and enthusiasm, and for their willingness to share their ideas and experiences freely. They are too numerous to mention here, but many are acknowledged in the case studies. In particular, Sue Stolton and Nigel Dudley have made major contributions to the development of methodologies and guidelines. The assistance and contributions of all the park managers and community members whose parks were evaluated are also appreciated: without them there would be no effective management and no evaluations! The support of IUCN WCPA, the UNESCO Enhancing our Heritage Project, World Bank, WRI, WWF, Parks Victoria, Queensland Parks and Wildlife Service and University of Queensland was critical in the preparation of this chapter.

Executive summary

Our world has changed beyond the recognition of those who lived just a century ago. We now live in a world of shifting climates, sea level rise, swelling human populations, invasions of alien species, shrinking and fragmented habitats, and the myriad processes and pressures of industrialization and ever-expanding globalized commerce and communication. To protected area managers, charged with maintaining sites either in the state our ancestors found them, or under controlled sustainable use practices, a report on global change may well appear to be a horror story, well beyond the scope of local interests or capacity. The challenges are indeed daunting, but managers must adapt and respond to these new realities, or protected areas as we know them today will soon cease to exist.

Changing the way that we do business is no easier for protected area managers than it is for anyone else. We cannot, however, fulfill our duties as stewards of the Earth's last natural ecosystems if we plan and manage for a world that no longer exists.

1. Understanding global change

Socio-economic change: "Global change" typically conjures images of climate change, biodiversity loss, and the like. But these biophysical changes are driven by equally momentous socio-economic changes:

- From 1900 to 2000, the world's population grew from 1.2 billion to 6 billion – a five-fold increase unprecedented in human history – and is expected to stabilize at near 9 billion by 2050. Humanity was largely a rural species until recently, but by 2030, 60% will live in cities, mostly in coastal areas, although the absolute number of rural people will continue to increase. Most population growth will occur in the high-biodiversity developing countries of the tropics.
- The global economy has grown at an even more stunning rate: global Gross Domestic Product (GDP) grew from US$17 trillion in 1950 to over US$107 trillion in 2000. The fruits of this global economic boom have not been equally shared, however. Today, fully 78% of the world's people may be considered poor, while 11% are middle income and another 11% rich. 1.1 billion people live on less than US$1 per day.
- Humanity now appropriates some 40% of the Earth's net primary productivity (solar energy captured by photosynthesis). Economic sectors with the most direct impacts on protected areas include agriculture, livestock raising, fisheries, the wood products industry, the trade in wild products, the generation of energy, and the appropriation and alteration of freshwater.

Biophysical change: People have fundamentally transformed the Earth as a result of this deepening human footprint:

- ***Climate change***, driven by anthropogenic greenhouse gas emissions, is already upon us. CO_2 concentrations are now about 30–35% higher than the natural background of the past 10,000 years. The global average surface temperature increased

over the 20th Century by about 0.6 degrees Celsius, and is expected to increase by 1.4 to 5.8 degrees by 2100, an increase greater than any during the past 10,000 years. As a result, ice and snow cover is receding, sea levels are rising, and weather patterns are changing. Impacts are greater at higher latitudes and from region to region, but all regions of the planet can expect to be affected. Species ranges are shifting, sea surface temperatures are rising, and natural resource-based production systems such as agriculture and forestry are expected to experience significant impacts, although the precise nature and distribution of future changes are difficult to specify.

- ***Habitat conversion and fragmentation*** are increasingly altering the basic context for conservation efforts. Only one-fifth of original forest cover remains in relatively large, undisturbed tracts, grasslands have been extensively converted to agriculture and pasture, and half the world's wetlands were lost during the 20th Century. Remaining natural habitats are increasingly fragmented into smaller and smaller patches, with growing negative effects on species abundance and distribution, and on the provision of ecosystem services from natural systems.
- ***Alteration of hydrological cycles*** is greatly diminishing the quantity and quality of the world's fresh water. Driving forces include fragmentation of rivers, expansion of dams, conversion of wetlands, pollution and sky-rocketing human demand for freshwater. Resulting changes in natural water flows, alteration of sedimentation processes and water quality degradation negatively affect the biodiversity and ecosystem functions of water systems worldwide.
- ***Invasive alien species*** have spread dramatically as a result of the increased mobility and trade of people, goods and species across the planet, and are now recognized as one of the greatest threats to the stability and diversity of ecosystems, second only to habitat loss. Small islands and freshwater ecosystems are particularly at risk.
- ***Biodiversity loss*** is occurring as fast today as at any time since the dinosaurs died out some 65 million years ago, and the current extinction rate is thought to be at least 1000 times higher than the rates typical through Earth's history. Some 20,000 species are known to be threatened with extinction, although the actual number may be considerably higher. Key drivers of biodiversity loss include habitat loss and fragmentation; over-exploitation of wild species; introduction of alien species; pollution; climate change; and the shrinking spectrum of species used in industrial agriculture and corresponding loss of agricultural, forest, and livestock genetic diversity.

Institutional change: These unprecedented socio-economic and biophysical changes do not bode well for the future of protected areas. A third dimension of " institutional global change" however – encompassing new norms of behavior, institutions, governance arrangements and communications technologies – provides significant opportunities for humanity to communicate, reason together and cooperate in new ways that can respond effectively to the other, more negative aspects of global change. Three dimensions of global institutional change are particularly relevant for protected area managers:

- ***The emergence of global norms of conduct***: All human societies have norms – rules and expectations concerning how a people and institutions should behave in a given situation – but for the first time, *global* norms that transcend particular countries and cultures are emerging. These include norms concerning universal human rights and equality; democracy, accountability and the rule of law; and global cooperation, including stewardship of the global environment. Like all norms, these new global norms are only variably respected or enforced. What is important, however, is that they are increasingly accepted as norms that should apply to and guide the behavior of everyone, everywhere – a truly revolutionary concept in the broad sweep of human history.
- ***New institutions and forms of governance***: These new global norms have catalyzed development of new kinds of institutions and forms of governance important for the future of protected areas. These include new global environmental institutions, as well as a proliferation of nongovernment organizations (NGOs) at local, national and global levels, forming a new and potent "third force" alongside government and the private sector. Finally, across the globe, many functions of government are being increasingly decentralized to lower levels of government, communities, and the private sector, including a wide variety of natural resources co-management arrangements with local communities and others.
- ***Globalization of communications, knowledge and culture***: The way that humanity communicates – and thereby shares and transforms knowledge and culture – has changed beyond recognition in just the past 50 years. Telecommunications, television and the Internet – virtually unknown to most people not long ago – are now ubiquitous, knitting the world's consciousness and culture together into a truly "global village." Increasingly, we all have access to the same, impossibly vast, and diverse fund of human knowledge and experience, but are at the same time drawn into an increasingly common global culture.

Protected areas managers – along with everybody else – face a fundamentally different reality than just a short time ago. This brave new world poses sobering challenges, but also presents us with new tools and opportunities to overcome them.

2. Designing protected area systems for a changing world

The world now has more than 100,000 protected areas, covering nearly 12% of the Earth's land surface, a dramatic increase from just 20 years ago. Despite this expansion, most protected area systems do not adequately conserve the many values, goods and services that protected areas provide. As our understanding of those values has improved, so too has our knowledge of how protected area systems need to be designed in order to conserve those values.

It is widely accepted that the current global protected areas network is deficient in many ways. Some ecosystems – notably marine and freshwater – are under-represented and overall, the network does not adequately protect a representative sample of the planet's distinctive ecological regions; many biodiversity "hotspots" of high endemism and under high levels of threat are not protected; the role of protected areas in

maintaining key ecological services is insufficiently appreciated; and global biophysical changes such as climate change and fragmentation have not been sufficiently taken into account in system design.

An international consensus is emerging out of processes such as the Convention on Biological Diversity and the Vth World Parks Congress concerning what protected areas, collectively, should accomplish:

Species-related conservation:

- Threatened species on the IUCN Red List, with particular attention to species listed as Critically Endangered or Endangered;
- Endemic species, with highest priority given to Critically Endangered and Endangered Species globally confined to a single site;
- Globally significant assemblages of congregatory species;
- Species important for the continued development of conservation science and management (e.g. indicator species);
- Wild relatives of domesticated or cultivated species.

Habitat/ecosystem-related conservation:

- Viable representations of every terrestrial, freshwater and marine ecosystem;
- Irreplaceable habitats and ecosystems (i.e. a habitat or ecosystem with unique characteristics such that no other area could be conserved in its place and still conserve those characteristics);
- Large, intact or relatively unfragmented natural areas;
- Natural ecosystems under high levels of threat;
- Habitats required for the maintenance of viable populations of migratory species.

Conservation of values of biodiversity for humanity:

- Ecosystem services, such as hydrological function, shoreline and soil protection, and provision of reproductive habitat for economically useful species (e.g. fish);
- Economically useful species, genes and genomes (e.g. for food, fiber, medicine and scientific research);
- Sites and species of particular socio-cultural value (e.g. sacred sites, charismatic species, recreation and retreat, aesthetic landscapes).

While this emerging consensus provides an important framework for deciding *what* protected areas should conserve, it does not yield concrete geographic priorities for *where* conservation resources and energies – always in short supply – should be invested. Numerous methods for setting priorities have emerged, including "biodiversity hotspots", "priority eco-regions", "key biodiversity areas", and the like,

each based on particular assumptions about what is most important to conserve. To be effective, however, all such methods need to balance two sets of considerations.

First, ecological considerations – such as species richness and endemism – are the essential basis for designing protected area systems, because a "system" designed in the absence of clear scientific goals and systematic scientific methods is not a system at all, but rather an *ad hoc* assemblage of protected areas. Equally important – but infrequently addressed – is the need to take biophysical global change factors into consideration in setting priorities. Conserving examples of habitat types that are particularly resilient to climate change, for example, should now be a key ecological criterion for system design, but was not something protected areas planners even considered several decades ago.

Second, and equally important, this conceptual priority map needs to be filtered through a set of socio-economic and political considerations, including threats, opportunities, available resources, and the relative balance of costs and benefits, taking global socio-economic and institutional change factors into account. Without factoring in these considerations, even the most elegant conceptual map of ecologically set priorities will remain a piece of paper.

The growing fund of knowledge and experience in global-level priority setting can provide some guidance for protected area system design, but ultimately, systems and sites are designed and managed at national and local levels, and must respond to national and local priorities and concerns as well as global ones. Systematic conservation planning methods developed over the past few decades provide important new tools for doing so. Systematic conservation planning consists, essentially, of six steps:

Getting started: Establishment of a core team, decision-making processes, budget, timeline, and processes for ensuring participation of all relevant stakeholders.

Choosing conservation indicators: Since biodiversity itself is too complex to directly measure and map, planners need to choose a set of indicators ("surrogates") to serve as their conservation targets. Depending on circumstances and goals, indicators may include some combination of species, species assemblages, and environmental information (e.g. geology or vegetative cover).

Establishing conservation goals: Representativeness (sampling the full variety of biodiversity) and persistence (long-term survival of species and other target elements of biodiversity) are the overall goals of systematic conservation planning. Planners need to translate these goals into quantifiable targets concerning how much of each element needs to be conserved, and where.

Assessing existing protected areas: Once conservation goals are set, planners have to determine the extent to which they are already conserved within existing protected areas, and what has not been covered (i.e. "gap analysis"). It is also important to assess the extent to which existing protected areas are in fact achieving these goals: just because an area is protected on paper does not mean it is being effectively managed and conserved on the ground.

Selecting additional protected areas: Once gaps have been identified, additional areas for protection need to be selected. This is usually accomplished by using an "algorithm" – a step-by-step problem-solving procedure, usually a computational process defined by

rules. Due to its complexity, many computerized algorithm methodologies are available for this process, all of which use the principle of "complementarity" – the extent to which a new area adds protection of unrepresented species or other biodiversity features.

Setting priorities for action on the ground: Once a theoretical portfolio of new protected areas (and existing areas for priority investment and action) is assembled, it needs to be "reality tested." Some areas may prove, on closer inspection, to be too degraded or too expensive to conserve. In addition, planning exercises usually identify more sites than can be immediately conserved, so priorities must be set between areas for immediate and future intervention, and between strengthening existing areas and establishing new ones.

Specific measures need to be taken to build global change factors into conservation planning processes. These factors cannot, of course, be systematically addressed unless conservation planning itself is systematic, so adoption of an ordered planning system is an important first step in factoring global change issues into system design. Climate change, fragmentation, and other biophysical change factors, however, need to be explicitly addressed as well. Climate change, for example, demands attention to potential shifts in species' ranges and their implications for protected area boundaries and connectivity. Addressing fragmentation also requires much more attention to connectivity and, therefore, to strategies for conservation in landscapes between existing protected areas where people live and work.

3. People and parks in a world of changes: Governance, participation and equity

Establishing comprehensive and effective protected area systems requires responding to socio-economic and institutional as well as biophysical global change. First, more attention must be paid to broadening the spectrum of governance models and mechanisms beyond the centralized, state-managed parks that currently dominate protected areas practice. Second, more effective and diverse protected areas governance requires participatory decision-making and management processes that incorporate and respond to the interests of a broader range of stakeholders – particularly the indigenous and local communities living in and around protected areas. Third, these new models and methods for governance and participation need to ensure that both the costs and benefits of protected areas are shared equitably.

A greater shift to community-based management (CBM) is a central element of these transitions. CBM is vitally important for a number of reasons. Contrary to popular images, there are very few places where wild biodiversity exists in isolation from human communities and activities; many "natural" ecosystems have in fact been shaped by anthropogenic disturbance; considerable local knowledge about biodiversity and its management has developed over human history, and is an important resource for management in many places; indigenous and local communities in many parts of the world directly depend on ecosystem goods and services, and so have considerable incentives to conserve them – if they can reap an equitable share of the ensuing benefits; and modern-day conservation authorities are hard-pressed to cope with the costs and logistics of management on their own, and need the help of local communities to succeed.

By the same token, CBM is not a panacea for protected areas management. Local communities vary greatly in their cohesiveness and quality of their environmental stewardship. The forces of global change have, in many cases, undermined formerly sustainable traditional resource management practices. Moreover, the sum of a local community's conservation objectives will not inevitably encompass all national and global conservation objectives. The challenges facing protected areas in the 21st Century require a diversity of approaches, ranging from community-managed initiatives with a substantial focus on poverty alleviation to state-led efforts to conserve relatively unpopulated, undisturbed large tracts of natural habitat.

Recognizing a diversity of protected area governance models

Planning and design of protected areas should encompass not just *what* needs to be done *where*, but must also address governance – *who* will have the authority and responsibility to do it. The classic model of a single national agency managing lands and waters owned or controlled by the state – albeit still important – is only one governance and management option. A number of other options are emerging or already in practice, including:

- Decentralized management by provincial, state or local government units;
- Co-management arrangements between government agencies and other stakeholders, including local communities;
- Community-conserved areas voluntarily established by indigenous peoples and local communities, whether legally recognized by governments or not;
- Protected areas owned and managed by private sector entities (both non-profit and for-profit).

Determining tenure – ownership, access and control – over conservation areas is a central concern of governance. In many cases, providing local communities and others with secure tenure over areas to be conserved can provide an important incentive for conservation action. Conversely, the blanket assertion of state ownership over protected lands and waters that the state does not in fact effectively control or manage on the ground has created, in many places, an "open access" situation conducive to a free-for-all of rapid resource exploitation and habitat degradation.

Strengthening participatory processes

Because the establishment of protected areas affects the livelihoods and interests of many people, groups and institutions, it is widely recognized that local participation is a key ingredient for success in protected area planning, design and management. There is no one right way to facilitate effective stakeholder participation, but there are a number of core issues that all protected areas managers will need to consider:

Defining and differentiating stakeholders: "Stakeholders" in protected areas decisions might include a range of local communities, government authorities, conservation advocates and businesses. Their respective claims and concerns are seldom of equal strength and legitimacy, however, and the relative weight that their respective

views will carry needs to be clarified at the outset through a transparent and principled process.

Defining problems and objectives: All too often, outsiders define the "conservation problem" in a particular area, without adequate discussion with local stakeholders. Protected area managers need to define problems and objectives jointly with local people and other stakeholders at the outset, if they are all going to speak the same language during further processes of participation.

Providing adequate information: Participation needs to be informed, and this requires the provision of adequate information to stakeholders in advance of consulting with them. In doing so, planners need to remember that different stakeholders will have different levels of technical expertise and local knowledge. In some cases, leveling the playing field for indigenous and local communities may require investments in the various forms of "participatory rural appraisal" and community-based mapping that have been utilized in many countries and communities.

Fair representation in decision-making fora: It is not always the case that a person or organization claiming to "represent" a particular stakeholder group is accurately representing the views of that group. This can cause problems later on, when, for example, protected areas authorities claim to have "consulted" with a local or indigenous community, but the community does not in fact feel that it was fairly represented in the process.

Facilitation: The persons or organization facilitating the consultative process must be perceived as objective and fair. If the convener or facilitator is viewed as biased towards the interests of one or another group, the whole process will likely be dismissed by other stakeholders as "fixed" and therefore illegitimate.

Time and travel constraints: Participation is expensive, particularly for local and indigenous communities. Taking time off from work for meetings is not an option for many rural people, unless the process is designed with their particular needs and limitations in mind. Local officials of poorly-funded protected area agencies may face similar problems.

Feedback and follow-up: Effective participation in protected area planning cannot be conducted as a one-off event, after which planners can tick off the "participation" box on their list and get back to work. Participation needs to be viewed and managed as an ongoing process, in which planners listen to stakeholders' views and concerns and meaningfully respond to them.

Ensuring equitable sharing of costs and benefits

Good governance and effective participation are important preconditions for equitable protected areas management, but equity is manifested, in the final analysis, by the equitable distribution of the costs and benefits of establishing and managing protected areas. Equity will vary depending on circumstances, and the purpose of effective participation, embedded within an effective and fair governance structure, should be to arrive at equitable and durable compromises through a process of negotiation.

Equity also has a dimension of scale. At the most local level, the concern is ensuring that local communities living within or adjacent to a protected area do not bear an undue share of the area's costs, and receive a fair share of any benefits it generates. But local stakeholders are not the only actors who count. Protected areas provide a range of national and global benefits valued by people who may live far from a protected area, but who nevertheless have a legitimate interest in its conservation.

In some cases, equity demands not only fairness in the present and future allocation of costs and benefits, but also redressing past inequities. Many protected areas have been established through the displacement of local and indigenous peoples from their ancestral domains, or have severely restricted local uses of important livelihood resources. The slate of the past can never be thoroughly cleansed of past injustices, but neither should it be wiped clean without a fair effort to redress those injustices.

Sharing protected area benefits requires the establishment of mechanisms to distribute benefits locally from income-generating activities such as tourism, recreation, sustainable use of renewable resources, as well as education and research. In general, benefits should be channeled towards long-term, community-wide investments rather than short-term cash payments to individuals or families, unless the tangible burden can be specifically associated with a specific and finite group of individuals.

4. Strengthening capacity to manage protected areas in an era of global change

Protected area managers need stronger capacities – and, in some cases, new skills – to build and manage comprehensive protected area systems that respond to the full range of global change factors discussed above. "Capacity" is the ability to perform functions, solve problems, and to set and achieve objectives. Most fundamentally, protected areas managers need to develop the capacity for "adaptive management" – an approach to planning and management that analyzes problems systematically, draws out lessons from experience, and uses those lessons to change and strengthen management approaches.

Building a supportive policy and legal framework

Protected areas can only thrive in a supportive legal and policy framework, and national governments ultimately hold the authority and responsibility for establishing that framework. Unfortunately, protected areas are not high on the agenda of most countries, and are often considered marginal or subordinate to other policy agendas.

Political and legal systems vary so greatly around the world that it is impossible to prescribe a "one size fits all" approach, but three dimensions are – or should be – addressed by all countries:

- Articulating a general national policy on the conservation and sustainable use of biodiversity;
- Enacting specific legal provisions governing the establishment and management of protected areas, including attention to "horizontal" coordination among sectors to resolve and minimize inevitable conflicts between conservation and use of

natural resources and "vertical" coordination of the relative authorities and capacities of central versus sub-national units of government;

- Ensuring sufficient will and capacity to implement and enforce protected area policies and regulations in the field.

Strengthening institutional capacity

At the institutional level, capacity development aims to increase the effectiveness of the total system as it pertains to overall organizational performance and functioning, as well as the ability of the management regime to adapt to change. Institutional capacity building involves clarification of missions, structures, responsibilities, accountability and reporting, changes in procedures and communications, and changes in the deployment and management of human resources.

Institutional structures: Although there is no single best model, experience shows that when responsibility for protected area management falls within government institutions also responsible for commodity production and economic development there is often limited compatibility between conservation and development functions. On the other hand, autonomous protected areas agencies established without a strong legal mandate or sufficient technical and financial capacities may find themselves equally marginalized in inter-agency competition. In other instances, authority for protected areas is spread over multiple agencies, generally resulting in a complex and devolved management structure, which acts as a barrier to effective conservation.

Experience has demonstrated that when protected areas have solid legislative grounding and are governed by agencies exclusively focused on conservation and protected area management, with sufficient financial and decision-making autonomy, they have the greatest effectiveness and efficiency.

Management plans: One of the most important methods for the development of institutional capacity is the formulation of management plans for particular sites which specify the objectives for which the area is being managed, define legal and operational rules, and lay out programmes and activities that together provide a strategic path for managing the area to achieve the stated objectives. It is important to note, however, that many sophisticated management plans have been developed and never implemented. To avoid this, planners need to ensure an inclusive, participatory process involving all important stakeholders and, perhaps most importantly, the full range of institutions that hold the real power to either frustrate or facilitate implementation.

Monitoring and research: In order for managers to be adaptive in their management, they must track and monitor various indicators within their parks, and ultimately use the resulting information to alter their strategies and actions. In many cases, more formal scientific monitoring can be complemented by community-based methodologies.

Partnerships: Protected area managers cannot do their job alone, no matter how strong their capacities. Global change factors are increasingly pressing in upon protected areas at just the time when the need to expand and connect protected areas across the landscape is growing. Furthermore, most countries' protected area agencies lack sufficient resources, capacities, and political clout to fulfil their mandates on their own. Managers therefore need to follow a "two-track" strategy, building up the

internal capacities of formal protected area agencies while at the same time reaching out to a wider range of institutions within society that can assist with – and in some cases take on – many tasks. Partners may include academic and research institutions, NGOs, indigenous and local communities, and the private business sector. The skills and capacities needed for engaging partners in collaborative management, however, are not necessarily skills that either protected area managers or their potential partners currently possess.

Strengthening individual skills and capacities

At the individual level capacity development is characterized by the methods through which attitudes, behaviors and actions are changed. This generally occurs by imparting knowledge and developing new skills through training. It can also involve "learning-by-doing", and increasing performance through changes in management, motivation, morale, and levels of accountability and responsibility. Key building blocks for individual skill and capacity development include:

Operational capacity of the protected area authority

- A sustainable flow of resources to support the staff's operational activities;
- Staff quantity, quality and retention;
- Autonomy of the protected area authority to plan and implement activities;
- Ability of the protected area authority to influence policy and decision-making.

Approach of the protected area authority to staff development and training

- Existence and use of job descriptions and terms of reference for staff;
- Existence and use of performance targets, individual appraisals and standards;
- Opportunities for career development, promotion and advancement;
- Staff perceptions of their role and value in the organization.

Availability of training and other development opportunities

- Identification of needs and planning of training;
- Availability of relevant post-secondary education;
- Availability and relevance of in-service training;
- Availability of wider learning and personal development opportunities.

The challenges posed by global change alter the context within which protected areas are managed, and thus modify the range of skills and capacities needed by managers. Some of the new skills that protected areas managers increasingly need include:

- management skills such as strategic planning, financial management and fund-raising, and good communication;
- adaptive skills such as application and integration of information arising from research and monitoring, as well as the ability to identify and analyze lessons learned;

- cultural and social expertise relating to partnership development, participatory processes, dispute and conflict resolution, and networking with a complex array of stakeholders;
- technical skills in project design, report writing and the use of existing and emerging information technologies;
- policy expertise, such as understanding broader legal frameworks and sectoral policies within which protected area strategies and activities are implemented.

Achieving sufficient and sustainable financing

While policies, institutions, partnerships, individual skills, and all of the other factors discussed above are very important, protected areas cannot be effectively managed without sufficient and sustainable financing. Developing the capability to ensure sustainable financing is therefore a central part of protected areas capacity building. To develop a sustainable financial base for protected areas, decision-makers can:

- design a sustainable financing plan for each individual site and for the entire system, and assign personnel to implement it;
- apply methodologies to calculate realistic costs of protected area systems that include all necessary expenditure items, including minimum salaries, infrastructure, equipment, operation and maintenance, outreach and education;
- develop mechanisms to complement core budgetary funds with other financing sources such as solicitation of grants from donor agencies and individuals; "debt-for-nature" swaps; dedicated "conservation trust funds"; user fees, taxes and other charges earmarked for protected areas; and establishment of ecotourism and other local sustainable development activities that may benefit local communities and protected areas management alike.

Strengthening communication, education and public awareness

Managing protected areas increasingly means engaging with and educating people, be they local communities, the general public, or the policy makers who make the basic decisions affecting protected areas. Frequently, however, communications activities receive a low priority. Given the multiple pressures that they face, and the need to work ever more closely with a wide range of partners and stakeholders, protected area managers can no longer afford to treat their "public diplomacy" as an afterthought.

Strengthening communication and information exchange *among* protected area managers and other stakeholders is also critically important. Managers have much to learn from each others' experiences and expertise, and the advent of the Internet age provides the technology where this can systematically happen. The IUCN Protected Areas Learning Network (PALNet) (www.parksnet.org) is one potentially powerful mechanism for this kind of dialogue and exchange.

5. Evaluating the effectiveness of protected area management: The challenge of change

We cannot afford to make the same mistakes over and over – or to ignore successes and good initiatives and let them languish uncelebrated and unrepeated. Managers need to build on the best ideas and practices of the past and combine them with inspiration, innovation, and initiative for the future. Evaluation of management effectiveness is therefore a vital component of responsive, proactive protected area management that can cope with global change. Through evaluation, every success and failure can be used as an opportunity for learning, and continual improvement can be combined with anticipation of future threats and opportunities. To serve these purposes, though, evaluation needs to be systematically built into the overall process for protected area management planning.

Extensive work on management effectiveness evaluation over the past decade and around the globe has yielded the following summary lessons and guidelines:

Work within a tested and accepted evaluation framework

The IUCN Management Effectiveness Evaluation framework provides a consistent and widely tested basis for designing evaluation systems for protected area sites. It is based on the assumption that protected area management follows a process with six elements:

- review of context (status and pressures) and establishment of a site management vision;
- site planning;
- allocation of input resources (human and financial);
- management actions (process);
- production of management outputs;
- outcomes (i.e. conservation impacts).

These six stages have a central core, which is a cycle of evaluation, reflection, and learning.

Evaluation that assesses each of these elements and the links between them provides a relatively comprehensive picture of management effectiveness.

Evaluation works best with a clear strategic plan

- A clear purpose, scope, and objectives are needed. It is important at the beginning of an evaluation project to know exactly what it is expected to achieve, and to understand the levels of funding and support that can be expected.
- Where possible, the scope of evaluation should be broad enough to capture the relationships and inter-linkages between various factors affecting protected area management.

- For some evaluations, such as those undertaken for adaptive management purposes and assessments of specific interventions or projects, a concept model of how the project is supposed to work is a vital tool.
- Most evaluations of management effectiveness assess a number of elements, and these are linked to one another. We need to understand the links between the elements or criteria being evaluated so we can interpret the results of evaluation. It is important to clearly specify the assumptions being made when any of these elements are linked.

The methodology needs to suit the purpose

- Learn from others and use or adapt existing methodologies to the extent possible, to allow for harmonization and comparability across sites and through time.
- Information should be "triangulated" where possible, using several different indicators for the same question, different sources of information, and different methods or tools.
- Flexibility should be retained, allowing methods to improve over time.

Questions and indicators need to be carefully chosen

- Different layers of questions look at conditions in a particular dimension. Layers of questions should proceed logically and link from very general to specific and measurable.
- It is critical that indicators are relevant and useful in answering higher-level questions (e.g. "is the park conserving biodiversity?").
- Indicators need to be as cost-effective as possible, using existing data wherever possible.
- Questions and indicators should be chosen and linked in ways that can provide cause-and-effect explanations.
- The limitations of indicators need to be understood. There is a danger that evaluations can over-simplify reality by interpreting indicators to mean more than they really do.

Good communication, team-building and stakeholder involvement are essential

- Gaining the trust and cooperation of stakeholders, especially the managers of the protected areas to be evaluated, is critical and must be ensured throughout the evaluation. Evaluation systems should be established with a non-threatening stance to overcome suspicion. If the evaluation is perceived to be likely to "punish" participants or to reduce their resources, they are unlikely to be helpful to the process.
- Care needs to be taken to ensure all stakeholders have an opportunity to express their viewpoints.

A long-term evaluation plan with a good monitoring programme is preferable

- Repetition of evaluations over time is important to obtain information on changes and trends. Harmonized or standardized reporting allows comparisons across sites, across time, and to meet multiple reporting requirements.
- Well-designed evaluation processes yield results with greater explanatory power, giving us some ideas as to why outcomes have been achieved or not achieved.
- Evaluation of management effectiveness is best if robust, long-term monitoring backs it up.
- Evaluations should make the most of available information, but should also be a catalyst for establishment of future monitoring efforts that can fill current data gaps.

Evaluation findings must be effectively communicated and used proactively

- Evaluation planning should include an early consideration of communication and of the evaluation audiences. The way that findings are reported must suit the intended audiences. Timeliness of reporting is critical to making it useful.
- Advice from evaluations needs to be clear and specific enough to improve conservation practices and it needs to be realistic, addressing priority topics and feasible solutions.
- Evaluations should spell out the need for planned change or should encourage reinforcement of what is going well at site or organizational level.
- Short-term benefits of evaluation should be demonstrated clearly wherever possible.
- Recommendations should include short-term actions, which are clear, concrete, achievable within time and resource constraints and prioritized; as well as long-term and other recommendations that enable managers to take advantage of potential increased resources and opportunities.
- Evaluation findings, wherever possible, should be positive, identifying challenges rather than assigning blame.
- Evaluations that are integrated into the managing agency's culture and processes are more successful and effective in improving management performance in the long term.

Two key factors that determine whether evaluation findings will make a difference are (a) a high level of commitment to the evaluation by managers and owners of the protected areas; and (b) adequate mechanisms, capacity and resources to address the findings and recommendations.

Introduction

Every country has identified and preserved certain places for their natural, biological, cultural or recreational value. Most of these *protected areas* fit within the IUCN definition agreed at the IVth World Parks Congress in 1992:

> an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

In the past, protected areas were primarily associated with "national parks" such as the archetypical Yellowstone National Park established in the USA in 1872. This site and many that followed were perceived and managed as areas of wilderness where there was little or no significant human impact, and where people were restricted to the role of visitor. Over time, however, the roles of protected areas have broadened significantly and many places where humans have a vital role in the landscape are now themselves considered a part of the global protected area network. Thus, the term "protected area" was adopted by the World Commission on Protected Areas (WCPA) – one of IUCN's six scientific commissions – to recognize an array of approaches differentiated by their management objectives. This array of "categories" extended from wildlands of minimum direct use dedicated to scientific research, monitoring, and specialized forms of preservation, on over to sites where multiple use is the norm, albeit under a commitment to maintain biodiversity within the framework of sustainable use.

This expanded view of protected areas has also made it clear that the history of protection is far older than Yellowstone, extending back to include ancient sacred sites, royal hunting reserves and restricted fishing areas, many of which may go back centuries or millennia and were protected and managed by a wide variety of governing entities from kings to local communities. This same breadth of protected area managers and stakeholders from the past has reemerged today. While sites legally designated and administered by national governments still form the core of globally recognized protected areas, many other models have emerged. These include, for example, state or provincial protected areas, private reserves, and many types of traditional protected zones managed by indigenous and local communities.

The 20th Century legacy of more than 100,000 protected areas covering nearly 12% of the Earth's terrestrial surface provides us an extraordinary base from which to pursue conservation goals such as species preservation, watershed protection, and the restoration and protection of habitats. In these early years of the new century, we, as a global community would do well to ask: How secure are these assets? And, we need to acknowledge that our social, economic, and ecological well-being depends upon the continued ability of our protected area estate to provide their values and services for people and nature.

Despite a nearly six-fold increase in the number of protected areas since the 1970s, the ability of our ecosystems to maintain their natural resources, including ecological functions, is being stressed by various types of *change* taking place. For example, climate is

changing in very tangible ways including the contraction of mountain glaciers. Forest cover is being reduced and fragmented, leaving a landscape consisting of many small and impoverished sites. All parts of the world are being affected by invading species alien to particular sites. The human population is growing, and settlement patterns are changing, typically including expansion out into remaining wildlands. Increasing demand for food and fiber is leading to the opening of forests for crops and plantations. And, globalization of national economies is providing access for virtually all citizens to goods and services far from their source of production, not always with limited impact and positive results.

With the welcomed spread of democracy around the world, people are demanding more equitable access to natural resources, and to the political processes that determine the future of their resource base. In response to this as well as the need to reduce the overhead costs of managing protected areas by traditional state government institutions, governments are decentralizing the authority and responsibility for some protected areas, and shifting tenure to traditional owners. Hence, indigenous and local communities, nongovernment organizations (NGOs), and local government units need to acquire the skills required to take up these new responsibilities.

These large-scale and long-term changes in the physical environment, in governance, and in the needs of human populations have the potential to overwhelm conservation efforts worldwide. Furthermore, these types of change are not only site specific and local, but they are *global*, in that protected areas in most parts of the world are already experiencing some of the same forces. Thus, when take together – biophysical, socio-economic, and institutional – we refer to these impacts on the landscape as *factors of global change*.

WCPA has developed the *Ecosystems, Protected Areas and People* (EPP) project of which this report forms one part. The aim of the project is to enable protected area managers and policy makers to anticipate some of the most important factors of change that may challenge their capacity to save biodiversity and provide sustainable flows of environmental goods and services. Furthermore, the project seeks to encourage managers and policy makers to adapt their management, policies, strategies, and field practices to these forces of change. In some cases changes, such as fragmentation, may have negative impacts; in others, they may in fact have potentially positive implications for protected areas. Decentralization of tenure and governance, for example, can strengthen protected areas if the process is properly managed. The advent of the Internet and other globalized communications technologies is another form of global change with enormous potential utility for protected area managers.

Who are the managers? By *manager* we mean to embrace all of those actors with responsibility and authority over the setting of policy, the planning process, and implementation of agreed plans. Used in this way, the term manager may include indigenous leaders, NGO site directors, local community organizations, and state and local government officers. Variably the chapters that follow will use the terms “manager” and “policymaker” somewhat interchangeably, although policymaker usually refers to those with official legal authority to set policy and manager generally refers to those with operational authority over the management of protected area sites or systems. *Stakeholder*, on the other hand, refers to the broader community of actors who have a

significant interest in a protected area and the decisions made concerning its establishment and management.

The EPP project is developing a global network of protected area managers that are interested in exchanging scientific and traditional knowledge and experience on specific topics and places of common interest, such as, coral bleaching, restoring and protecting mangrove forests, setting up cooperative relations with neighboring farmers and forestry operations, and "learning by doing" to take on management responsibility for areas devolved to local communities. A critical component of EPP is development of an interactive Web-based *Protected Areas Learning Network* (PALNet) that will enable managers to access and generate new knowledge and raise their professional capacity by sharing and exchanging field-based lessons and cutting-edge science.

To provide solid credibility to the project and its various components, five working groups of experts from WCPA and beyond have provided the background material and compiled the initial chapters upon which this report is based. They worked over two years on a voluntary basis.

Chapter 1, *Understanding global change*, identifies the selected factors of global change that are likely to have the most persistent and pervasive impacts on protected areas, and analyzes their current and likely future impacts on protected areas.

Chapter 2, *Designing protected area systems for a changing world*, looks at critical factors of protected area establishment, design, and prioritization in the face of change. This chapter discusses current best methods for identifying gaps in existing protected areas coverage, as well as anticipating and incorporating likely future impacts of global change.

Chapter 3, *Parks and people in a world of changes: Governance, participation and equity*, discusses the issues of governance and equity that are critical in establishing and managing protected areas within a larger changing environment.

Chapter 4, *Building capacity to manage protected areas in an era of global change*, discusses the importance of supportive political and legislative enabling environments for developing and adapting protected areas to change. The chapter further identifies the human and institutional capacities necessary to make protected areas effective and successful into the future.

Chapter 5, *Evaluating the effectiveness of protected area management: The challenge of change*, discusses the methods and tools by which managers can measure and evaluate their effectiveness, and take corrective action to reach protected area conservation goals.

The options and guidelines presented throughout the chapters that follow are the results of extensive consultation processes with field-based and academic experts. Regional workshops, conducted in Africa, Asia, and Latin America, were designed to ensure broad input from a diverse range of protected area stakeholders. The technical meetings of the Convention on Biological Diversity (CBD) have provided important venues in which to capture new ideas and exchange early drafts with important members of our constituency. WCPA and its partners presented workshops at each CBD session to inform the CBD community of the project's progress, culminating in the 7th CBD

Conference of the Parties in early 2004, where protected areas were extensively discussed and a CBD Programme of Work on Protected Areas was adopted by the Parties.

Global change presents protected area policy makers and managers with immediate and daunting challenges. The chapters which follow provide in-depth analysis of these challenges, and suggest strategies and options with which all of those who manage and care for protected areas can ensure that these fundamental components of our heritage and livelihood are secured as we move into an uncertain and ever more rapidly changing future.

1. Understanding global change[4]

In times of change, learners inherit the Earth, while the learned find themselves beautifully equipped to deal with a world that no longer exists.
Eric Hoffer, 20th-Century writer and longshoreman

1.1 Introduction

Shifting climates. Sea level rise. Swelling populations and shrinking habitats. Biodiversity loss. Industrialization. Globalization. Invasions of alien species. To protected area managers, charged with maintaining sites and their systems in the state our ancestors found them or under controlled sustainable use practices, a report on global change might look something like a horror story, well beyond the scope of local interests and capacity.

Without a doubt, this first chapter – tracking the trends of global change in the biophysical, socio-economic and institutional realms – presents a startling picture. See here a snapshot of the steeply rising figures – 6 billion people, farming 4 billion hectares (ha), raising 13 billion chickens, burning 75 million barrels of oil and belching untold tons of greenhouse gases every day. Watch as we reshape rivers, wetlands, coasts and reefs; burn and clear forests; suck aquifers dry; fish farther and find less.

Skimming the pages ahead, one can't help but wonder if the human race really *is* in a race, now hurtling into dangerous curves – or off a cliff. Is ours a uniquely challenged generation, entrusted to steer along the brink of even greater change – some synergy of change that proves even more chaotic and catastrophic?

In this world of change, will we be willing to change ourselves, to bend and stretch and adapt as nature has done for us? Or will change mock us, leaving us "beautifully equipped to deal with a world that no longer exists"? Will change undermine our generations of learning on how to manage protected areas, stealing them from generations to come?

The good news is that an exploration of global change and protected area management reveals ways in which managers innovate and experiment around change, even using it to their advantage. Most fundamentally, we see redefinitions of protected areas across ecoregional scales, incorporating both natural and human landscapes. Likewise we see redefinitions of protected area managers, broadening the scope to include communities, indigenous peoples, various levels and agencies of government, nongovernmental organizations, individual landowners, corporations and international bodies. We see a range of collaborative management strategies developing support for protected areas and, in some cases, much-needed funding. We see how the leaders of protected area

[4] **Authors:** Charles Victor Barber, IUCN Consultant; Bret Bergst, IUCN; Anthony C. Janetos, H. John Heinz III Center for Science, Economics and the Environment; Sara Scherr, Forest Trends; and Robert M. Wolcott, U.S. Environmental Protection Agency.

management are taking on greater roles as communicators and negotiators – even salesmen – to pitch the values of scarce ecosystem services to growing populations. And we see how managers use site-specific strategies to ameliorate and mitigate physical changes beyond their control. Recognizing and learning from these trends makes global change look a little less daunting while putting it in closer reach of local interests and capacity.

1.2 The nature of global change

Change alone is unchanging.
Heraclitus, Greek philosopher

Across millennia and cultures, it has been observed that the only true constant is change. The observation underscores the inherently dynamic character of our biophysical world, as well as the social, economic, cultural and institutional conditions which drive and reflect change. This report reinforces this observation, and relates it to the policy and management context within which the global protected area network is formed and managed.

We define global change as "a transformation which occurs on a worldwide scale (for example, an increase in CO_2 concentrations in the atmosphere) or exhibits sufficient cumulative effects to have worldwide impact (for example, local species extinction resulting in global loss of biodiversity)."[5] The scope of our analysis broadens this definition beyond biophysical factors to incorporate social, economic and institutional changes that are global in scope and impact.

Many factors of global change were initially considered for possible attention in this report. We have decided to focus on the following factors, bearing in mind that there are others worthy of attention at a later date:

- **Socio-economic changes:** Human population growth and dynamics, economic growth, trade and consumption, and poverty and inequality;
- **Biophysical changes:** Climate change, conversion and fragmentation of natural habitats, hydrological change, invasive alien species, and biodiversity loss;
- **Institutional changes:** Changing global norms, global trends in governance and institutions, and globalization of communications, knowledge and culture.

We selected these factors because they either represent the most important threats to biological sustainability of the global protected area network and its constituent components, or present protected area managers with new opportunities for addressing those threats. Consideration was given as well to the scale, immediacy, pervasiveness and potential irreversibility of impacts. Further, because of their global character and readily observable local impacts, the need to address these factors is evident to the entirety of the global protected area community.

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[5] NOAA Coral Reef Information System (CoRIS) Glossary of Terminology A through K (online version). www.coris.noaa.gov/glossary/glossary_a_k.html#g. April 27, 2004.

These global change factors are now the focus of increasing attention for many in the conservation community. In contrast to the past, the observable reality of change renders it more evident and comprehensible. Global change represents the "elephant in the room" management challenge which will not simply go away or remain unnoticed.

As those responsible for safeguarding our Earth's vital biological systems and diversity, protected area mangers face enormous challenges in the decades to come, but they are also presented with important opportunities. Be they public servants, private enterprises, non-governmental organizations, local governments, communities or indigenous peoples, managers face a future where human demands on protected areas and biological resources will be greater than ever before. Careful management will be crucial if humans are to coexist with healthy ecosystems and thriving wild species populations. Perhaps most critically, equitable balances and positive synergies must be found between conservation of nature and human needs. This is particularly so in the Earth's most biologically rich regions, which largely coincide with high human populations and concentrations of poverty.

To manage carefully and critically, managers must understand the vulnerabilities of their areas to change and adapt their strategies and practices to strengthen protected areas and encourage resiliency. Given the pace of global change, managers must begin now to ensure the security of protected areas for the future.

While managers take on the daily challenges of protected areas, the ultimate success of their efforts is largely dependent upon a supportive policy framework. Policy makers set the framework that either facilitates the efforts of mangers to adapt to change, or hinders and discourages their work. Without political leadership and legal underpinnings that recognize the importance of conservation and sustainability, competing interests and priorities from above can easily dismantle efforts on the ground. The challenge for policy makers in the coming decades is to create an enabling environment that not only supports the protection of biological diversity, but adapts, as mangers do, to emerging threats and opportunities.

1.3 The world humanity made: Global socio-economic change

"Global change" typically conjures images of climate change, biodiversity loss, sea level rise, and the other biophysical changes discussed in Section 1.4. These global biophysical changes are, however, driven by equally momentous changes that have characterized human socio-economic development during the past century. We therefore begin with a review of these truly epochal transformations in our own species' presence on this planet.

1.3.1 Human population growth and dynamics

Trends

As a result of improved public health, increased food production, and reduced mortality rates, Earth's human population grew from 1.2 billion in 1900 to 6 billion in 2000 – a five-fold increase unprecedented in human history. But declining fertility rates – largely

related to education and empowerment of women in the developing world – have significantly reduced annual population growth rates since 1995.[6] Another major factor reducing recent projected population growth rates is HIV/AIDS, especially in Africa and Asia. As a result, population is projected to reach approximately 7.9 billion in 2025 and to stabilize around 8.9 billion in 2050.[7] The growing human population is significantly younger, more urban and more mobile than ever before, and is increasingly concentrated in coastal areas. Despite urbanization, rural populations continue to increase in absolute terms as well.

The ***age structure*** of the global human population is significantly younger than in the past, largely as a result of past, higher fertility. Children (ages 0-14) outnumbered all other age groups in 2002, making up just under 30% of the world's population. Over the next 50 years, the absolute number of children is projected to remain fairly stable, but their number relative to total global population is expected to decline to 20%. This large youthful cohort is the main reason that projected fertility declines will not translate directly into equivalent declines in population growth. The world's elderly population (65 and older), on the other hand, is expected to grow considerably in both absolute and relative terms. By 2050, there are expected to be three times as many elderly people as today, comprising nearly 17% of global population, up from 7% in 2002.[8]

Urbanization is accelerating, due to global patterns of economic development, dramatic declines in transport costs for consumer goods and raw materials, and a reduction in the number of people involved in agriculture. By 2010, more than 50% of all people will live in urban areas, with more than 40% of these in developing countries. The fastest urban growth has occurred in many intermediate-sized cities with populations of 1 to 5 million, which grew in number by 80% in the last 20 years. By 2030 the urban population will reach 4.9 billion – 60% of the world's population.[9] Nearly all of this urban population growth will be in the cities of developing countries, whose population will double to nearly 4 billion.[10] More and more people of the developing world live in "mega-cities," of at least 10 million people. By 2015 the number of mega-cities will increase to 23 and all but four will be in the developing world.[11]

The ***mobility*** of the growing global population is increasing, both within and among countries. While migration has no impact on aggregate global population growth, its social and economic impacts on particular countries and regions are growing. Economic disparities between areas of origin and destination have long driven migration, but the number of international migrants has increased dramatically in recent decades, largely as a result of high population growth rates in the poorer developing countries and the subsequent dearth of employment opportunities for young workers entering the labor force. The UN Population Division estimated that there were 175 million people living

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6 Growth rates peaked at 2.04% in 1964–70 and declined to 1.35% between 1995 and 2000. Fertility rates have declined from about 4 children per woman in 1975 to less than 3 children per woman in 2000. A steady state replacement rate is 2.1; Europe and North America rates are below this. Doering *et al*. 2002.

7 These estimates are from the United Nations medium variant projections which were revised downward by 0.4 billion due to impacts of HIV/AIDS. United Nations 2003.

8 U.S. Census Bureau 2004.

9 UNPD 2000.

10 WRI 1996.

11 UNPD 2000.

outside of their country of birth or citizenship in 2000, twice as many as in 1975. While the majority was seeking better economic opportunities, many are displaced persons fleeing persecution, war, and human rights abuses.[12]

Although international migration receives the most attention, migration within countries – especially to cities – constitutes the majority of moves. In the Asia-Pacific region, for example, as much as 20–30% of the population may migrate internally over a five-year period.[13] In China, some 70 million people migrated internally every year during the late 1990s.[14]

Increasingly, people are also fleeing environmental disaster – some 25 million, according to United Nations data. The number of "environmental refugees" thus now compares closely to that of refugees from conflict, and environmental degradation may impose a much longer term of exile.[15]

Populations in ***coastal regions*** are growing faster than the overall rate of global population growth. Approximately 3.2 billion people (more than half the world's population) live within 200 km of a coast, and by 2025 the proportion of coastal dwellers is expected to be more than 75% – an estimated 6.3 billion people. The location of most of the world's largest cities in coastal areas is a major factor driving this trend.[16]

In developing countries, ***rural population*** continues to increase in absolute terms, despite the growing proportion of global population concentrated in urban centers. While the ratio of rural-to-urban dwellers declined in most developed and a few developing countries (such as Brazil) from 1960 to 1995, the *absolute* number of rural dwellers in developing countries rose by almost 40%, from 2.0 to 2.8 billion. The total rural population of Africa grew by 68% from 1960 to 1995. By contrast, rural populations in industrialized countries are expected to decline further, from 301 million in 1990 to 198 million in 2025 – a 34% decline in 35 years. Rural populations in developing countries are projected to peak at 3.09 billion in 2015 (accounting for 94% of the world's total rural population), then decline by 2025 to 3.03 billion. However, in the lowest-income countries, rural population is expected to grow for several more decades.[17]

Impacts

The ecological impacts of population demographics cannot easily be separated from the impacts of intensifying economic activity, growing resource consumption, and poverty, which are discussed in subsequent sections. Two direct impacts of population growth trends, however, are particularly relevant for protected areas. These are the disproportionate share of population growth expected in the world's high-biodiversity regions and the restructuring of rural landscapes in response to both urbanization and continued rural population growth.

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12 Population Resource Center 2004.

13 Guest 1999.

14 Chan 2001.

15 Brown 2004.

16 WRI 1996.

17 McNeely and Scherr 2003.

Population growth in high-biodiversity regions: Recent efforts to map "the human footprint" on the earth found that 83% of the land surface (excluding Antarctica and most oceanic islands) is influenced by human population density greater than one person per km^2. This includes agricultural lands, built-up areas or settlements within 15 km of a road, a major river or the coastline, and areas with nighttime light bright enough to be detected by satellite sensor. Almost 98% of areas where bioclimatic conditions make it possible to grow rice, wheat or maize (the world's major food crops) are influenced by one or more of these factors. Indeed, the only parts of the world with large areas of low human impact are in the northern tundra and Arctic region, desert regions, and parts of the Amazon and Congo rainforests.[18]

By far the greatest population increase is expected to occur in the biodiversity-rich countries of the tropics. The population of sub-Saharan Africa, for example, is expected to double by 2025.[19] Population is growing faster than the global average in most of the 34 "biodiversity hotspots" (areas of high endemism and high threat – discussed in Chapter 2) identified by Conservation International. In 2002, nearly 2 billion people were living within these hotspots – which include only 15.7% of the Earth's land surface – and nearly 335 million people were living less than 10 km from the border of a protected area within a hotspot.[20] Population in the world's few remaining tropical wilderness areas – by definition characterized by low population density – is also growing, on average, at an annual rate of 3.1%, more than twice the world average.[21]

Restructured landscapes: Though cities occupy less than 2% of the Earth's land surface they use 75% of the Earth's resources.[22] Modern high-density settlements now appropriate the ecological output and life support functions of distant regions through trade and commerce, the generation and disposal of wastes, and the alteration of natural cycles. Locally, cities put huge strains on natural ecosystems by polluting rivers and coastal waters, degrading soils, disrupting drainage and stunting crops.[23] The biodiversity "hotspots", for example, are rapidly urbanizing. In the late-1990s, 146 major cities were located in or directly adjacent to a hotspot, 62 of them with over 1 million inhabitants.[24]

As noted above, most large cities are located on the coast, and some 75% of the world's population is expected to live in coastal zones by 2025. Already, nearly half a billion people live near fragile coral reef ecosystems, mostly in the Indian Ocean and Southeast Asia.[25] Growing coastal populations and urban centers lead to heavier pollutant and sediment loads that impact the ability of sensitive coastal ecosystems to provide shoreline protection, healthy fisheries, water filtration and sites for recreation and tourism.

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18 Sanderson *et al*. 2002.

19 Rosen and Conly 1998.

20 Conservation International 2004.

21 Cincotta and Engelman 2000.

22 Harrison and Pearce 2001.

23 Rees 1996.

24 Cincotta and Engelman 2000.

25 Bryant *et al*. 1998.

Meanwhile, continued rapid rural population growth in most low-income countries means that many already densely populated areas will demand additional land for settlement and infrastructure. They will also demand natural resources to provide food, fuel, water and raw material needs. Many regions still have much unutilized land, but this is found in "mosaic" configurations – interspersed with farmlands and settlements, rather than in large contiguous blocks.

Both urban and rural population growth demand, and in turn stimulate, increased transport and communications infrastructure. Road building and infrastructure are deemed directly responsible for threats to 40% of the world's remaining large, relatively intact areas of natural forest.[26] Indirectly, roads facilitate logging, mining, farming, hunting, wildfires, the extraction of wild plants and animals, and the invasion of alien species. Roads also threaten the viability of populations and species by increasing habitat fragmentation and by altering natural patterns of runoff, erosion and sedimentation.[27]

The world that human population dynamics have shaped over the past century presents a varied and challenging landscape for conservation advocates, planners and managers. Human population dynamics have resulted in five broad situations in which conservation action must take place:

- Large areas with very low population density and minimal infrastructure;
- Landscape mosaics where natural habitats predominate, but are interspersed with human settlements, farms, infrastructure, mining operations, and other economic activities;
- Landscape mosaics in which human uses are dominant, but many patches exist where natural habitats can be conserved or restored;
- Urban and peri-urban areas of intensive human use; and
- Marine and coastal areas – often under heavy population pressure – requiring different forms of protection than terrestrial areas.

Each situation is characterized by different levels of population pressure, and different kinds of landscapes that have resulted from that pressure, as summarized in Table 1.1. These various circumstances require equally diverse approaches to establishing and managing protected areas.

26 Bryant *et al*. 1997.

27 Forman and Alexander 1998; Minnemeyer 2002; Wilkie *et al*. 2000.

Table 1.1 Conservation potential of different landscape and habitat types under varying human population densities

Type of region ■ (typical population/ km^2) ■ major habitats	Main socio-economic threats to biodiversity	Potential for biodiversity conservation	Other valued ecosystem functions
Undeveloped areas ■ (<3/km^2) ■ Desert, tundra, rainforest, coastal marine environments	Extractive industries; habitat conversion; infrastructure development; over-exploitation of plants and animals	Conserve species and natural communities needing large, contiguous, undisturbed habitat	Carbon storage
Mosaics with abundant natural habitat ■ (agriculture < 60% area; 3–20/km^2); ■ mountains, dryland, forests	Transportation infrastructure; over-extraction of plants and animals; agricultural land conversion	Conserve diverse wildlife and plant communities; may contain agricultural areas	Carbon storage, watershed, agricultural services
Mosaics with human uses dominant ■ (agriculture > 60% area; 20–100/km^2) ■ grasslands; highlands, inland valleys	Agricultural intensification; infrastructure; agricultural, livestock and agro-processing pollution; high fragmentation	Reduce threats to adjacent and downstream biodiversity; restore native biodiversity	Watersheds; landscape beauty; agricultural services; carbon sequestration
Urban and peri-urban (built environments) ■ (200+/km^2) ■ valleys, natural ports; plateaus	Industrial pollution; habitat conversion; human settlements; hydrological infrastructure; transport infrastructure	Conserve biodiversity that enhances human habitat; reduce threats to species adjacent or downstream	Landscape beauty; spiritual values; watersheds; local food security
Coastal regions with high population ■ (>20/km^2) ■ tropical reefs, mangroves, wetlands	Conversion of marine breeding habitat (loss of wetlands and mangroves); industrial and agricultural pollution; resource over-exploitation	Conserve coastal and marine habitats; marine species breeding sites	Shoreline protection; water filtration; recreation; landscape beauty; recreation

1.3.2 Economic growth, trade and consumption

Trends

The rate of global economic growth over the past half-century is without precedent in human history, greatly exceeding population growth rates. Global Gross Domestic Product (GDP), which stood at US$17 trillion in 1950, nearly quadrupled to more than US$63 trillion in 1990. Then, in just one decade to 2000, global GDP increased by another 70% to over US$107 trillion. Per capita income (adjusted to 1993 purchasing power parity) grew during that period from US$6.31 to $17.71.[28] International trade has grown at an even more astonishing pace. According to the World Trade Organization, the value of global merchandise

[28] Bhalla 2002.

exports (agricultural products, mining products and manufactures) grew 80-fold from 1950 to 1999, while volume grew 19-fold. The value of all merchandise trade grew from US$58 billion in 1948 to nearly US$5.5 trillion in 1999.[29] Global economic growth slowed to 1.3% in 2001 and 1.9% in 2002 from the annual average of 2.7% in the 1990s, but the world's recorded output still grew by more than US$1.1 trillion in 2002.[30]

This unprecedented increase in human economic activity is based in large part on exploitation of natural resources. Indeed, some scientists estimate that humans now annually appropriate some 40% of the Earth's net primary productivity (solar energy captured by photosynthesis) and 35% of the productivity of the oceanic shelf.[31] For the first time in human history, humans dominate – and have fundamentally transformed – Earth's ecosystems.[32]

Though certain agricultural and industrial processes are becoming more efficient due to technical innovation, institutional incentives and regulations, most production increases are due to unsustainable over-exploitation of the resource base. Waste is also a growing problem: one-half to three-quarters of resource inputs into industrial economies are returned to the environment as wastes.[33] The major elements of the Earth's resources that humanity uses to fuel burgeoning populations, economic growth and trade are summarized below.

Agriculture: Crop production has doubled over the past 30 years, as consumption of agricultural products has grown more rapidly than population. Between 1950 and 1984, per capita grain production increased by 40%. Cereals now account for nearly 60% of total calories consumed in developing countries, while in developed countries meat, animal products and sugar consumption are almost as important as cereals. Land conversion accounted for part of the increase in production, but yield increase was the key factor. Between 1950 and 1995, grain yields increased by 141%, largely due to the use of improved varieties, application of chemical fertilizers, and expansion of irrigation. Average cereal yields increased from just over one metric ton to nearly 3 metric tons per ha, and use of nitrogen fertilizer increased dramatically from about 5 to 80 million metric tons between 1950 and 1995.

Global demand for food will continue to grow throughout this century. Projections indicate that demands for cereals will increase by 41%, while demands for roots and tubers will increase by 40% between 1993 and 2020. Some 80–90% of increased demand for these crops will come from developing countries.

Livestock: Livestock production has approximately tripled over the past 30 years. Domestic livestock globally number 1,225 million beef cattle, 227 million dairy cattle, 148 million buffalo and 1,708 million sheep and goats. In 1993 there were 878 million pigs and some 13 billion chickens. All these add to total demand for water, land and feed resources. Between 1950 and 1990 the per capita supply of beef and mutton increased by 26%. For all developing countries combined, per capita consumption of beef, mutton,

29 WTO 2004.
30 World Bank 2004.
31 Vitousek *et al*. 1986.
32 Vitousek *et al*. 1997.
33 WRI 2000.

goat, pork, poultry, eggs and milk rose by an average of 5.4% per year between 1982 and 1994, while for developed countries meat demand grew by only 1% annually. In all, global meat demand increased by 2.9% per year during this 22-year period.[34] Between 1950 and 1990 the per capita supply of beef and mutton increased by 26%. Aggregate meat demand is projected to increase by 63% between 1997 and 2020, with significant variation between developed and developing countries: developed country demand is expected to increase by only 17%, while demand in developing countries will increase by 92%.[35] As demand for livestock increases, demand for animal feed inputs including grains, cassava and fish meal will also increase.

Fish: World fish catches underwent a 4.6-fold increase between 1950 and 1989, doubling the per capita production of seafood. Aquaculture production tripled between 1984 and 1995, from 7 million to 21 million tons per year, and in 1995 accounted for 19% of the global fish harvest.[36] Fish and shellfish now provide one-sixth of the animal protein consumed by people worldwide. Some one billion people (mostly in developing countries) depend on fish for their primary source of protein.

Wood products: World consumption of wood increased 2.5-fold between 1950 and 1991, with per capita consumption increasing by a third during this period. Developed countries now account for 71% of the world's paper consumption, but as populations and economies grow in developing countries, so, too, does the demand for paper.[37] Between 1996 and 2010, global consumption of industrial forest products is projected to rise by 25%, with Asia and Oceania showing the highest rates of expanded consumption.[38] Requirements for shelter are projected to more than double by the middle of the 21st Century,[39] further increasing the demand for wood-based products.

Wild plants and animals: In many parts of the developing world, wild plants and animals still play important roles in food security and as sources of medicine and fuel, even as domestic and international demand now threatens the viability of the most sought-after species. Direct consumption of wild foods is especially important in the provision of protein and micronutrients, and as a "safety net" in times of crop failure or pre-harvest hunger. In West Africa, for example, bushmeat is the principal source of protein. But as population and household incomes increase, meat consumption is projected to increase by 3% or more, far exceeding the natural replacement of wildlife. Wild plants also play an essential role in farm production, providing livestock fodder, fertilizer, packaging and fencing.

International trade in wild plants is also growing, and many people sell wild species for income to buy food.[40] In Europe, the rise in demand for natural health care cosmetics, treatments, and household products is creating international markets for medicinal and aromatic plants. Europe uses one-quarter of the world's imports of wild plants, and in recent years has imported an average of 120,000 tons of wild plants annually from more

34 Wood *et al*. 2000.
35 Rosegrant *et al*. 2001.
36 Wood *et al*. 2000.
37 Abramovitz and Mattoon 1999.
38 Scherr *et al*. 2003.
39 Brown *et al*. 1998.
40 Scherr *et al*. 2003.

than 120 countries, threatening populations of at least 150 species.[41] In a similar fashion, Asian demand for medicines made from the parts of a wide range of animals threatens large mammals and other species throughout the region.[42]

Water and hydroelectricity: Massive transfers of water from rivers, artificial reservoirs and underground aquifers – along with associated flood control, canal and drainage infrastructure – have reshaped hydrological regimes and their dependent biological communities.[43] Nearly half of the world's rivers have at least one large dam (15m or higher). The number of large dams has increased sevenfold from 1950 to present. Such dams now impound 14% of the world's annual runoff,[44] and generate 19% of global electricity. One-third of the countries in the world rely on hydroelectric power for more than half of their electricity supply. Half of the world's dams, however, were built explicitly for irrigation. Some 30–40% of the world's 271 million ha of irrigated cropland rely on dams for water supply.

Energy: World energy production rose by 42% – from 6,600 to 9,352 million tons of oil equivalent – between 1980 and 2000. Increased outputs were sourced almost entirely from fossil fuels (e.g. oil, coal and gas). Biomass contributes approximately 15% of energy supplies worldwide and accounts for one-fifth to one-third of energy consumption in developing countries. Wood fuel demand continues to grow in developing countries, despite increased availability of alternatives.[45]

The biophysical impacts of these dimensions of humanity's appropriation and transformation of the Earth's natural resources are discussed in detail in Section 1.4, below, as well as in Chapter 2.

1.3.3 Poverty and inequality

Trends

Poverty and inequality have characterized the human condition for millennia. The sheer numbers of people living in poverty today, however – and the width of the gap between the poor and the rich – define a situation that is fundamentally different than in the past. Other aspects of global change contribute to this fundamental difference. Changes in the composition of the global population mean that the poor are younger than ever before. Urbanization and globalization of communications mean that, for the first time, the poor can see, in detail, "how the other half lives" – and aspire to live that way too. From a conservation perspective, as already noted, many of the most biologically diverse regions of the globe are also areas with high levels of extreme poverty. Increasingly, poverty eradication is becoming the highest priority for international development policy. This is reflected in the U.N. Millennium Development Goals, which call for halving the number of people living in extreme poverty – and those suffering from hunger – between 1990 and 2015.

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41 Lange 1998.

42 Mills 1997.

43 World Commission on Dams 2000; Revenga *et al*. 2000.

44 Levovitch and White 1990; Revenga *et al*. 2000.

45 Arnold *et al*. 2003.

In 1990, more than 1.2 billion people – 28% of the population of low- and middle-income countries – lived on less than US$1 a day. By 2001, the poverty rate had fallen to 21%, but population in those countries grew by 15% in that same period, leaving about 1.1 billion in extreme poverty. Poverty rates fell most rapidly in China and East Asia, and also fell to a lesser extent in South Asia. In Sub-Saharan Africa, however – where GDP shrank 14% – poverty rose from 41% in 1981 to 46% in 2001, adding an additional 140 million people living in extreme poverty. Other regions saw little or no change.[46]

By contrast, citizens in high-income countries saw their incomes grow on average much more rapidly than those in middle- or low-income countries, leading to wider income disparities today than in 1975.[47] Today 78% of the world's people may be considered poor while 11% are middle income and another 11% are considered rich.[48]

But the disparity does not end there. A few of the rich are very rich and many of the poor are very poor. The richest 1% of the world's population reaps as much income as the bottom 57%.[49] Meanwhile the poorest 24% lives on less than the purchasing power equivalent of US$1 per day. In India that figure is 40%. In the world's poorest households, food accounts for 40–70% of all expenditures.[50]

Impacts

Disparities of poverty and wealth have distinctive impacts on natural resources and the environment. About 75% of the world's poorest 20% (those earning less than the equivalent of US$1 per day) live in rural areas of the developing world. Of these, over two-thirds live in regions where physical conditions make agriculture more risky, including arid lands, steep slopes, and infertile lands, and in ecologically vulnerable areas.[51]

In general, the rural poor are more dependent on natural resources for their livelihood than are the wealthy.[52] Poverty may constrain people's ability to manage their private and community lands and resources in a sustainable way that protects biodiversity and ecosystem services. Poverty is associated both with agricultural "extensification" (increasing the amount of land being farmed) often into remote or protected areas, and unsustainable forms of "intensification" (increasing production in a given land area through more intensive cultivation, irrigation or greater use of inputs like fertilizer or pesticides). This is often due to lack of access to alternative employment or to agricultural inputs that would enable sustainable, long-term production.

Poor people are often driven to convert natural habitat or to degrade land, water, and vegetation resources due to factors such as chronic family labor scarcity and/or declining labor productivity, debt, unemployment, severe food insecurity and insecure land tenure. On the other hand, there is also considerable evidence of good resource husbandry by low-income resource users.[53]

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46 World Bank 2004.

47 World Bank 2001.

48 Milanovic and Yitzaki 2001.

49 Milanovic 1995.

50 OECD 1998.

51 Scherr *et al*. 2003.

52 Leonard 1989.

On the other side of the gap between the rich and the poor, higher per-capita consumption has been closely linked with environmental degradation.[54] The 20% of people living in industrialized countries account for 86% of all private consumption and over 80% of world trade. These countries' growing demand for high-value products such as oil, meat, sugar, coffee, cocoa and tea has led to large-scale forest clearing for commercial plantations. Destructive land management practices are often encouraged by subsidies, political conditions that facilitate "land grabs," tax incentives or other factors that favor the wealthy. But increased wealth has also increased demand for ecosystem values. This is reflected in growing demand for nature tourism, environmentally-friendly products, recycling programmes, and financial contributions to environmental causes in higher-income countries.

Unequal access to natural resources is also often associated with social unrest and violent conflict. The causal relationships linking natural resources scarcity, socio-economic and political inequality, and environmental degradation are not, however, very well understood and are vigorously debated in the literature on "environment and security."[55]

1.4 The Earth transformed: Global biophysical change

The global socio-economic changes reviewed in the previous section have dramatically widened and deepened the human footprint on the Earth. For the first time in history our sheer numbers, our accelerating appropriation of the Earth's natural resources, and our increasing use of nature as a "sink" for our wastes, is visibly changing the face of the planet and the ecological and geo-physical systems upon which it – and we – depend.

1.4.1 Climate change

Context and trends

The greenhouse effect: The greenhouse effect is a necessary condition for maintaining life on Earth. Greenhouse gases in the atmosphere, primarily water vapor, and secondarily carbon dioxide, methane, nitrous oxide and ozone, absorb solar radiation that has been reflected by the Earth's surface and re-radiate it through the atmosphere, warming it, as shown in Figure 1.1. Without the greenhouse effect, the Earth's surface would be several tens of degrees Centigrade (°C) cooler than it currently is, on average, and the earth would be unable to support life.[56] The significance of the greenhouse effect for climate change is related to the concentrations of the major greenhouse gases in the atmosphere, their vertical distribution, and the physical effects of their radiative properties.

Sources of greenhouse gases: The human impact on atmospheric composition over the last 150-200 years has been substantial. The most noticeable change has been in the atmospheric concentrations of carbon dioxide (CO_2), the second most important greenhouse gas

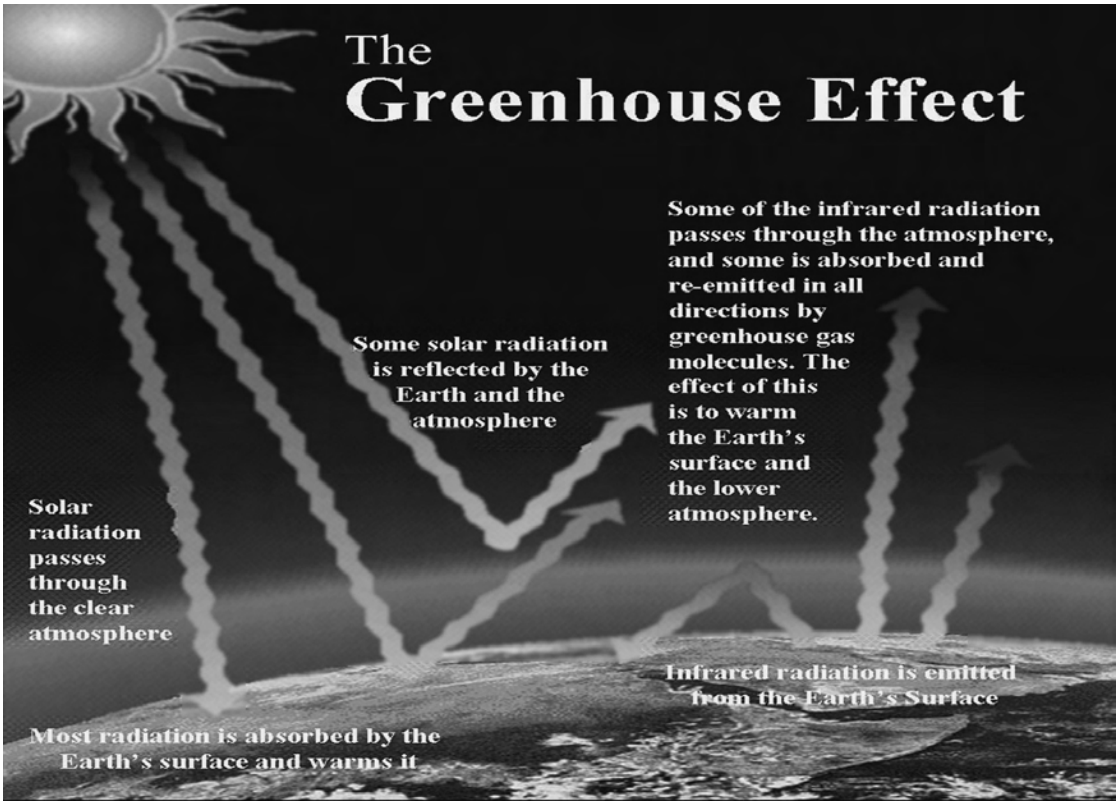
53 Scherr 2000.

54 Stedman-Edwards 1997.

55 See, for example: Homer-Dixon 1999; Peluso and Watts 2001.

56 Houghton 1994.

Figure 1.1 The greenhouse effect



Source: United Nations Environment Programme (www.grida.no/climate/vital/03.htm).

(GHG) after water vapor. Carbon dioxide concentrations today have reached 370 parts per million by volume (ppmv). The natural background during the entire last interglacial period of approximately 10,000 years has been about 280–285 ppmv. CO_2 concentrations are thus now about 30–35% higher than the natural background. The cause is known to be two-fold: the burning of fossil fuels; and land-use change, primarily the clearing of forests for agriculture. Concentrations of methane and nitrous oxide have also increased at a similar rate over about the past 150 years, the causes of which are also thought to be largely human-induced.[57] The majority of anthropogenic GHG emissions are by-products of combustion to supply energy to the electricity, industrial, and transportation sectors, with 25% of total commercial energy consumed worldwide attributable to transportation alone.[58]

Changes in climate: According to the Intergovernmental Panel on Climate Change (IPCC)[59], the global average surface temperature increased over the 20th Century by about 0.6°C.[60] During this period of global temperature increase there has been a decrease in the extent of snow and ice cover, a rise in the average sea level and the heat content of our oceans, and a number of changes in weather patterns that can also be associated directly or indirectly with the rising temperatures.

57 IPCC 2001a; IPCC 2001c.
58 IPCC 2001b.
59 IPCC 2001c.
60 IPCC Summary for Policymakers: A report of Working Group I of the IPCC.

These global changes are averages, and thus are not necessarily experienced uniformly in different regions around the world. One assessment of the USA, for example, has documented rises in the annual average surface temperature over the continental 48 states, accompanied by changes in the frequency of extreme precipitation events during the 20th Century.[61] The coastal Northeast, the upper Midwest, the Southwest, and parts of Alaska have experienced increases in the annual average temperature approaching 4°F (2°C) over the past 100 years. The rest of the nation has experienced less warming. Even larger changes in annual average surface temperature have been measured in high latitudes, especially in Siberia and Alaska, where annual averages have increased as much as 1°C per decade for the past several decades. Hence, the warming at these latitudes is over five times that experienced on average globally.

There is now an international consensus across a broad range of the scientific community that these changes in the physical climate system bear the imprint of human influences. While this consensus is broad and deep, the conclusion is not unequivocal, because there are still features of the climate system that we do not adequately understand, such as the role of clouds in affecting atmospheric warming, and the role of anthropogenic aerosols.

Scenarios for the future: The physics of the climate system are enormously complex, although they can be simulated with good accuracy on very short time scales of minutes to a few days (for weather forecasting) and with reasonable accuracy on inter-annual and longer time scales (for climate simulation) in general circulation models (GCMs). Quantitatively accurate forecasts of what the future climate holds in store would be extraordinarily difficult, however, even if GCMs could reproduce the details of climate perfectly. There are too many societal decisions about the industrial, land-use, and agricultural activities that produce greenhouse gases to know exactly what future atmospheric concentrations will be.

Many simulations have nevertheless been performed in order to better understand the potential climatic consequences of a doubling of pre-industrial atmospheric CO_2 concentrations, a level expected to be reached near the end of the 21st Century, based on mid-range emissions scenarios. These projections are expected to yield globally-averaged surface temperature increases in the range of 1.4 to 5.8°C by the year 2100, based on a 1990 baseline.[62] This increase would likely be more than has been experienced at any time during the last 10,000 years and would be substantially more rapid than the natural world has seen in at least the same time frame. All areas of the globe would be affected in some way. However, ecoregions closer to the poles would experience substantially greater warming.

Impacts and vulnerabilities

Potential consequences: Many areas in Siberia, Alaska and northern Canada have already experienced rising annual average temperatures and subsequent substantial melting of permafrost areas.[63] In addition, there has been, over the past several decades, a retreat in the area and thickness of sea ice. At times during summer 2002, for example,

61 NAST 2000.

62 IPCC 2001b; IPCC 2001c.

63 NAST 2000; IPCC 2001a; IPCC 2001c.

the Northwest Passage from the Atlantic to the Pacific actually became navigable. In Alaska, warming and associated hydrological changes have been documented to cause substantial damage to roads, buildings, and other infrastructure as permafrost melts and the resulting land subsides.

Inland glaciers around the world have been documented to be losing ice mass extremely rapidly over the last several decades. Similarly, overall snow extent has been reduced in many areas already, and montane snow pack is projected to decrease dramatically over the coming decades. Spring snowmelt is also projected to occur earlier. The results may have important implications for water management, as well as the viability of anadromous fishes (those that ascend rivers to spawn) in coastal regions.

Sea level rise is one of the most dramatic impacts of climate change (see Figure 1.2 and Box 1.1). Sea level along most of the Earth's coast is rising and the rate of rise is expected to accelerate. Rising seas result from both the rise of the average level of the oceans and subsidence of many coastal lands. The average global sea level appears to be rising 1.5–2 mm/year.[64] Approximately half of that rise is explained by the expansion of ocean water and melting of glaciers and small ice caps resulting from the global warming of the last century. Approximately one quarter of the rise appears to be a delayed response of the Antarctic Ice sheet and ocean expansion to the warming that has taken place since the last ice age. Scientists are unable to explain the remainder.

Land subsidence is caused by ongoing adjustments of the Earth's crust to the removal of the ice sheets from the last ice age, tectonic deformation, subsidence of river deltas under sediment loads, and extraction of underground water, oil, or natural gas near the coast. Sea level is rising more than 10 mm/year in many river deltas and in areas with substantial groundwater pumping, and is rising about 3 mm/year along most of the US Atlantic Coast and the coast of the Gulf of Mexico. Sea levels are rising at approximately the global average in the Pacific atolls, while levels are actually dropping along the extreme northern coasts.

Future sea level is difficult to predict. IPCC (2001c) projects that the factors included in its model will contribute 0.09–0.88 m over the 1990–2100 period, primarily from thermal expansion. The central value is 0.48 m, which corresponds to an average rate of about two to four times the rate over the 20th Century. Even if greenhouse gas concentrations were to be stabilized by the year 2100 at a level no greater than twice their pre-industrial rates, thermal expansion of the world's oceans would proceed for centuries. Various models have depicted multi-meter eventual rises on a 1,000-year time scale. Moreover, although the ice sheets of Greenland and Antarctica are not expected to provide a significant net contribution to sea level in the next century, they could add a few meters over the next several centuries.

Although there has been much speculation that climate changes would raise the frequency and intensity of storms, scientific consensus on these points has not been reached. There is no evidence from modeling studies or the last hundred years of the climate record to suggest that the frequency of intense storms would increase. However, there is a legitimate scientific theory that storm intensity could increase, at least in terms of

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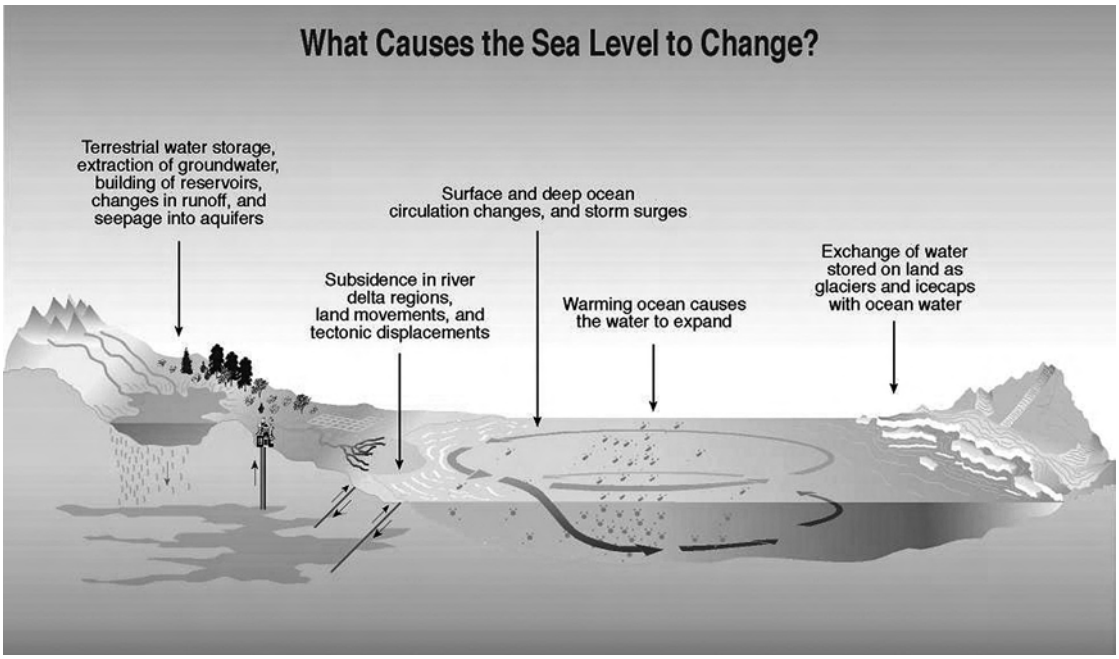
64 IPCC 2001c.

Figure 1.2 Causes of sea level rise



Source: United Nations Environment Programme (www.unep.org/vitalwater/41.htm).

the amount of precipitation, as the hydrologic cycle speeds up due to increasing rates of evaporation and transpiration. A review of data covering the last few decades shows that changes in weather patterns depend heavily on latitude. While these general conclusions are broadly held, it is important to point out that analyses of precipitation patterns in the USA, the former USSR, South Africa, China and India show a significant increase in heavy rainstorms.[65]

Potential ecological consequences: There have now been a number of studies around the world that have investigated potential ecological consequences of climate change, or that have identified potential sensitivities to the kinds of change that might reasonably be expected to occur. Among these are a major national study in the USA, analogous studies in Canada and the countries of the European Union, and a growing number of academic studies for different regions, ecosystems, and countries around the world. There are a number of general conclusions that can be drawn from the growing literature on this subject.

The overall impacts of climate change will vary by latitude and geographic region. National and regional assessments focusing on the northern industrial countries indicate that the greatest sensitivity to the projected magnitudes and rates of change are likely in unmanaged ecosystems. In the US assessment, for example, the climate scenarios analyzed would likely lead to considerable reduction and possibly the loss of Alpine meadow habitats, as the climatically optimal zones for the original vegetation moves

[65] NAST 2000; IPCC 2001c.

Box 1.1 Examples of the impacts of sea level rise

Tuvalu – The small island nation of Tuvalu, situated in the South Pacific, is in imminent danger as regional sea level rises. No point of the nation is more than 5 m above sea level. As sea level has risen, Tuvalu has experienced lowland flooding. Saltwater intrusion is contaminating its drinking water and food production. All nine of its islands have been impacted by coastal erosion, compounded by increasingly damaging storms in the area. The National Tidal Facility of Australia has been conducting research on the sea level rise affecting Tuvalu since 1993, and has found an average rise of 0.9 mm annually. With nearly 40% of its land uninhabitable and remaining areas being gradually inundated, Tuvalu's environment is facing extreme and growing population stress, even with a population of just 11,000 people. Considering the IPCC's maximum projection of a 0.88 m sea level rise in the next century, Tuvalu's existence is unquestionably threatened, as is that of many other small island nations.

Bangladesh – One of the most densely populated nations in the world, Bangladesh is home to fertile farmland. Sea level in the Bay of Bengal, however, is expected to rise at a rate greater than the global average, inundating the fertile lands at the mouth of the Indus River and increasing the frequency of floods in the river valley, augmenting the loss of inhabitable land[66]. Bangladesh could lose half of its rice production capacity as a result of a 1m sea level rise[67], and the 140 million people who depend on that staple crop would undoubtedly suffer. Under natural conditions, many of the vulnerable areas could be largely replenished with silt from river-flooding, but flood control structures are planned which would thwart natural land-building processes. Such an environmental strain will create millions of refugees, the price of relocating them will be very high, and infectious diseases are likely to spread due to unsanitary living conditions.

Chesapeake Bay, USA – Chesapeake Bay is the largest estuary in the USA. Its waters rose 30 cm during the 20th Century, one-third of which is most likely due to global warming. One third of the marsh at the Blackwater National Wildlife Refuge has been lost since 1938, and most of the remainder is expected to disappear within 30 years. Blackwater is one of several important protected areas in and around the Bay, and is vital for migratory waterfowl and shorebirds. In addition, approximately 200 miles of natural shores have been armored with rock revetments and wooden bulkheads to protect property from erosion, removing habitat for horseshoe crabs, terrapins, and kingfisher. In response to these consequences of sea level rise, Blackwater Refuge is rebuilding some of the drowned marshes by dredging mud from some of the shallow ponds created by wetland loss and the state has created a "living shorelines program" to find alternatives to shoreline armoring.[68]

The Everglades, USA – The 607,000 ha Everglades National Park, in southern Florida has been called the most endangered national park in the USA. Saltwater intrusion into the freshwater aquifer below the Park has been partially attributed to the exportation of freshwater to support the large human population in the area. The freshwater Everglades are separated from the sea by a broad ring of mangroves, whose roots trap sediments, building thick layers of peat that have created a wide, low dike against the sea. If this natural barrier continues to grow in pace with sea level rise, the Everglades may be relatively unaffected. But if the sea rises faster, or if large tracts of mangrove forest are damaged by hurricanes and fail to recover, much of the freshwater Everglades might disappear during the next 100 years, replaced by saltwater wetlands and shallow bays.

66 McNeely *et al*. 2001.

67 Perrings *et al*. 2000.

68 McNeely *et al*. 2001.

further up-slope.[69] Coastal ecosystems are also particularly sensitive, since they will experience continuing sea-level rise and saltwater intrusion into groundwater aquifers, compounded by intensifying coastal development.

Forested ecosystems in the northern countries have mixed levels of sensitivity.[70] While increased CO_2 concentrations in the atmosphere will likely lead to higher biological productivity for at least some time, experimental evidence is beginning to demonstrate that this effect will be minimal. Experiments at Duke University and other sites suggest increased productivity, but much of the excess available carbon is sequestered in leaves, twigs, and other ecosystem pools with very rapid turnover, rather than in soils and long life biomass pools.

Most research suggests substantial sensitivity to climate variability in forests over the longer term. There is reasonable consensus that as the physical climate system changes, tree species will begin to migrate to follow optimal climate zones. But the limits and rates of this migration are so far only known from paleoecological studies, which suggest that most species cannot migrate fast enough to keep up with the rates of change that appear likely to occur. While detailed predictions are not possible at present, it appears likely that forest ecosystems could break up and perhaps rearrange in very different broad combinations of species than those that are typical today. There is considerable concern that this breakup could be manifested as large ecological disturbances, such as increased frequency of fire and pest outbreaks.[71]

The fate of grasslands, like that of forests, is closely tied to changes in rainfall and disturbance frequency. The details of precipitation change are extremely difficult to forecast (much more so than temperature). But those regions that experience decreases in already sparse rainfall are likely also to see replacement of current grass species with those that have higher water-use efficiency and drought tolerance. Whether overall biological productivity will increase or decrease is not clear.[72]

There has been considerable attention to the effects of climate change on forestry and agricultural production. Assessments of northern countries suggest that in neither case are there likely to be large national-level consequences for some decades to come. However, as the US assessment points out, there are likely to be substantial adverse effects at the regional scale, most significantly for rain-fed agriculture, as precipitation patterns change.[73]

In the USA, Canada, and much of Europe, agricultural (and to some degree forested) lands are already highly managed, and there is a great deal of technological capacity and sufficient wealth for farmers in these regions to make adjustments and adapt to new climate patterns. Indeed, some areas in the north may well benefit from climate change, not only from increased CO_2 in the atmosphere, but also from longer growing seasons.[74] The picture for developing countries is very different.

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69 NAST 2000.

70 NAST 2000; Dale 2000; McNulty and Aber 2001.

71 NAST 2001; Parson *et al*. 2003.

72 NAST 2000.

73 NAST 2000.

74 IPCC 2001a.

IPCC has summarized the available literature on the potential impacts of climate change in developing countries.[75] Many conclusions of the developed-country assessments also apply in the South. Forest systems of lower latitudes are also sensitive to both rising CO_2 concentrations, and, over the longer term, to climate variability, which will yield increased frequency of fires and other disturbances, and ultimately very different mixes of species in individual regions. Immense, adverse impacts are widely presumed to be in store for developing countries, but sufficient research has not been done to allow greater specificity across a range of ecosystems. Tropical montane systems, for example, are thought to be extremely sensitive to climate variability, although their sensitivity has not been well-studied. Tropical coastal ecosystems will experience many of the same stresses that temperate coasts will exhibit, such as rising sea level and saltwater intrusion. Coral reefs are thought to be particular sensitive to changes in sea surface temperatures.

The developing world is also likely to suffer from a decrease in agricultural productivity due to rising temperatures, particularly in already arid zones. While northern Canada and Siberia may experience an increase in farm productivity, currently vulnerable areas such as South and Southeast Asia, tropical Latin America and sub-Saharan Africa are predicted to be those hardest hit by agricultural shortfall. Grasslands in the developing world, which are already under enormous stresses due to overstocking with animals, may also be especially sensitive to climate changes.[76]

As noted above, climate change is thought to be responsible for about 50% of ongoing and expected sea level rise. Rising seas inundate low coastal areas, erodes beaches and wetlands, increases the frequency of flooding, and allows saltwater to advance upstream and inland in rivers, estuaries, and aquifers. Although public attention has tended to focus on the implications for human settlements, all of these processes would have important – and mostly negative – implications for ecosystems. Indeed, measures taken to protect human settlements from sea level rise often have an even more adverse impact on ecosystems than the sea level rise itself.

Sea level rise is likely to have particularly adverse effects on river deltas, atolls, and estuarine ecosystems. River deltas tend to be very low, and have both fertile agricultural lands and coastal wetlands with abundant birds and fish. As a result, deltas often have large human and wildlife populations. Because deltas are formed by sediment washing down rivers, they can keep up with sea level rise as the land accretes vertically. But dams and river levees along the Nile, Niger, Mississippi and other major rivers have disabled the natural protection from sea level rise, preventing sediment from reaching the deltas.[77] As a result, these deltas are losing land to the sea – and authorities for managing other major rivers have plans to repeat this process.

Coral atolls are particularly threatened by sea level rise, including entire small nations such as Tuvalu, the Maldives, and the Marshall Islands. Several other nations also have significant populations on atolls, including Vanuatu and India. Atolls are rings of coral islands with lagoons in the center, with land elevations below 4–5 m and

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75 IPCC 2001a.

76 IPCC 2001a.

77 NAST 2000.

many islands below 1 m. These islands have kept pace with past sea level rise, as the living corals grow upward to stay close to the sea surface and occasional storms break off pieces of coral to form islands. But coral mining and other human activities may thwart the ability of these lands to keep up in the future, and even in the best of cases existing islands with infrastructure could be submerged as new islands formed nearby.

Sea level rise also threatens the nearly unbroken chain of wetlands and beaches along continental coasts. Over the last 6000 years, coastal wetlands have generally kept up with rising sea level as wetlands maintained their seaward boundaries while advancing inland as new areas were flooded. As a result, the amount of tidal wetlands right at sea level is generally several times the amount of dry land within 50–100 cm above the wetlands. If sea level rise accelerates beyond the ability of wetlands to keep pace, wide areas of wetlands will shrink to narrow margins and eventually be inundated. Even those wetlands will be eliminated in populated areas if dikes, bulkheads, and other structures are erected to hold back the sea.

1.4.2 Conversion and fragmentation of natural habitats

Context and trends

The socio-economic change factors discussed in Section 1.3 have significantly altered the composition of the Earth's land cover, with a significant net global change from natural habitats (e.g. forests, grasslands, wetlands) to agricultural, pastoral, urban, and other human land uses. Almost half of the Earth's original forest cover, for example, is gone, much of it cleared within the past four decades. Only one-fifth of original forest remains in large tracts of relatively undisturbed forest.[78] Grasslands, which cover some 40% of the Earth's land surface (excluding Greenland and Antarctica), have been extensively converted to agriculture and grazing, particularly in temperate areas of North America and Europe.[79] Half the world's wetlands are estimated to have been lost during the 20th Century, as land was converted to agriculture and urban use, or filled to combat diseases such as malaria.[80]

Habitat loss and fragmentation are driven by forces that are complex and unique to particular sites and regions, but are most often related to human activities. These include resource extraction, agricultural expansion, urban development, extension of transportation infrastructure, and other forms of habitat alteration.

Global estimates from satellite images (excluding Antarctica) indicate that at least 27% of all land is heavily influenced by the presence of crops or planted pastures, although this is probably an underestimate.[81] Excluding deserts and high mountains, the

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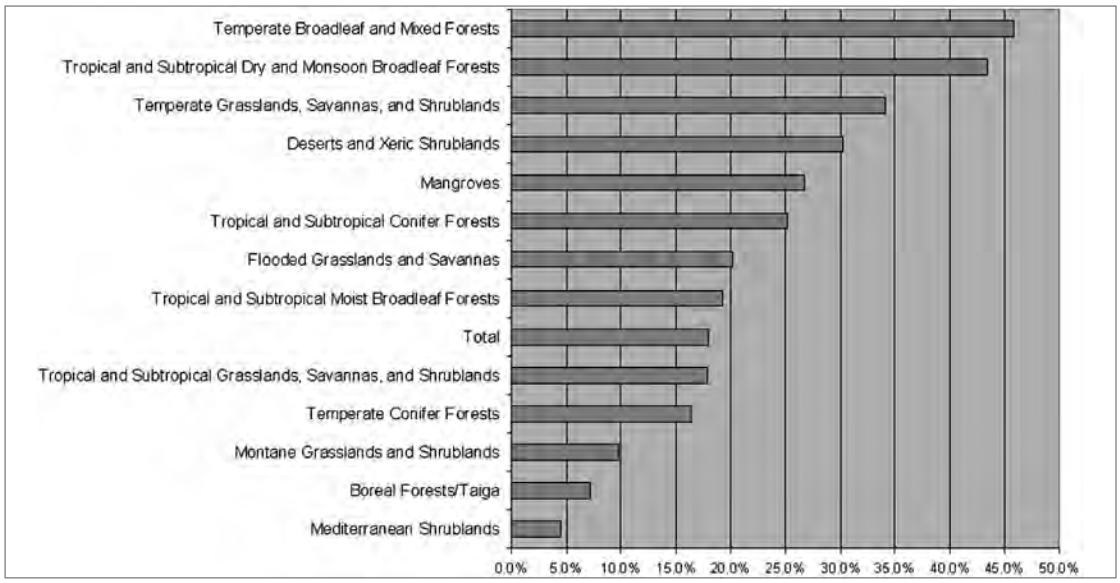
78 Bryant *et al*. 1997.

79 White *et al*. 2000.

80 Revenga *et al*. 2000.

81 This satellite-derived estimate includes only the 10% of global land units whose satellite image showed more than 60% of area under crops and planted pastures, as well as the 17% of global land units that had more than 30%. This figure significantly underestimates the real extent of cropping, as it excludes areas cropped in land units with less than 30% area in crops (including a significant share of irrigated farms in dry areas and crops grown in forest swidden fields), many tree crops in forested ecosystems and all areas left in fallow during the season for which data was recorded.

Figure 1.3 Estimated percentage of agricultural land within major habitats



Source: WWF 1999 (Ecoregions Database).

share is much higher.[82] Another 10–20% of land is under extensive grazing systems. Historically, natural grasslands have been most extensively converted to annual crops, but recent agricultural expansion has occurred most widely in forest areas (see Figure 1.3). Of 17,000 major protected areas, 45% of them – accounting for more than 20% of total land area under protection – are heavily influenced by agriculture (i.e. at least 30% of the area is under crops or planted pasture).

Impacts and vulnerabilities

Loss of natural habitat through land cover change has been extensively documented to be one of the major causes of biodiversity loss.[83] Destruction of natural ecosystems such as forests and wetlands also results in the loss of ecosystem services such as the provision of freshwater (discussed below), and diminution in the flow of natural resources that support human economic activity and livelihoods.[84]

The division of remaining natural habitat into smaller and scattered remnants introduces an additional level of stress on species and ecosystems. Fragmented forests, wetlands and grasslands are more vulnerable to collapse of their ecological communities, invasion by alien species and breakdown of ecosystem processes.[85]

While there is general consensus within the scientific community that fragmentation of habitat is a major problem, there are few comparable ways to measure its frequency and intensity in different places around the world. As a result, there is no current global

82 Wood *et al*. 2000.

83 Heywood 1995; Pimm 2001; Pimm and Raven 2000.

84 Heywood 1995.

85 Saunders *et al*. 1991.

estimate of the amount of habitat affected by fragmentation, although several indices of fragmentation have been proposed.[86] There are many reasons for this situation, but among the most important is that the effects of fragmentation, and indeed the metrics used to define it, vary by ecosystem and by the particular taxa of interest to scientists, managers, and policy analysts.

For protected areas, where the goal is often to conserve large, intact and functioning ecosystems and manage them to sustain species and ecological communities, the effect of fragmentation can be disastrous. Three dimensions of habitat fragmentation are particularly destructive: the diminishing size of individual patches of habitat; their isolation from each other; and the increased ratio of edge to habitat.

Patch size effects: Fragmentation results in a reduction of average patch size. In fragmented landscapes, patch size effects can be detected in a number of ways. Intuitively, loss of habitat should result in a proportional decline in the number of animals living in a particular landscape. For example, if a forest habitat supporting a large animal population is reduced by 50%, one might expect a 50% decline in species abundance. However, it often has been found that species abundance declines beyond that predicted by habitat loss alone. This difference stems from the effects of reduced mean patch size and decreased connectivity in the landscape (i.e. a reduction in the rate of successful dispersal).[87]

Edge effects: The major impact of fragmentation is initially manifest on the edge of habitat patches. Edge effects are defined as **"**the result of the interaction between two adjacent ecosystems, when the two are separated by an abrupt transition."[88] Edge effects vary largely in terms of distance. Gascon *et al*. (2000) describes a three-step process in the development of edge effects in fragments of humid tropical forest. The first step is a microclimate change caused by formerly protected interior areas receiving sunlight and wind. The resultant change in arboreal vegetation is from old growth to pioneer species. The new secondary growth may act as a buffer against the original edge-induced temperature increases and humidity declines. Fragments can regenerate and create buffer zones of secondary regeneration, but the land use surrounding the remnant is crucial in determining the fragment's survival. If edge effects permeate the entire forest, fragmentation will likely lead to the destruction of the remnant.

Isolation effects: Human activities often break connections between once-continuous areas of native habitat, resulting in patches interspersed with areas of degraded habitat. The distances between patches can cause lasting or permanent damage. Further, disruptions to continuous habitats may alter many ecological processes, including "nutrient and sediment flow in riparian ecosystems, plant dispersal, plant community dynamics, plant and animal reproduction, and animal movement patterns."[89] Isolation effects that result in shifting animal movement patterns can have particularly severe consequences. For example, behavioral avoidance of, or higher predation rates in, areas between native habitat fragments may reduce movement rates, and result in higher probabilities of extinction and lower rates of colonization.[90]

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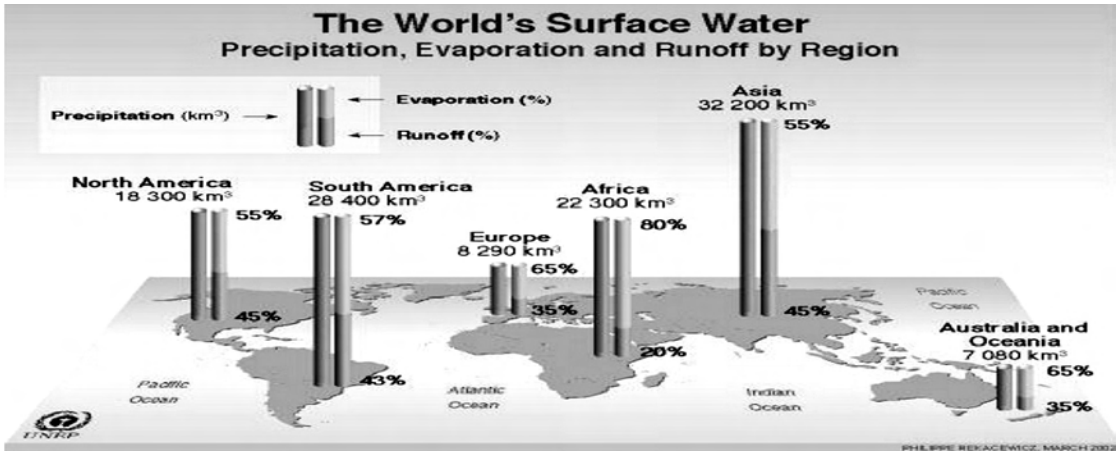
86 NRC 2000.

87 Bender *et al*. 1998.

88 Murcia 1995.

89 Collinge 2000.

Figure 1.4 The world's surface water: precipitation, evaporation and runoff by region



Source: Gleick 1993.

1.4.3 Hydrological change

Context and trends

The hydrological cycle begins when water enters the terrestrial environment as rain or snow. Water then flows toward the world's oceans through rivers, streams, lakes and wetlands. The availability of freshwater resources varies by region, depending on the geography and the related hydrological cycle (see Figure 1.4). Globally, surface water is only a small fraction of the world's total available water and covers less than 1% of the Earth's terrestrial surface.[91]

One of the most significant threats to freshwater ecosystems is hydrological modification resulting from human changes to the landscape. Over the past century, roughly half of the world's wetlands (which include swamps, marshes, lakes, rivers, estuaries and peat lands) have been lost, and river systems accounting for nearly 90% of the earth's total flow volume have been fragmented as a result of human activity.[92] In addition, chemical and biological pollutants contaminate freshwater ecosystems in many parts of the world, altering or destroying habitats and infecting people with a range of waterborne diseases. The erection of dams for flood control, irrigation and electricity generation, water withdrawals for agricultural production, and the conversion of wetlands represent some of the most important human modifications affecting the biological, chemical and physical balance that determines the health of freshwater ecosystems and the quality and quantity of water.

Key drivers of stress on hydrological systems in coming years will include continued population increase, growing demand for food and fiber, and continued expansion of dams and other hydrological modifications to meet additional water and energy needs.

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90 Wilcove *et al*. 1986.

91 Revenga *et al*. 2000.

92 Frazier 1999; Moses *et al*. 1999; Revenga *et al*. 2000; UNEP 1999.

By 2020, water use is expected to increase by 40%.[93] The impacts of climate change will add an additional set of stresses.

Population increase: As reported in Section 1.3.1, the total human population grew from 1.2 billion in 1900 to 6 billion in 2000. As a result, potential water availability decreased from 12,900 m^3 per capita per year in 1970 to 9,000 m^3 in 1990 and to less than 7,000 m^3 in 2000.[94] In densely populated regions of Asia, Africa and Central and Southern Europe, current per capita water availability is between 1,200 m^3 and 5,000 m^3 per year.[95] Global population is projected to reach approximately 7.9 billion in 2025 and to stabilize around 8.9 billion in 2050. The global availability of freshwater is accordingly projected to drop to 5,100 m^3 per capita per year during this same period. This amount would be enough to meet individual human needs if it were distributed equally among the world's population.[96] However, estimates show demand for non-irrigation water growing as much as 100% between 1995 and 2025 in developing countries, with irrigation consumption growing an additional 12% in the same regions. This additional demand will be most felt in places like northern China, northwestern India and West Asia and North Africa where demand for water resources is already stressed.[97]

Expansion of irrigated croplands: The rapid expansion of agricultural production, discussed in Section 1.3.2, has greatly intensified the demand for water to irrigate crops. Irrigated cropland area increased from about 140 to 270 million ha between 1950 and 1995.[98] Irrigation now accounts for over 70% of total freshwater withdrawals globally, and 87% of freshwater withdrawals in low-income countries.[99] As demand for food continues to grow, the demand for irrigation water will increase as well. At the same time, the expansion of agriculture will generate additional nutrient runoff from fertilizers and pesticides, compromising water quality.

Demand for dams: There are currently over 45,000 large dams in more than 140 countries around the world. Five countries – China, the USA, India, Spain and Japan – account for over 80% of the total.[100] It has been estimated that at least one large dam modifies 46% of the world's 106 primary watersheds.[101] Dams are often seen as beneficial because they assist in flood control and irrigation, provide domestic and industrial water supply and produce hydropower. These projects, however, often have high social and environmental costs associated with their construction and maintenance. Siltation and salinization, water temperature changes, fish stock depletion and wetland destruction are a few of the many potential negative environmental consequences.[102]

Currently, about 20% of the world's total electricity supply is provided by hydropower. The future expansion of hydropower will depend upon demand for electricity, as well as

93 UNEP 2002.
94 Clarke 1991; Jackson *et al.* 2001; Shiklomanov 1999.
95 Shiklomanov 1999.
96 Shiklomanov 1999.
97 Rosegrant *et al*. 2002.
98 McNeely and Scherr 2003.
99 Postel 1999.
100 World Commission on Dams 2000.
101 Revenga *et al*. 2000.
102 World Commission on Dams 2000; Berger 1994; Seckler 1996.

how societies value the environmental impacts of hydropower compared to the impacts of other sources of electricity. The worldwide annual average for new dam construction is between 160 and 320 new dams per year.[103] In coming years, the decommissioning of large dams may also be a factor for consideration. Attempts at decommissioning dams in North America and Europe have shown that this process is extremely complicated. While removing dams may allow for restoration of natural habitats, the process of decommissioning may also have negative downstream impacts.[104]

Climate change: According to the Intergovernmental Panel on Climate Change, global climate change is likely to have drastic regional, national and local impacts on hydrology, affecting the availability and quality of freshwater resources. Shifting temperatures and weather patterns will alter the existing hydrological cycle and impact the existing natural flow of water as it moves from ocean or sea, through the atmosphere and over land. Sea level rise and increases in storm surges associated with climate change could result in the erosion of shores and habitat, increased salinity of estuaries and freshwater aquifers, altered tidal ranges in rivers and bays, changes in sediment and nutrient transport and increased coastal flooding.[105]

Impacts and vulnerabilities

Changes in natural water flows: Water quantity and flow are important factors of freshwater ecosystem health. Dam construction can strongly disrupt natural production cycles, including among others, migration of fish that ascend rivers from downstream areas or the sea in order to spawn. Furthermore, the alteration of natural river flow can impact channel shape, deposition and arrangement of sand, gravel and boulders, nutrient transports, and the creation and refreshment of shorelines.[106] For example, dam construction has so severely disrupted flow in the Colorado River (USA) that all native fish stocks in the lower reaches have declined and/or been eliminated.[107] After the Pak Mun Dam was built in the early 1990s on Thailand's Mun River, a Mekong tributary, all 150 fish species that had inhabited the river virtually disappeared.[108]

Continuing urbanization and expansion of activities such as mining, deforestation and agriculture into natural landscapes will ultimately mean more roads, parking lots, sidewalks, and rooftops. When a watershed is built up with many impervious surfaces, water cannot penetrate to the soil, and large volumes of water flow directly into streams and rivers. This changes the natural hydrology of a watershed by reducing groundwater accumulation and increasing surface runoff. Rainfall can then result in higher runoff levels as water reaches rivers and lakes faster and in greater volume. During dry seasons, surface and ground water levels in developed watersheds are often lower than normal since the impervious surfaces prevents water infiltration and groundwater recharge. Conversely, floods are more frequent and intense during rainy seasons.[109]

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[103] World Commission on Dams 2000.
[104] World Commission on Dams 2000.
[105] IPCC 2001a.
[106] DePhilip 2003.
[107] Moyle and Leidy 1992.
[108] Gray 1997.
[109] Riley 1998.

Alteration of sedimentation processes: Erosion is the detachment of particles of soil, surface sediments and rocks. It occurs naturally by hydrological processes and from the wind. It is a fundamental and complex natural process that is strongly modified by human activities such as land clearance, agriculture (plowing, irrigation, grazing), forestry, construction, surface mining and urbanization. Soil erosion is an important social and economic problem and an essential factor in assessing ecosystem health and function. Sedimentation can allow soil particles to accumulate in a streambed, where, over time, they can fill a channel. This can alter normal stream flow and degrade habitats. Estimates of erosion are essential to issues of land and water management, including sediment transport and storage in lowlands, reservoirs, estuaries, and irrigation and hydropower systems.

Conversely, dams can prevent sediments and nutrients from reaching deltas, wetlands, estuaries and inland seas where they may be necessary for species composition and productivity.[110] Furthermore, the elimination or reduction of spring runoff or flood pulses can impact breeding and feeding grounds of fish and bird species.[111] Since Egypt's Aswan Dam came into operation the number of commercially harvested fish species on the Nile has dropped by almost two thirds, and the sardine catch in the Mediterranean has fallen by more than 80%.[112]

Water quality degradation: As water flows over the Earth's surface, it picks up and carries pollutants which flow into streams, lakes, wetlands and, eventually, the ocean. Water also carries pollutants into underground aquifers. Pollution from rapidly expanding cities, including untreated wastewater, sewage and industrial waste are substantial contributors. The runoff from agriculture also presents a threat to freshwater resources. Polluted runoff can sometimes cause eutrophication, through which the increased nutrients alter the chemical composition of the water and deprive aquatic species of valuable oxygen.

Increased runoff due to impervious surfaces can also degrade water quality. As water flows over paved surfaces, it may pick up pollutants, such as oils, fertilizers, and other toxic chemicals, high levels of nutrients, debris, and pathogens and carry them into creeks, rivers, and estuary systems. Impervious surface runoff may also cause warmer water temperatures and a reduction in water clarity.

Habitat loss and modification: Drought, storm, fire, deforestation, agricultural expansion and road construction can all result in loss or impairment of freshwater habitat function. Destruction or degradation can occur within the habitat itself (draining of a wetland for crop planting or dredging of a river to increase navigability) or outside the habitat (deforestation of the riparian zone). The resulting changes can impact waterfowl and fish species, lessen the area's storm-diminishing ability and affect the capacity to retain sediments and nutrients. It has been estimated that 56–65% of wetlands in North America and Europe and over 26% globally have been lost to agriculture alone.[113]

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110 Revenga *et al*. 2000.

111 Abramovitz 1996.

112 Postel 1996.

113 Wetlands International 1996.

Anthropogenic disturbances also often alter the thermal characteristics of water, which are crucial for aquatic life. Temperature determines the rate of chemical and biological processes, such as algal growth and decomposition of organic matter. Fragmentation of rivers by dams and reservoirs, as well as industrial uses such as hydropower and cooling plants, have significant impacts on water temperature.

1.4.4 Invasive alien species

Context and trends

The introduction of invasive alien plants, animals and diseases has increased dramatically with the expansion of trade and the global mobility of humans. These biological invasions are now recognized as one of the greatest threats to the stability and diversity of ecosystems, second only to habitat loss.[114] Alien, non-native or exotic species are distinguished from natives because they have been introduced into a habitat beyond their natural distribution range.[115] These species are defined as those that have crossed some kind of biogeographical barrier that would have otherwise impeded migration to the new habitat. The alien species is invasive if it acts as "an agent of change, and threatens native biological diversity."[116] Invasive Alien Species (IAS), as a subset of all other alien or non-native or exotic species, are those plants, animals and diseases "whose establishment and spread threatens ecosystems, habitats, or species with economic or environmental harm."[117]

A number of alien or non-native plant and animal species serve important roles for agriculture, forestry, fisheries and as sources of raw materials for local populations. For these reasons and possibly others, they have been deliberately introduced into a new habitat. During the colonization of the world by European countries from the 16th–19th centuries, the widespread planting of fruit trees such as the *Prosopis* spp. in Kenya to feed livestock or conifers and eucalyptus throughout the temperate and tropical regions for timber production, served distinct socio-economic purposes.[118] Cases in Sri Lanka, the USA and parts of West Africa illustrate that even botanic gardens and scientists have directly enabled biological invasion when introduced species negatively impacted the recipient habitat.

Impacts and vulnerabilities

The problem of invasive alien species (IAS) is immense, and has both environmental and economic impacts. As the Global Strategy on Invasive Species notes:

> Most nations are already grappling with complex and costly invasive species problems. Examples include: zebra mussels (*Dreissena polymorpha*) affecting fisheries, mollusc diversity, and electric power generation in Canada and the USA; water hyacinth (*Eichornia crassipes*) choking African waterways; rats exterminating native birds on Pacific islands; and deadly new disease organisms

114 Baskin 1998; Baskin 2002; Perrings *et al*. 2000; McNeely 2000; McNeely 2001.
115 Shine *et al*. 2000.
116 IUCN 2000.
117 McNeely *et al*. 2001.
118 McNeely 2000.

attacking human, animal, and plant populations in both temperate and tropical countries.[119]

Some ecological systems are clearly more vulnerable than others to invasion. Oceanic islands like Hawaii, Sri Lanka or the Galapagos of Ecuador, because their plant and animal species evolved without the selection pressures of predation, the impacts of large herbivores or a number of diseases found in other places, have proven to be particularly vulnerable to invasions. Freshwater ecosystems such as the North American Great Lakes or Lake Victoria in Africa are also at particular risk.[120]

Predicting which species, and which ecological circumstances lead to greater likelihood of alien species becoming invasive has proven to be extremely difficult. Making matters more difficult, a non-native species may have a "lag" period after introduction and not exhibit invasive characteristics until after habitat disturbance or alteration, or even the introduction of another alien species. These complications have led some groups, such as The Global Invasive Species Programme (GISP) to recommend that all alien or non-native species be treated as invasive unless there is strong evidence indicating otherwise.[121]

The economic costs of IAS are also immense. The Global Strategy on Invasive Species does not provide a global estimate, but notes that one study in the USA estimated annual IAS costs at US$137 billion, and provides a variety of other examples indicating the magnitude of the costs elsewhere (see Table 1.2).

Table 1.2 Indicative costs of some invasive alien species (US$)

Species	Economic variable	Economic impact
Introduced disease organisms	Annual cost to human, plant, animal health in the USA	$41 billion/year
A sample of alien species of plants and animals	Economic costs of damage in the USA	$137 billion/year
Salt cedar	Value of ecosystem services lost in western USA	$7–16 billion over 55 years
Knapweed and leafy splurge	Impact on economy in three US states	$40.5 million/year direct cost; $89 million indirect cost
Zebra mussel	Damages to US and European industrial plants	Cumulative costs 1988–2000 = $750 million to $1 billion
Most serious invasive alien plant species	Costs 1983–92 of herbicide control in Britain	$344 million per year for 12 species
Six weed species	Costs to Australian agroecosystems	$105 million/year
Pinus, Hakeas and *Acacia*	Costs of restoring South African Floral Kingdom to pristine state	$2 billion
Water hyacinth	Costs in 7 African countries	$20–50 million/year
Rabbits	Costs in Australia	$373 million/year (agricultural losses)
Varoa mite	Economic cost to beekeeping in New Zealand	$267–602 million

Source: McNeely *et al.* 2001.

[119] McNeely *et al*. 2001.
[120] Perrings *et al*. 2000.
[121] McNeely *et al*. 2001.

1.4.5 Biodiversity loss

Biological diversity (biodiversity) is defined by the Convention on Biological Diversity (Article 2) as:

> The variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.

Many of the socio-economic and biophysical change factors that have already been discussed are, of course, causes of biodiversity loss. But the present scale and speed of biodiversity loss is so fundamentally different from anything that has occurred in human history that it must certainly be considered a fundamental global change factor in its own right. It is, of course, of fundamental importance to protected areas managers, for whom biodiversity conservation has become a central objective.

Trends

Biodiversity is being eroded as fast today as at any time since the dinosaurs died out some 65 million years ago.[122] The current extinction rate is thought to be at least one thousand times higher than the rates typical through Earth's history.[123] The IUCN "Red List" now lists approximately 20,000 species as "threatened" with a high probability of extinction in the wild in the medium-term. The Red List, however, only included well-studied groups (e.g. vertebrates and plants), so the real number is far higher.[124]

Tropical forests are the "crucible of extinction." At least 10 million species live on earth – and perhaps many more – and tropical forests are home to between 50 and 90% of this total. As discussed above, however, tropical forests are being cleared at unprecedented and accelerating rates. Species are threatened – and many have been lost – in other biomes as well, including temperate rainforests, coastal wetlands, and freshwater ecosystems. In several spots in Europe, fungal species diversity has declined by 50% or more over the past 70 years. The number of documented species extinctions over the past century is small, however, compared to those likely in coming decades. This is due in part to the acceleration of habitat loss in recent years, but is also due to the difficulty of documenting extinctions, particularly among the vast majority of species that remain unidentified by science.[125]

Key drivers of biodiversity loss (discussed in detail in previous sections of this chapter and in Chapter 2) include: habitat loss and fragmentation; over-exploitation of wild species; introduction of alien species; pollution, climate change; and the shrinking spectrum of species used in industrial agriculture and corresponding loss of agricultural, forest, and livestock genetic diversity. These factors often interact synergistically. Root causes lie in the socio-economic global change factors discussed in Section 1.3, and in

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[122] Jablonski 1995.
[123] Pimm *et al*. 1995.
[124] Rodrigues *et al*. 2003.
[125] WRI *et al*. 1992.

related incentives and dynamics brought about by a wide range of public policies and market forces.[126]

Impacts

Extinction is irreversible on any time scale meaningful to humans. For that reason it is, in the words of biologist E.O Wilson, "the folly that our descendants are least likely to forgive us." But the impacts of biodiversity loss are being felt here and now, particularly by local and indigenous communities who directly depend on wild biodiversity and natural habitats for their livelihoods and, in some cases, their cultural survival. As forests and other natural systems fall, the broad spectrum of foods, materials for shelter and clothing, medicines, and other goods utilized by traditional peoples disappear. But biodiversity loss impacts many other people as well, through, for example, the loss of agricultural genetic diversity and wild relatives of crops that are essential to the continued productivity and adaptability of world food production.

Of all of the biophysical global change factors surveyed here, biodiversity loss is the one of most directly concern to protected area managers, for conserving biodiversity is at the heart of their mission. It is also the issue where protected area managers can have the most direct impact, since protected areas are recognized as the cornerstone of efforts to conserve biodiversity.

1.5 Global institutional change

The sweeping socio-economic and biophysical changes discussed in the last two sections present a daunting set of challenges for protected areas managers – and, indeed, for all of humanity. None of the global changes reviewed bode well for the future of the human condition or the biosphere on which humanity depends. Humans are, however, an adaptable and problem-solving species whose greatest strengths have always been the capacities to reason, learn, communicate, and cooperate within the framework of shared values and norms of behavior. It is not surprising, therefore, that this era of rapid socio-economic and biophysical change has also generated a wide range of new norms, institutions, governance arrangements, and ways to learn, reason together and communicate. Within these transformations in the ways that people relate to each other and the environment – here collectively termed "global institutional change" – lies the promise that humanity can respond effectively to the other, more negative aspects of global change.

1.5.1 Changing global norms

All human societies have norms – expectations of how a person or persons will behave in a given situation, based on established protocols, rules of conduct or accepted social practices. New in our world today is the emergence of *global* norms that transcend the rules and expectations of particular cultures and are thought to apply to the behavior of *all* human beings. This globalization of norms of behavior is another important

[126] Wood *et al*. 2000.

dimension of the multifaceted globalization of human interaction so evident in the discussion of global socio-economic change in Section 1.3.

As is the case with long-established local norms, these global norms are only variably respected or enforced. What is important, however, is that they are increasingly accepted as norms that should apply to and guide the behavior of everyone, everywhere – a truly revolutionary concept in the broad sweep of human history. Much can be said on this topic, but we focus here on three broad global norms of particular relevance to protected areas policy makers and managers: human rights and universal equality; democracy and accountability; and global cooperation and stewardship.

Human rights and equality: The idea that all human beings are entitled to equal respect and concern by virtue of their humanity has a long and complex history of development, reaching back at least several centuries.[127] The evolution of global norms of human rights and equality in the second half of the 20th Century, however, can be largely traced to a number of key factors.

Revulsion at the horrors of the Second World War led to the adoption of the 1948 U.N. Universal Declaration on Human Rights, a document that set the template for development of much subsequent international and national human rights law and policy. Decolonization and independence of former colonies in the developing world was also a significant factor. Social movements against racial discrimination in the USA, South Africa and elsewhere made a large contribution. Recognition of women's rights – and their empowerment through the invention and wide dissemination of birth control technologies – has been another factor. The struggles of indigenous peoples for recognition of their rights – recognized in Convention 169 of the International Labor Organization and, increasingly, in other international instruments and national laws – has added yet another dimension to this evolving global consensus.[128]

Violations of human rights are still widespread, of course; the existence of norms does not guarantee their observance or enforcement. It is nevertheless true that, for the first time in human history, all humanity is encompassed by a single set of norms about how people should behave towards each other. This has important implications for protected areas management, which are increasingly manifest in calls for recognition of the rights of indigenous and local communities, and the empowerment and participation of women.

Democracy, accountability and the rule of law: Democracy – the idea that governments should be elected by, and be accountable to, citizens who hold relatively equal rights, and should obey the rule of law rather than the whims of rulers – has been an ideal and norm of governance in the more developed countries for several centuries. The end of the 20th Century, however, saw a rapid expansion of the ideal and practice of democracy across the globe, in both developing countries and in the countries of the former Soviet Union and its satellites. Of course many countries are not democracies, and many that claim to be do not live up to the ideal. And the transition to democracy

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127 Dunne and Wheeler 1999.

128 For detailed analysis of the development of the idea of human rights and the numerous international conventions related to human rights, see Nickel 2003.

is, for many countries, a process fraught with instability and set-backs. It is nevertheless true that, with some exceptions, people everywhere increasingly agree (and most governments at least pretend to agree) that democracy is a fundamental global norm, equally applicable to all countries.

Democratic norms have also permeated institutions other than national governments. Increasingly, citizens are calling for – and getting – more representation, participation, transparency, accountability, and respect for the rule of law in local government, the private sector, and in international institutions such as the World Bank, the World Trade Organization, and U.N. conventions and processes. Democracy is, therefore, no longer just about the norms and practices of formal structures of national government. Rather, is applies to the full range of institutions that determine power relations, make decisions, and allocate and use resources.

Global cooperation and stewardship: The idea that humanity, collectively, has responsibility for stewardship of global problems and threats is a third important global norm that has only developed in the past 50 years or so. The founding of the United Nations and the Bretton Woods Institutions (e.g. International Monetary Fund, World Bank) after the Second World War, and the establishment of international development assistance programmes in the wake of decolonization soon thereafter were key landmarks in the growth of this new global sensibility. The rapid globalization of economic activity, culture and communication also hastened – and necessitated – this new ethic of global stewardship. Poverty and conflict on the other side of the earth is harder to ignore when it is beamed into your house on the nightly news. The adoption in 2000 of the U.N. Millennium Development Goals on poverty reduction and other global challenges is the most recent high-profile manifestation of this new global norm.

Concerning global environmental stewardship, many have argued that the stunning photos of the Earth floating in space, beamed back to us by the first lunar explorers in the late 1960s, have had a profound effect on the human psyche, reminding us that we are indeed all residents of the same fragile planet. A series of U.N. sponsored environment-and-development summits (Stockholm 1972; Rio 1992; Johannesburg 2002) have elaborated and strengthened norms of global environmental stewardship, and catalyzed the development of numerous international environmental agreements. The discussion on global biophysical change in Section 1.4 makes it painfully clear that this new ethic is not yet sufficiently strong to reverse the damage we are visiting on our planet. But it is undeniable that the norm of global environmental stewardship is now an important part of how people think about their relationships to each other and the planet upon which we depend.

1.5.2 Global trends in governance and institutions

These new global norms have catalyzed the development of new kinds of institutions, and new forms of governance. We focus here on three areas of particular importance for protected areas: global environmental institutions; non-governmental organizations (NGOs) and other institutions of "civil society"; and decentralization of governance.

Global environmental institutions: The increasingly apparent impact of global biophysical changes and the growing ethic of global environmental stewardship

have catalyzed development of a wide range of new international institutions. The United Nations Environment Programme (UNEP) was established in 1972 to encourage sustainable development through sound environmental practices, and numerous other U.N. agencies have also added an environmental dimension to their mandate and programme. After several decades of attack by activists concerned with the environmental harm that World Bank-funded projects were causing, the Bank has embraced environmental sustainability as one of its core objectives, and has become one of the largest funders of environmental projects in the developing world. The 1992 Rio "Earth Summit" was the catalyst for negotiation of both the Convention on Biological Diversity and the Framework Convention on Climate Change, and for the establishment of the Global Environment Facility (GEF), the single largest funding source for global environmental priorities. Other global treaties deal with trade in endangered species, migratory species, wetlands, desertification, management of Antarctica, and a host of other issues. There are also innumerable regional environmental agreements.

Many of these institutions and agreements are important for protected areas managers because they provide international guidance for national conservation policies – and may thus exert political pressure on national leaders to act – and can also facilitate, for developing countries, the flow of international protected areas funding. In 2004, for example, the Parties (ratifying governments) to the Convention on Biological Diversity established a comprehensive programme of work on protected areas (Decision VII/28) that substantially embodies the priorities and targets of the international community of protected areas professionals, and calls on governments to significantly increase funding for protected areas.

Development of global environmental institutions has not been confined to the governmental sphere. Numerous large, international conservation and environmental protection non-government organizations (NGOs) have been established and grown rapidly over the past decades. By 2003, for example, seven of the largest international conservation NGOs managed some US$1 billion in combined resources for conservation activities in 120 countries.[129]

Non-government organizations (NGOs): The past several decades have seen an explosive growth in the number, diversity and influence of NGOs, which have taken their place alongside the state and the private sector as the most visible element of "civil society", a new "third force" on the international institutional landscape. "Civil society" can be defined as:

> the realm of organized social life that is voluntary, self-generating, (largely) self-supporting, autonomous from the state, and bound by a legal order or set of shared rules. It is distinct from 'society' in general in that it involves citizens acting collectively in a public sphere to express their interests, passions, and ideas, exchange information, achieve mutual goals, make demands on the state, and hold state officials accountable. Civil society is an intermediary entity, standing between the private sphere and the state.[130]

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[129] BirdLife International *et al*. 2004.

[130] Diamond 1994.

Civil society is thus an institutional expression of the democratic norms and principles discussed above. So too, the explosive growth of international environmental NGOs is a key manifestation of the norm of global environmental stewardship.

The growth of the "NGO sector" is a new global phenomenon in two ways. First, NGOs have become ubiquitous across the world at the local and national level. Second, many NGOs operate at a global scale and have become influential international actors. Amnesty International, CARE, Doctors without Borders, Greenpeace and the World Wildlife Fund are just a few well-known examples.

It is difficult to ascertain the total number of NGOs globally, or even within a country, since not all such groups are officially registered, and definitions vary from place to place. It is clear, however, that the number of NGOs has grown exponentially over the past few decades (see Box 1.2).

NGOs are now common and influential actors in numerous international meetings and negotiations, in national government agencies and parliaments, and in millions of rural communities and urban neighborhoods where they work on the ground. They are particularly important actors in developing countries, where their roles include policy advocacy, research, providing data and information services, serving as intermediaries for aid disbursement to local organizations, public service delivery, giving voice to marginalized groups, and facilitating participatory processes. In 1996, according to one study, 21 OECD countries between them channeled some US$1.6 billion in bilateral aid through NGOs. In 1999, Norway channeled 24% of its bilateral aid through NGOs, Sweden 29%, and Finland 11%.[131] Another study estimates that of the US$13–15 billion that development NGOs are thought to disburse annually, over half comes from taxes and official aid, up from less than 30% a decade ago. This suggests that about 13% of all official development assistance (ODA) is channeled through development NGOs.[132]

Some governments, however, are suspicious of unelected organizations that claim to represent large constituencies and espouse views sometimes contrary to those of the state. Some developing country governments – and local NGOs – are particularly uncomfortable with the growing influence of international NGOs on the policy agendas and decisions of multilateral development banks and aid agencies, a process in which states sometimes feel that NGOs' priorities are supplanting their own. In the words of one critic:

> Where once global politics were dictated exclusively by elected governments, now elected governments must compete with 'civil society' – interest groups accountable only to themselves but often with significant financial resources, the management structure of a multinational company and a media image that governments can only envy … Is it safe to grant a mandate to change the world to unelected organisations which operate under the banner of democracy, but which answer only to their directors, fundholders or members, and are far less transparent than most political parties?[133]

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131 Pinter 2001.

132 Fowler 2000.

Box 1.2 Snapshots of NGO sector growth

- The USA has 1-2 million NGOs, 70% of which are less than 30 years old.
- 60,000 NGOs were created in France in 1990 alone, compared to 10,000–15,000 in the entire decade of the 1960s. Growth in Germany has been comparable.
- New Zealand's civic sector includes at least 36,000 incorporated groups, with perhaps 20 new groups formed each week.
- Hungary had 13,000 associations two years after the end of Communism, at least half of them formed in the preceding two years.
- By the mid-1990s, about 1 million NGOs were operating in India, 210,000 in Brazil, 96,000 in the Philippines, 27,000 in Chile, 20,000 in Egypt, and 11,000 in Thailand.
- By 2002, more than US$7 billion in private and government aid to developing countries flowed through NGOs, compared to US$1 billion in 1970.
- In one cross-national study of nine countries, the growth rate of nonprofit employment exceeded that of overall employment by a factor of more than two-to-one. In general, nonprofit organizations are growing much more rapidly than other components of national economies.

Sources: Levinger and Mulroy 2003; WRI 2003.

This critique of course glosses over the fact that many governments are not elected, or were elected through less-than-credible electoral processes, and are not viewed by many ordinary citizens as representing their interests. Indeed, it is this imperfect state of representative democracy in many countries that has catalyzed development of NGOs in the first place.

The growing importance of civil society and the increasingly visible presence role and presence of NGOs are important developments for protected areas managers for two principal reasons. First, NGOs are increasingly important stakeholders in protected areas decision-making, both as advocates for their own positions and, in many cases, as representatives of the interests of local and indigenous people, women, and other often-marginalized groups. Second, NGOs with technical conservation skills and financial resources can be among protected area managers' best allies, mobilizing funding, catalyzing political support, and providing technical assistance.

Decentralization of governance: Across the globe, many functions of government are being increasingly decentralized to lower levels of government and other sub-national institutions. Powers that can be decentralized include legislative powers (elaboration of rules), executive powers (making, implementing, and enforcing decisions), and judicial powers (interpretation of rules and adjudication of disputes). Decentralization is often used generically to refer to a variety of different processes including deconcentration, delegation, and co-management (see Table 1.3). The utility and success of these various approaches is dependent on local circumstances; no one approach is inherently better than the other.

[133] Bond 2000. Also see "Sins of the Secular Missionaries." *The Economist*, 29 January 2000, and Khare and Bray 2004.

Table 1.3 Different approaches to decentralization

Decentralization	Any act in which a central government formally cedes power to actors and institutions at lower levels in a political-administrative and territorial hierarchy.
Political decentralization	The powers and resources are transferred to authorities representative of and downwardly accountable to local populations, in order to increase public participation in local decision-making.
Deconcentration	Powers are delegated to local branches of the central authority. These branches are considered local administrative extensions of the central state.
Delegation	Public functions are transferred from governmental and central authority to a non-government entity, including individuals, corporations, and NGOs.
Co-management	Two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources.

Sources: Ribot 2002; Borrini-Feyerabend *et al*. 2000.

Decentralization offers opportunities to develop innovative local systems for governance and management of natural resources, including protected areas. Such systems can be more effective and more equitable than protected areas and other natural resources management activities run by central governments, as has been the norm in the past. Decentralization can, however, be disastrous for protected areas if local authorities are not committed to conservation, or not prepared to assume their new responsibilities. Additional risks are presented when responsibilities are transferred without links to agencies that possess enforcement authority and have the power to resolve conflicts and redress abuses of power. Effective and accountable decentralization thus does not remove the need for central authority; rather, it changes the functions of central government to the setting and enforcement of framework laws and policies and the provision of supportive services. The implications of decentralization for protected areas are discussed in detail in Chapter 2.

1.5.3 Globalization of communications, knowledge and culture

The past few decades have seen enormous changes in the way that humanity communicates – and thereby shares and transforms knowledge and culture. The telecommunications revolution – telephones, television, and the Internet – provides the "glue" of globalization that binds together the global socio-economic and institutional changes that we confront in the 21st Century.

Fifty years ago, most international telephone calls were delivered over short-wave radio. People got their news from the radio. Faxes, mobile phones, and the Internet did not exist. Even local telephones were relatively rare – and often non-existent in the rural areas of most developing countries. Television was a novelty, unknown to most of the world. Since that time, the world has experienced an accelerating telecommunications revolution with extraordinary consequences (see Figure 1.5).

Fixed-line – and more recently, mobile – telephone networks now encompass a vast majority of the planet. Fixed lines have been ubiquitous for some decades in developed countries, but developing countries have begun to catch up. From 1995 to 1998, developing countries connected more than 171 million fixed lines, along with 238 million mobile

subscribers and 8 million leased lines.[134] In 1991, less than 1% of the world's population had access to a mobile phone and only one-third of countries had a cellular network. By 2002, over 90% of countries had a mobile network, almost one billion people had a mobile phone, and almost 100 countries had more mobile than fixed-line telephone subscribers.[135]

The development and consolidation of the global media market – worth more than US$1.1 trillion in 2003[136] – has also happened very rapidly. Most of the world has become, in a remarkably short time, one media market, with access to an increasingly complex – but increasingly common – range of information and entertainment sources controlled by a relatively small number of private transnational firms:

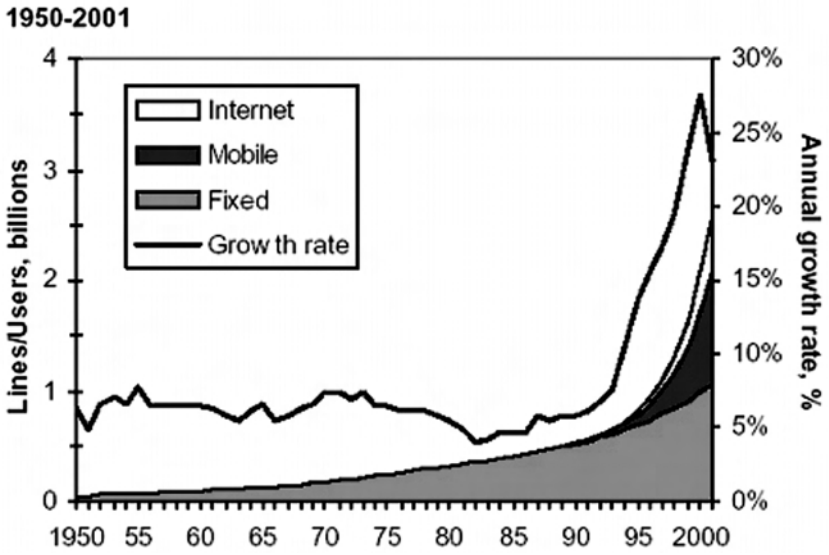
> Where previously media systems were primarily national, in the past few years a global commercial-media market has emerged … Together, the deregulation of media ownership, the privatization of television in lucrative European and Asian markets, and the new communications technologies have made it possible for media giants to establish powerful distribution networks, within and among nations … Together, the sixty or seventy first- and second-tier giants control much of the world's media: book, magazine and newspaper publishing; music recording; TV production; TV stations and cable channels; satellite TV systems; film production; and motion picture theatres.[137]

The growth of the Internet has been even more remarkable. Restricted to a few academic and government institutions in developed countries as recently as 20 years ago, the Internet is now ubiquitous, with 730 million people online, more than 500 million of them living in countries where English is not the first language.[138] For many, the Internet is becoming a primary source of news and information, an essential tool for daily communication, and an increasingly important vehicle for commerce. To give but one example, most of the sources cited in this chapter can be downloaded from the Internet, at no cost.

Access to the Internet is not evenly shared, however, resulting in a "digital divide", a term referring to differential access to the Internet, which is much less evenly distributed than telephone access. "The divide exists between countries at different levels of development, and within a country, for instance, between urban and rural areas, between men and women, between the educated and the unschooled or between the young and the elderly. It is a result of socio-economic disparities and thus little different from other income, health and education divides."[139] There is some evidence that the digital divide is shrinking. Developing countries have raised their share of the world's Internet users from 2% in 1991 to 23% in 2001. But the nature of the divide is now changing from quantity – how many people are connected – to quality. High-speed "broadband" access, which allows practical access to the World Wide Web and all it has to offer, is still disproportionately concentrated in the developed countries. Luxembourg's 400,000

134 World Bank 2002.
135 International Telecommunications Union 2002.
136 PricewaterhouseCoopers 2003.
137 McChesney 1999.
138 Global Reach 2004.
139 International Telecommunications Union 2002.

Figure 1.5 Fixed telephone lines, mobile phones and internet users (in billions) and annual growth rate (in %) 1950–2000



Source: International Telecommunications Union 2002.

citizens, for example, share between them more international Internet bandwidth than Africa's 760 million people, 5 million of whom are Internet users.[140]

Impacts

The impacts of the global telecommunications and media revolution – and the broader forces of globalization which it facilitates – are complex, far-reaching and, in many cases, not yet fully understood. Some aspects are widely appreciated – and often resented – such as the growing penetration and domination of US popular culture around the globe, and the increasingly dominant role of English as the *de facto* global language. Barber (1995) calls this emerging globalized reality "McWorld", a future painted by its proponents

> in shimmering pastels, a busy portrait of onrushing economic, technological and ecological forces that demand integration and uniformity and that mesmerize peoples everywhere with fast music, fast computers, and fast food – MTV, Macintosh, and McDonalds – pressing nations into one homogeneous global theme park, one McWorld tied together by communications, information, entertainment and commerce.

The advent of "McWorld" has considerable implications for conservation, and for the day-to-day work of protected areas managers. People all over the planet now regularly watch the same TV shows on nature conservation and protected areas issues on popular wildlife channels. Websites disseminate ecotourism opportunities to the farthest corners of the globe. Extensive technical and policy information on protected areas can be accessed almost anywhere in the world at the click of a mouse. The Internet allows

[140] International Telecommunications Union 2002.

protected area managers to communicate with each other, and with technical experts, in real time. (This is one of the main goals of the Protect Areas Learning Network – PALNet – discussed in Chapter 4.)

By the same token, the global media and Internet revolution means that local issues and conflicts now have an instant global audience. Illegal logging in Indonesia, wildlife poaching in Africa, or politically-expedient giveaways of logging rights in the US national forests are no longer just local stories. Whatever happens on the ground in and around a protected area, there is a good chance that the whole world will be watching, activists will raise the alarm, and politicians will take notice.

1.6 What's a protected area manager to do?

This brief tour of the startling and unsettling global changes sweeping the planet may leave many protected area managers and policy makers saying "yes, but what can *I* do about all of this?" Understanding the nature of global change and appreciating the present and future impacts of these changes on protected areas and their management is the first step. But the crucial second step is to take action, bearing in mind that there are things one can control, things one can take advantage of, things one can influence, and some things that can only be appreciated, understood, and adapted to as best as one can.

The remaining four chapters of this volume elaborate what we believe are the key areas where protected area managers and policy makers – and the politicians and stakeholders who can and should become their partners – need to take action to respond effectively to the global change factors outlined in this chapter:

- Build and strengthen comprehensive protected area systems that conserve the full range of biodiversity and ecosystem services, and systematically incorporate actions that counter, mitigate, and adapt to the socio-economic and biophysical dimensions of global change (Chapter 2);
- Develop and manage protected area systems in participatory and equitable ways that respect and enlist the multiple stakeholders who depend on protected area resources and are affected by protected area policies, implement new global norms of respect for human rights and democracy, and utilize the diverse forms of protected areas governance that have developed in recent decades (Chapter 3);
- Develop the capacities needed to build, strengthen and manage protected areas in an adaptive manner that incorporate responses to global change factors (Chapter 4);
- Establish and implement systematic monitoring and evaluation of the effectiveness of protected areas management in a changing world, and use evaluation results to inform and adapt management to changing conditions and lessons learned about what works and what doesn't (Chapter 5).

These are daunting challenges, but they can be met. The most important global change of the 21st Century for protected area managers will be changing the way we conduct our own business to meet the unprecedented challenges of a fundamentally new world.

2. Designing protected area systems for a changing world[141]

2.1 Introduction

Almost all countries have a system of protected areas, and protected areas now cover some 11% of the planet's land surface, making them one of Earth's most significant land uses. Despite considerable expansion over the past few decades, most protected area systems do not adequately conserve many values, goods and services that biodiversity provides to humanity. Nor do these systems add up to a comprehensive global network[142] that protects globally-threatened species and ecosystems. This insufficiency is compounded by the challenges to protected areas posed by the range of global changes discussed in Chapter 1.

Most of today's protected area systems developed in an *ad hoc* manner, and were not designed with biodiversity conservation or the maintenance of ecosystem goods and services in mind. This is due in part to the relatively recent development of the scientific knowledge needed to design systems and sites to conserve biodiversity – as opposed, for example, to designation of areas of outstanding scenic beauty or recreational utility.

As scientific understanding of conservation biology has improved and the vision of the objectives of protected areas has widened, it has become clear that current protected areas systems have the following deficiencies:

- Some ecosystems are greatly under-represented, notably marine and freshwater ecosystems;
- Many biodiversity "hotspots" – areas with high levels of endemism that have lost much of their original natural habitat and will be the sites of massive extinctions if that loss continues – are not adequately protected;
- The global protected areas network does not adequately conserve a representative sample of the planet's distinctive ecological regions ("ecoregions");
- Protected areas are often biologically isolated from each other as islands within a sea of agricultural, industrial and other human uses, and therefore do not provide biologically necessary connectivity for the movement of species and exchange of genes;

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[141] **Author:** Charles Victor Barber, IUCN Consultant. The author wishes to acknowledge the significant contributions to the chapter made by Dr Mohamed Bakarr of the International Center for Research in Agroforestry (ICRAF), and Dr Gustavo Fonseca and his colleagues at Conservation International.

[142] In line with decisions of the Convention on Biological Diversity, this chapter distinguishes between a global protected area "network" and national or regional protected area "systems." The term "system" is used here to refer to national and regional systems of protected areas that have both a biological rationale for their structure and composition, and an element of governance and management. "Network" is used here to refer to the global sum total of protected area systems as a biological entity, but does not imply the existence or desirability of any governance or management authority at the global level.

- The role of protected areas in maintaining key ecological services – such as hydrological functions – is insufficiently appreciated and is not factored into protected area system design;
- The need to design – or, in some cases, redesign – protected areas to cope with the impacts of climate change is not sufficiently appreciated or acted on;
- Invasive alien species pose significant threats to protected areas, but this threat is insufficiently appreciated and addressed.

Current protected areas systems are also not designed to respond to changing socio-economic and institutional conditions:

- Rapid increases in human population and economic activity, combined with the biological imperative to expand protected areas and link them together across the landscape, mean that human settlements and economic activity must be integrated into protected area systems in ways that both meet human needs and serve conservation objectives. A comprehensive protected area system must therefore encompass sustainable use of natural resources in agricultural and other modified landscapes as well as strict protection of relatively intact natural ecosystems. Few protected area systems, however, have taken this approach, and fewer still have succeeded.
- Decentralization of governance and management – including privatization of formerly public functions – is a widespread trend across much of the globe. Protected area systems must therefore grow to encompass a wider range of protected area governance types than has been the case in the past. Protected areas managed by local government units, local and indigenous communities, and private landowners and companies need to complement those managed by national governments. This is particularly the case as protected areas expand further into areas where people live and work across the landscape. Most protected area systems, however, are still dominated by the traditional model of state-run parks on state-owned lands.
- Increasing pressure for popular participation in government decision-making has been a defining political feature of the past few decades in most of the world, including decision-making about the establishment and management of protected areas. Protected area systems therefore need to incorporate participatory processes to ensure that rights and interests of relevant stakeholders are taken into account, and that costs and benefits are equitably shared. While some examples of effective participation in protected areas management exist, they are still the exception.

Because protected areas need to take all of these complex factors into account – and because funding is limited and difficult choices therefore have to be made – protected area system development is a political as well as a scientific process. Effective conservation must have a sound scientific basis, but "conservation planning is an activity in which social, economic and political imperatives modify, sometimes drastically, scientific prescriptions."[143] Every approach to assessing a system's gaps, and every approach to

[143] Margules and Pressey 2000.

deciding which areas should be selected to fill those gaps, is based on particular scientific, socio-economic, and political assumptions about what the goals of protected areas should be.

When conservation policymakers, planners or donors choose to utilize a particular method for establishing their protected area priorities, they are accepting, *a priori*, certain assumptions about what is most important to conserve. The "hotspots" approach prizes high concentrations of endemic species that are under high levels of threat, as determined from a global perspective. The ecoregional approach prioritizes conservation of representative samples of the world's distinctive ecosystems. Other approaches focus on particular species, such as birds (albeit as surrogates for wider conservation objectives), specific ecosystems, such as wetlands, or the world's remaining large tracts of relatively pristine natural habitats.

All of these approaches are valid, and are indeed necessary to ensure establishment of a globally comprehensive protected areas network. These global-level "biocentric" approaches, however, often miss values of biodiversity that may be extremely important from a national or local level, such as maintenance of key ecosystem services, or continued availability of economically-important natural resources. By the same token, if conservation priorities are based exclusively on locally- and nationally-determined human preferences for goods and services provided by nature, the resulting "anthropocentric" protected area systems will miss conservation of many important biodiversity values.

Comprehensive protected areas systems therefore require the fusion of different approaches – the global and the national/local, the biocentric and the anthropocentric – and must respond systematically to global change. The main purpose of this chapter is, therefore, to provide an overview of available methods and approaches to setting conservation priorities and systematically planning the development and management of protected areas, incorporating specific measures that respond to the biophysical global change factors outlined in Chapter 1. Subsequent chapters address how socio-economic and institutional and global change factors can be incorporated.

2.2 The current status of protected areas

2.2.1 The global extent of protected areas

A recent report by the UNEP World Conservation Monitoring Centre (UNEP-WCMC), based on 2003 statistics in the World Database on Protected Areas (see Box 2.1), determined that there are 102,102 protected areas worldwide. This figure includes all nationally designated sites, and covers a broad range of types of protection including forest reserves, private reserves, strict nature reserves and national parks. The total global surface (including oceans) covered by these sites is some 18,764,958 km^2 (more than five times the area of India, or greater than the area of Brazil and Canada combined) but still only representing 3.4% of the planet's surface. Most of these areas are on land and the total terrestrial surface covered by protected areas is some 17,125,893 km^2, or 11.57% of the total.[144] The report goes on to caution, however that:

[144] Mulongoy and Chape 2004.

High numbers and large area figures do not necessarily reflect achievement of conservation objectives. Many of the world's largest protected areas lie over relatively remote and low-diversity landscapes, including ice-caps and sand deserts. These sites have a tendency to greatly skew statistics and other, highly important, habitats remain poorly protected. The figures include a broad range of levels of protection and provide no basis for assessing management effectiveness, and many sites may still be undergoing degradation or loss.

Box 2.1 The World Database on Protected Areas (WDPA)

The World Database of Protected Areas (WDPA) consortium was created in 2002 to review and update previously existing data on the global coverage of protected areas. The WDPA was built on Version 5 of the database on protected areas compiled by the United Nations Environment Programme's World Conservation Monitoring Centre (UNEP-WCMC). The vision of the WDPA project is to create a freely available, accurate and up-to-date database that will be accepted and used as the global standard by all stakeholders. Specifically the WDPA is intended to provide:

- Readily available information on protected areas to support assessment, monitoring, decision-making and development of policy at national and international levels;
- A core database on protected areas that is internationally recognized, current and managed to international standards;
- Improved access to information on protected areas that is already available on the Internet and gradual increases in the information available;
- Improved use of information and sharing of experience by protected area professionals.

Organizations currently involved in the consortium include: BirdLife International, Conservation International, Fauna & Flora International, The Nature Conservancy, UNEP-WCMC, the World Resources Institute, the Wildlife Conservation Society, and the World Wildlife Fund.

The process of constructing the WDPA database, as approved by the Steering Committee of the World Commission on Protected Areas (WCPA), has included two phases. The first phase pooled and integrated all existing datasets from the consortium organizations. During this phase, the consortium also asked governments around the world to submit the official version of their protected areas system and related data. The second phase involved consolidating and reviewing the resulting integrated dataset, drawing upon the expertise available through the extensive membership of the WCPA. The WDPA was formally launched at the Vth World Parks Congress in September 2003. Currently, the database is being continually updated as new data become available, and as countries create new protected areas and/or alter the status and/or extent of existing areas.

Protected areas in the WDPA are recorded either as polygons (60,160 records) or as points (102,341 records, of which 70,831 records have no associated area information). Protected areas with polygon data have had their boundaries digitized. Protected areas recorded as points have only a single set of latitude and longitude coordinates marking their geographical location. Both types of data were provided as ArcView shapefiles, with associated tables of attributes. Data for each protected area includes a unique site code, protected area name, country, geographical coordinates, designation (e.g. Nature Reserve, National Park), IUCN categories, and status (e.g. Designated, Proposed, Degazetted). Additionally, the WDPA includes data on protected areas with international status (e.g. UNESCO Man and the Biosphere Reserves, World Heritage Sites, Ramsar Wetlands).

Sources: Mulongoy and Chape 2004; Rodrigues *et al*. 2003.

The marine environment is particularly under-protected. UNEP-WCMC's 2003 effort marked the first-ever global statistical assessment of the extent of marine protected areas (MPAs). The assessment revealed that 4,116 MPAs cover some 1,639,065 km^2 of ocean surface, representing only 0.45% of the ocean. This tiny figure is even more notable when one considers that more than one third of this area is made up of two very large sites (the Great Barrier Reef and the Northwestern Hawaiian Islands).

Inland aquatic ecosystems are also thought to be poorly protected, but data are so sparse that it is difficult to say. A review conducted for the Convention on Biological Diversity concluded that it is currently not possible to estimate reliably the total extent of wetlands at a global scale, or to estimate figures for different inland wetland types.[145] The most systematic registry of protected areas for wetland ecosystems – including inland aquatic ecosystems – is the list of Wetlands of International Importance under the Convention on Wetlands (Ramsar Convention). This registry contains 1,328 wetland sites totaling 1.12 million km^2. These sites, however, include many non-wetland areas as well as marine areas, such that this figure is not a reliable estimate of the extent to which inland aquatic ecosystems are protected.

The 2003 UNEP-WCMC study also conducted an assessment of how evenly distributed protection was in different regions and different ecosystems. In 1975, IUCN developed a biogeographic structure for assessing protected areas coverage at the global level (the "Udvardy System"), dividing the world into eight realms, each of which is subdivided into a number of biogeographic provinces. Each province is characterized by one of 14 major biome types.[146] UNEP-WCMC estimated protected area coverage for the 14 Udvardy terrestrial biomes and determined that nine of the 14 biomes have now met or exceeded the target of 10% set by the 3rd IUCN World Parks Congress in 1982 and widely adopted as an international goal in subsequent years. Biomes falling below the 10% target include temperate grasslands and lake systems, as well as temperate needleleaf forests and temperate broadleaf forests. The study cautioned, however, that:

> It is important to realize, however, that biomes provide only a crude measure of "potential" natural vegetation or habitat at a coarse level. They do not reflect the vast areas of land now altered by human activities, and they do not provide sufficiently detailed resolution to pick of fine-scale variation in habitat.

The UNEP-WCMC study therefore carried out a second assessment using new global-level land-cover maps that provide a more detailed analysis of actual habitats protected. This analysis showed similar, perhaps slightly higher levels of protection for the same biomes and habitats reviewed in the first analysis (see Table 2.1).

The UNEP-WCMC study indicates considerable variation in the extent of protected areas coverage in different regions of the world. The Pacific region is the least protected, and levels of protection are also low in North Africa, the Middle East, South Asia and East Asia. Central and South America, by contrast, show high levels of protection, at least on paper. North America also shows a high level of protection, but this is skewed by the presence of the world's largest protected area, the Northeast Greenland National Park.

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145 Revenga and Kura 2003.

146 Udvardy 1975; McNeely, Harrison and Dingwall 1994.

Table 2.1 Major habitat types, their global coverage and the areas protected (in all sites including IUCN categories I–VI and unassigned)

Habitat type	Total habitat area (km^2)	Protected area (km^2)	Percentage protected
Temperate and boreal needleleaf forest	11,425,000	1,514,000	13.3
Temperate broadleaf and mixed forest	10,180,000	1,240,000	12.2
Tropical moist forest	10,392,000	2,471,000	23.8
Tropical dry forest	2,716,000	339,000	14.7
Savannah	15,368,000	1,878,000	12.2
Shrubland	5,611,000	692,000	12.3
Grassland	14,284,000	1,478,000	10.3
Wetlands (inland)	3,429,000	434,000	12.7
Desert	45,474,000	4,589,000	10.1
Caspian Sea	375,000	4,000	1.1
Marine	361,800,000	1,637,000	0.5
Artificial – terrestrial	24,421,000	1,880,000	7.7
Artificial – aquatic	3,167,000	170,000	5.4

For this analysis the global land-cover characterization (GLCC) was used. This classification is based primarily on unsupervised 1 km AVHRR (advanced very high resolution radiometer) 10-day NDVI (normalized difference vegetation index) composites. The source imagery dates from the early 1990s, and there have also been some problems with the classification.

Source: Mulongoy and Chape 2004.

While global achievement of the IUCN 10% target – and achievement of that target for many terrestrial biomes – is certainly a noteworthy step, the origin and purpose of the "10% target" has often been misunderstood. When first proposed by IUCN in the early 1980s, protected areas covered only 3–4% of the Earth's land surface, and the call for "10%" was, in fact, a relatively bold political call to triple the extent of the world's protected areas, a call that was successful in a relatively short time period. 10% is certainly much better than 3%, but it is now well understood that an across-the-board target of 10%, whether globally or by biome, will not add up to an adequately comprehensive global network of protected areas. Protection of only 10% of earth's ecosystems could make at least half of all terrestrial species vulnerable to anthropogenic extinction in the near future, based on the species-area relation, under which a 50% loss of species is assumed to occur after a 90% lost of habitat area.[147] Similar concerns have been raised about across-the-board targets proposed for establishment of "no-take" marine protected areas.[148]

2.2.2 Threats to protected areas

While a significant portion of the earth's land area and some marine habitats are formally under some form of protection, the ecological viability of many protected areas is under threat, and some have already been significantly degraded. In many parts of the world,

147 Soulé and Sanjayan 1998.

148 Agardy *et al*. 2003.

however, protected areas are so little studied or monitored that it is virtually impossible to get a detailed picture of the level and types of threat. A 1999 survey of threats to forest protected areas by IUCN concluded that "considerably less than 10% of protected areas has been subject to any kind of analysis of threat, and far less have been subject to detailed assessment."[149]

What information there is paints an ominous picture. The IUCN survey, conducted in 10 key forest countries,[150] found threat levels to be high, and identified two key issues:

Management: Less than 25% of forest protected areas were considered to be well managed with a good infrastructure, and 17 to 69% of forest protected areas in these countries had no management at all.

Security: Only 1% of forest protected areas were regarded as secure in the long term. A further 1% had been so badly degraded that they had lost the values for which protection was given. Some 22% were suffering various levels of degradation and 60% were currently safe but faced possible future threats.

Another review of threats to tropical rainforest protected areas concluded that in the tropical forest realm, "protected nature reserves are in a state of crisis. A number of tropical parks have already been degraded almost beyond redemption; others face severe threats of many kinds with little capacity to resist. The final bulwark erected to shield tropical nature from extinction is collapsing."[151]

Even less is known about the threats to marine protected areas. A recent survey of 342 marine protected areas (MPAs) in Southeast Asia (the center of global marine biodiversity) concluded that only 14% were effectively managed. The same study also concluded that "human activities now threaten an estimated 88% of Southeast Asia's coral reefs … For 50% of these reefs, the level of threat is 'high' or 'very high.'"[152]

Threats to protected areas are not confined to developing countries or to the tropics. Loss of old-growth forest in Europe and North America, for example, has been near complete in most areas except the boreal north, and remaining forest fragments within protected areas are under threat from air pollution, acid rain, overuse of national parks, and other threats.

Threats to protected areas can be divided into *direct threats* which directly stress the biological components of the protected area, *indirect threats* which drive the direct threats, and *underlying causes* which comprise broad socio-economic forces often far from the site. Encroachment by small farmers, for example, may pose a direct threat to a protected area. This encroachment may be driven, however, by an indirect cause – the rapid privatization and concentration of agricultural land in adjacent areas. The underlying cause for this situation, in turn, may be subsidies or other changes in government policy aimed at boosting export agriculture to help pay off international debts. The IUCN World Commission on Protected Areas (WCPA) report *National System Planning for Protected Areas* notes that

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149 IUCN 1999.

150 The IUCN survey covered Brazil, China, Gabon, Indonesia, Mexico, Papua New Guinea, Peru, Russia, Tanzania and Vietnam.

151 Van Schaik *et al*. 1997.

152 Burke *et al*. 2002.

"The major threats to conservation in most countries lie outside the protected area system. Unless the linkages between protected areas management and external factors are identified and addressed, fundamental conservation issues are difficult to resolve."[153]

Direct threats to protected areas can be classified into four main categories:

- Individual elements removed from the protected area without alteration to the overall structure (e.g. plant, animal or marine species);
- Overall impoverishment of the ecology of the protected area (e.g. through encroachment, grazing, air pollution damage, persistent poaching and illegal logging);
- Major conversion and degradation (e.g. through removal of vegetative cover, construction of roads and settlements, or mining);
- Isolation (e.g. through major conversion of adjacent lands).[154]

Indirect threats to protected areas vary from place to place, but often include:

- Inappropriate land allocation and land use decisions;
- Unclear legal status of lands and waters and resulting conflicts and "open access" situations;
- Weak and inconsistent enforcement of laws and regulations;
- Subsidies and other policies that create excess capacity for natural resource-based industries and thereby boost demand for raw materials such as timber;
- Rural poverty and landlessness;
- Revenue needs of central or local governments.

The ***underlying causes*** of the threats to protected areas are difficult to separate from the underlying causes of biodiversity loss generally. These were defined by the 1992 *Global Biodiversity Strategy* as:

- The unsustainably high rate of human population growth and natural resource consumption;
- The steadily narrowing spectrum of traded products from agriculture, forestry and fisheries;
- Economic systems and policies that fail to value the environment and its resources;
- Inequity in the ownership, management and flow of benefits from both the use and conservation of biological resources;
- Deficiencies in knowledge and its application;
- Legal and institutional systems that promote unsustainable exploitation.[155]

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153 Davey 1998.
154 Carey *et al*. 2000.
155 WRI *et al.* 1992.

Threats to protected areas, at all these levels of scale and analysis, rarely come singly. Any given protected area likely faces a whole range of threats. The previously quoted study of rainforest protected areas found, for example, that most protected areas faced an average of at least three direct threats.[156]

The effects of climate change – which is both a direct and an indirect threat – compound more conventional threats, and also interact synergistically with them. As discussed in Chapter 1 and a number of recent studies, the impacts of climate change on biodiversity are already observable in some cases, and are likely to grow more pervasive and extreme over the coming century.[157] Impacts of climate change on biodiversity vary from place to place, but may include the following:

- Total disappearance of habitat, as in the case of coral reefs, mangroves and salt-marshes inundated by sea-level rise;
- Serious and often irreversible changes to ecosystems, such as large-scale bleaching of coral reefs in the tropics caused by rising sea surface temperatures, the loss of sea ice in Arctic regions, reduction of clouds in tropical montane cloud forests, and loss of glaciers and ice-fields;
- Catastrophic temporary changes to ecosystems, such as increased frequency and intensity of droughts in wetlands and other ecosystems;
- Distributional changes in species towards the poles and higher altitudes;
- Individual changes to species and local food webs, as rapid temperature changes affect season length.[158]

Climate change is also likely to exacerbate the impact of invasive alien species on both natural and modified ecosystems for a number of reasons. First, global warming is likely to have a "winnowing effect" on ecosystems, favoring more adaptive and aggressive invasive alien species in their existing ranges, and allowing them to move more rapidly into new areas.[159] Second, as climate changes, patterns of production and trade will change, with more crops adapted to tropical conditions being grown at higher latitudes and altitudes. Third, climatically-induced stress on plants can reduce their ability to resist invaders. Finally, the greatest impacts may arise from changes in the frequency and intensity of extreme climatic events that disturb ecosystems, thus providing exceptional opportunities for dispersal and growth of invasive species.[160]

The impacts of climate change on biodiversity pose specific problems for protected areas, arising most dramatically from expected species distributional shifts:

- Habitats and ecosystems that protected areas were established to conserve may

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156 Van Schaik *et al*. 1997. The direct threats considered in this study included agricultural encroachment, hunting/fishing, logging/fuelwood collection, grazing of livestock, mining, fires, road-building and hydropower development.

157 Thomas *et al*. 2004; Buddemeier *et al*. 2004; Root *et al*. 2003; Hannah and Lovejoy 2003; Green *et al*. 2003; Malcom *et al*. 2002; IPCC 2002.

158 Dudley 2003.

159 Hansen *et al*. 2003.

160 McNeely *et al*. 2001.

disappear or be radically altered or degraded;

- As species' ranges shift, protected areas that are currently rich may lose richness, and others may gain, especially in the uplands;
- Range shifts will make connectivity between protected areas more important;
- Rare and threatened species or species with restricted ranges may become increasingly rare, even in areas where overall diversity is increasing;
- Invasive species may spread more rapidly, threatening native biodiversity;
- Active management interventions (such as fire control or controlled burning, assisted regeneration, introductions, translocations, etc.) will become more necessary elements of management.

2.3 What should protected areas protect? The science and politics of global conservation priority setting

2.3.1 The evolution of conservation targets

Historically, protected areas have been established on an *ad hoc* basis to conserve sites of particular scenic beauty, or to protect the habitats of high-profile species such as tigers and pandas. Over time, the targets of conservation activity have evolved, and notions of protected areas planning have changed accordingly.

Redford *et al*.[161] trace the history of conservation targets ("objects of conservation activity"), noting that conservation in the Western world began with a focus on species, first to protect useful species from over-harvesting and later to conserve species as objects worth protecting for their own intrinsic value. Later, ecosystems (such as tropical rainforests and coral reefs) became a conservation target, based on recognition of both the importance of ecosystem conservation for protecting species and the value of ecosystem services such as water and soil stability. The concept of "wilderness" as a priority conservation target, an idea which arose primarily in the USA about a century ago, has also had a strong influence on protected areas thinking.[162]

Over the past few decades, "biodiversity" has been identified and widely adopted as a conservation target, most prominently through the forum provided by the Convention on Biological Diversity (CBD), which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems."

The growing focus on a more comprehensive approach to conservation that incorporates diverse biodiversity targets has been accompanied by greater emphasis on an

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[161] Redford *et al*. 2003.

[162] The 1964 U.S. Wilderness Act defines wilderness as a place "where man himself is a visitor and does not remain." Current scientific findings suggest that there are actually very few places where this is the case, although the intensity of human occupation obviously varies greatly across the globe. See Sarkar 1999.

"ecosystem approach."[163] The ecosystem approach – which is a central principle of the CBD – expands the focus of conservation to broader landscapes (and seascapes) within which protected areas are one component, and includes a stronger focus on the human element in conservation:

> The landscape approach often includes a philosophical approach that sees human activities as integral to, not separate from, the environment. This philosophy is exemplified in bioregional approaches to conservation that treat human beings as necessary components within biocultural landscapes.[164]

The landscape approach (discussed in detail below) also stresses the importance of incorporating "connectivity" into conservation efforts, including the use of "corridors" and other habitat configurations that link protected areas to each other.[165]

2.3.2 The emerging global consensus on priority conservation targets

What then, should be the conservation objectives of protected area systems? Two recent and quite similar answers to this question at the global level are provided by the 2003 IUCN Vth World Parks Congress and the CBD process.

World Parks Congress Recommendation 5.04, "Building Comprehensive and Effective Protected Area Systems", urges governments (and others) to afford protection to:

- All globally threatened species on the IUCN Red List, with particular attention to species listed as Critically Endangered and Endangered, and highest priority given to Critically Endangered and Endangered Species globally confined to a single site;
- Sites that support internationally important populations of congregatory and/or restricted-range species;
- Viable representations of every terrestrial, freshwater and marine ecosystem;
- All large intact ecosystems that hold globally significant assemblages of species and/or provide ecosystem services and processes.

The CBD (Article 8) obliges contracting Parties, "as far as possible and appropriate", to:

- Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;
- Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity.
- To carry out these obligations, CBD Annex I provides an indicative list of general conservation targets, which include:

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163 Smith and Maltby 2003.

164 Redford *et al*. 2003.

165 Boyd 2004; Bennett 2003.

1. Ecosystems and habitats:

- containing high diversity, large numbers of endemic or threatened species, or wilderness;
- required by migratory species;
- of social, economic, cultural or scientific importance; or
- which are representative, unique or associated with key evolutionary or other biological processes.

***2. Species and communities* which are:**

- threatened;
- wild relatives of domesticated or cultivated species;
- of medicinal, agricultural or other economic value; or of social, scientific or cultural importance; or
- important for research into the conservation and sustainable use of biological diversity, such as indicator species.

***3. Described genomes and genes* of social, scientific or economic importance**

In Decision VII/28 (February 2004), the CBD Conference of the Parties (COP) reaffirmed that Annex I "should guide the selection of protected areas and areas where special measures need to be taken to conserve biological diversity." The COP decision goes on to recommend that in carrying out national analyses of gaps in protected area systems, Parties should take the Annex I criteria into account as well as "other relevant criteria such as irreplaceability of target biodiversity components, minimum effective size and viability requirements, species migration requirements, integrity, ecological processes and ecosystem services." The Decision also calls on countries, as a matter of urgency, by 2006, to "take action to establish or expand protected areas in any large, intact or relatively unfragmented or highly irreplaceable natural areas, or areas under high threat, as well as areas securing the most threatened species … and taking into consideration the conservation needs of migratory species."

Comparison of these two approaches shows a high degree of overlap between the consensus of the international scientific community and the consensus of the nearly 200 governments that are Parties to the CBD. The major difference between the two approaches is that the Parks Congress approach does not cover the genetic diversity or social and cultural importance criteria specified by CBD Annex I (although social and cultural issues are stressed in other Parks Congress outputs). It is therefore possible to sketch out an outline of what is broadly agreed at the international level about what protected areas systems should conserve, as presented in Box 2.2.

Box 2.2 Conservation objectives for protected area systems

The emerging international consensus

The outcomes of the Vth IUCN World Parks Congress (2003) and the 7th Meeting of the Conference of the Parties to the Convention on Biological Diversity (2004), taken together, provide the most authoritative international consensus available on the general conservation objectives that protected areas systems should serve. These objectives break down into three categories: species-related objectives; habitat or ecosystem-related objectives; and objectives related to the conservation of ecosystem goods and services useful for human well-being.

Species-related conservation objectives:

- Threatened species on the IUCN Red List, with particular attention to species listed as Critically Endangered and Endangered;
- Endemic species, with highest priority given to Critically Endangered and Endangered Species globally confined to a single site;
- Globally significant assemblages of congregatory species;
- Species important for the continued development of conservation science and management (e.g. indicator species);
- Wild relatives of domesticated or cultivated species.

Habitat/ecosystem-related conservation objectives:

- Viable representations of every terrestrial, freshwater and marine ecosystem;
- Irreplaceable habitats and ecosystems (i.e. a habitat or ecosystem with unique characteristics such that no other area that could be conserved in its place and still conserve those characteristics);
- Large, intact or relatively unfragmented natural areas;
- Natural ecosystems under high levels of threat;
- Habitats required for the maintenance of viable populations of migratory species.

Conservation objectives related to values of biodiversity for humanity:

- Ecosystem services, such as hydrological function, shoreline and soil protection, and provision of reproductive habitat for economically useful species (e.g. fish);
- Economically useful species, genes and genomes (e.g. for food, fiber, medicine and scientific research);
- Sites and species of particular socio-cultural value (e.g. sacred sites, charismatic species).

This widely-agreed list of conservation objectives provides a common basis from which countries can work to develop their own protected area systems, although not every objective is equally relevant or important for every country. At the same time, this list provides a "global checklist" of key globally-agreed priorities, against which the coverage of national systems, in the aggregate, can be compared to ensure that important global priorities do not fall through the cracks of national protected area systems development.

Sources: Recommendation 5.04, Vth IUCN World Parks Congress; The Convention on Biological Diversity (Annex I); Convention on Biological Diversity Decision VII/28.

2.3.3 Methods for setting geographic conservation priorities at the global level

While this emerging consensus provides an important general starting point for making decisions about *what* should be conserved by protected areas, it does not yield concrete geographic priorities for *where*, specifically, resources available for conservation should be invested, at either international or national levels. Governments, donors, and conservation organizations recognize that financial resources (and political support) for establishing and managing protected areas are limited, and priorities therefore need to be set in a systematic, scientifically valid and transparent manner. To that end, numerous priority-setting methods have been proposed and implemented over the past decade or so – one recent study documented fully 21 approaches being utilized by 13 conservation organizations.[166]

As the Global Environment Facility (GEF) points out, however, "a consensus does not exist among conservation experts regarding the priorities and approaches in preserving biodiversity."[167] This is in part due to differences of scientific methods and interpretation, but is also a result of the fact that reasonable people can disagree about which elements of biodiversity deserve the most urgent attention. For some, preventing extinctions of vulnerable species is most important. Others may be willing to trade some species extinctions in exchange for conservation of a widely representative selection of the earth's distinctive natural ecosystems. Others still may be most concerned with preserving those species, communities and ecological processes of most direct economic utility to human society. Finally, a number of international agreements include their own criteria for officially listing priority sites for conservation, thereby investing them with increased visibility and attention (see Box 2.3).

All methods for selecting priority conservation sites, however, need to take two sets of considerations into account. First, ecological considerations – such as species richness and endemism – are widely promoted as a means to design a conceptual system of protected areas. This is essential, because a "system" designed in the absence of clear scientific goals and systematic scientific methods to achieve those goals is not a system at all, but rather an *ad hoc* assemblage of protected areas – i.e. the currently reality for most parts of the planet.

Second, and equally important, this conceptual priority map needs to be filtered through a set of human considerations, including threats, opportunities, available resources, and the relative balance of costs and benefits. Without factoring in these human dimensions, even the most elegant conceptual map of ecologically-set priorities will remain a piece of paper.

Spatial parameters for setting global conservation priorities

Setting geographic priorities for conservation requires a system for dividing up the Earth into discrete spatial units possessing distinct biological and ecological

166 Redford *et al*. 2003.
167 GEF 2004.

Box 2.3 Geographic conservation priorities under international treaties and programmes

Several international environmental agreements or programmes specify particular sites for priority international conservation action. Sites thus designated often receive increased attention from national governments and donor agencies.

The ***Ramsar Convention on Wetlands***, for example, has established criteria for identifying wetlands of international importance. Under this system, priority wetlands include those that are a "representative, rare or unique example of a natural or near-natural wetland type," or which have particular significance for the conservation of endangered species, threatened ecological communities, important populations of plants and animals, or protect species at critical stages in their life cycles. In addition, there are specific criteria based on wetlands' importance for waterbirds and fish. Currently, 1267 wetland sites in the Convention's 136 Contracting Parties, totaling 107.5 million ha, have been designated for inclusion in the Ramsar List of Wetlands of International Importance.[168]

The ***World Heritage Convention*****,** adopted in 1972, aims to engage all nations in protecting those sites that are the most important examples of the world's natural and cultural diversity. State Parties to the Convention are required to identify and delineate areas of cultural and natural heritage within their territory. To this end, "natural heritage" is defined as:

- Natural features consisting of physical and biological formations … which are of outstanding universal value from the aesthetic or scientific point of view;
- Geological and physiographical formations … which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science, or conservation; and/or
- Natural sites or … natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

Specific criteria are enumerated for inclusion of a site in the Convention's Natural World Heritage List, including such factors as significant natural habitats for *in situ* conservation of biodiversity, outstanding examples of significant ecological and biological processes, sufficient size, and sufficient integrity in terms of containing all or most of the key interrelated and interdependent elements in their natural relationships. To date 175 States have ratified the Convention, and its 167 natural and mixed (natural and cultural) sites – which include well over 200 protected areas – are distributed amongst 76 countries.[169]

UNESCO's ***Man and the Biosphere Programme*****,** established in 1970, has initiated a global network of protected areas known as "Biosphere Reserves." From the outset, the goal was to identify a global system of designated areas consisting of representative ecosystems providing the broadest possible biogeographical coverage. They are also intended to operate beyond the boundaries and objectives of strict protection, and to incorporate the participation and needs of local communities through sustainable use. Sites are nominated by national committees, and should normally: be representative of a major biogeographic region; contain landscapes, ecosystems, species or varieties that need to be conserved; provide opportunities to demonstrate approaches to sustainable development within the larger regions where they are located; be of an appropriate size; and have an appropriate zoning system, with a legally constituted core area (or areas) devoted to long-term protection, a clearly identified buffer zone (or zones), and an outer transition area. Currently there are more than 400 sites in the network, with approximately 20 sites added annually.[170]

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168 www.ramsar.org.

169 Spalding 2002.

170 Bridgewater 2002.

characteristics. Methods for mapping the planet's vegetation have been developed since the early 1970s, building on previous regional efforts in Europe during the first part of the 20th Century.[171] Dasmann (1974) and Udvardy (1975) were the first to carry out a global representation analysis for the purpose of terrestrial conservation. Both systems situated nearly 200 biotic provinces or units within a framework of seven biogeographic realms and 13 terrestrial biomes and one freshwater biome.[172] Jepson and Whittaker (2002) argue that the resulting Dasmann–Udvardy system has proved useful for many conservation planning efforts, and give the example of Indonesia:

> The Dasmann–Udvardy system has the merit of a transparent and repeatable methodology … The delineation of biogeographic provinces and units is open to review as distributional data sets on fauna groups other than birds and mammals are completed, or after changes in taxonomy. Furthermore, the method provides for finer-scale sub-divisions. The seven Dasmann–Udvardy biogeographic provinces of Indonesia accord with the main geographic, cultural and economic developmental regions of Indonesia, and they have been adopted widely as a framework for understanding biological variation … They are taught in schools … and they provide the planning units for several strategies and overviews … In short, biogeographic provinces have attained a social reality in Indonesia.

In the 1990s, however, scientists affiliated with the World Wildlife Fund-US, found that "the relative coarseness of Dasmann's and Udvardy's biotic provinces … limits their utility as regional conservation planning tools as many distinctive biotas may remain unrecognized."[173] They therefore developed a finer-scale analysis, resulting in a digital map of 867 terrestrial, 53 freshwater and 43 marine "ecoregions", classified within biomes and realms, to be used for priority-setting analyses.

An ecoregion is defined as:

> a relatively large area of land or water containing a characteristic set of natural communities that share a large majority of their species, ecological dynamics, and environmental conditions. They function effectively as coarse-scale conservation units because they encompass similar biological communities, and their extent roughly coincides with the area over which key ecological processes interact most strongly.[174]

While WWF has used the ecoregional framework to establish global conservation priorities (discussed below), the biogeographical mapping function of the framework is distinct from the way WWF has used it for priority-setting. This is an important distinction, because a number of organizations have adopted the ecoregional framework as a spatial framework for analysis, but have not necessarily adopted the priority-setting methodology that WWF has used the ecoregional framework to implement. Conservation International, for example, uses ecoregions as its unit of analysis for mapping and setting conservation priorities for the world's remaining major wilderness areas,[175] and

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171 Vreugdenhil *et al*. 2003.

172 Olson and Dinerstein 2002.

173 Olson and Dinerstein 2002.

174 Olson and Dinerstein 2002.

175 Mittermeier *et al*. 2003.

has made considerable efforts to ensure that the boundaries of the biodiversity "hotspots" it has identified correspond directly to those of the WWF ecoregional system.[176] The Global Environment Facility (GEF) is using ecoregions as the unit of analysis in its biodiversity programme, but sets the relative priority of each ecoregion based on a range of factors much broader than those proposed by WWF.[177] While some conservationists question the utility of introducing ecoregional classification in places where older systems are well established and have worked reasonably well as conservation planning tools,[178] ecoregions appear to be emerging as the dominant spatial unit of analysis for conservation priority setting and planning.[179]

Biodiversity hotspots

Perhaps the most widely-known method for setting geographic conservation priorities at the global level is the "hotspot" approach,[180] which has become "the reigning scientific paradigm among conservationists … [and] has grown so popular in recent years within the larger conservation community that it now risks eclipsing all other approaches."[181] The hotspots approach is based on the assumption that while the biodiversity of every nation and community is important locally and should be protected, conservation efforts at the local scale in some places "have planetary consequences that transcend local and regional scales and thus justify priority allocation of scarce financial resources."

Preventing species extinctions is the primary focus of this approach, which therefore tries to answer the question "in which areas would a given conservation dollar contribute the most towards slowing the current rate of extinction of global biodiversity?"[182] To answer this question, hotspots are identified according to two characteristics:

Endemism is used as a measure of irreplaceability – a species endemic to one area cannot be conserved in any other area, and the area is therefore irreplaceable on a global scale – and the number of endemic plant species is used as a measure for overall endemism.

Threat is used as a measure of vulnerability, and the extent of habitat destruction is used as a measure of threat, based on the well-documented relationship between the size of an area of habitat and the number of species it retains.

To qualify as a hotspot, a regional has to meet two strict criteria based on these indicators. First, it has to contain at least 1,500 species of vascular plants (>0.5 of the world's total) as endemics, and it has to have lost at least 70% of its original vegetation. The global hotspot analysis has been updated and revised several times since Myers first proposed it in 1988,[183] most recently in 2004. The most recent analysis resulted in the following findings:

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176 Conservation International 2004.

177 GEF 2004.

178 Jepson and Whittaker 2002.

179 Wikramanayake *et al*. 2002.

180 Myers 1988; Myers 1990; Mittermeier *et al*. 1998; Myers *et al*. 2000; Conservation International 2004.

181 Kareiva and Marvier 2003a.

182 Conservation International 2004.

183 Myers 1988.

- The 34 hotspots meeting the requisite endemism and threat criteria once covered 15.7% of the Earth's land surface, but have collectively lost 86% of their original habitat, which now covers a mere 2.3% of the planet's land surface, an area about the size of Argentina;
- Hotspot distribution is greatly skewed towards tropical forests (65%), while six hold primarily temperate forest (18%), five Mediterranean-type ecosystems (15%) and one (3%) is desert;
- Among them, the hotspots hold some 150,000 plant species as single-hotspot endemics – 50% of the world's total;
- 36% of all terrestrial vertebrates are endemic to a single one of the 34 hotspots, and 42% of all terrestrial vertebrates are endemic to the 34 hotspots combined;
- 77% of all known terrestrial vertebrates (mammals, birds, reptiles and amphibians) occur in these 34 hotspots;
- 28% of the world's freshwater fishes are endemic to individual hotspots, and 55% occur in the hotspots;
- Preliminary research on the distribution of phylogenetic diversity (the length of time of independent evolution of a given species) – an important representation of evolutionary potential, ecological diversity and options for future human use – indicates that the hotspots hold particularly large numbers of endemic genera and families, even relative to their high levels of species endemism.[184]
- While much less is known about spatial distribution of marine species, a global analysis published in 2002 identified 10 coral reef hotspots which cover only 15.8% of the world's coral reefs, but include approximately half of restricted-range reef species.[185]

Despite its intuitive appeal to "conservation efficiency" – and the undeniable fact that extinction of the endemic species harbored in these areas would absolutely foreclose attaining the internationally-agreed target of "substantially reducing the rate of biodiversity loss by 2010" – over-reliance on the hotspots approach has been criticized on a number of counts. Kareiva and Marvier (2003a) point out the following:

- Use of endemic plants as a surrogate for species richness is a sensible approach given that available data tend to be more complete for plants than for animals, and the fact that plant endemism does correlate well with others measures of species richness at vary large spatial scales (e.g. tropical versus temperate). But hotspots for different taxa do not coincide well with one another at the finer spatial scales at which most conservation decisions are made.[186] By utilizing only plants, it is likely that hotspots miss rare species and major animal groups.
- The degree of threat to an area is difficult to quantify, since there are many types of threats and various ways to evaluate them. The hotspot approach uses

184 Sechrest *et al*. 2002.
185 Roberts *et al*. 2002.
186 See also: Reid 1998.

destruction of primary vegetation as its threat indicator, but this "is more a statement about land use in the past than a direct indication of future threat."

- The hotspot approach assumes that the exclusive – or at least dominant – goal of conservation is to protect the largest possible number of species in the smallest area. But the hotspot approach is not necessarily appropriate if one's conservation goals are, for example, "maintaining functioning ecosystems throughout the world, providing the greatest variety of distinct plant and animal lineages for future evolutionary breakthroughs, preserving spectacular wild landscapes that inspire the human spirit or protecting nature in a way that provides for the well-being of people living alongside." (See Box 2.4 for an example.)
- The hotspot approach does not take ecosystem services such as clean air, fresh water, and fertile soil into account. A typical *Spartina* wetland, for example, has no endemic plants and only 20–30 species in total. Such tidal marshes, however, provide services such as flood regulation, waste treatment and fisheries production, with an estimated annual value of US$10,000 per ha.

In the end, though, Kareiva and Marvier (2003b) do not call for abandoning the hotspot approach, but rather argue that "in setting conservation priorities we should consider hotspots – but we need to consider many other factors as well … If one's goal is to forestall the loss of critical ecosystem functions, then it is more important to save some proportion of the species in many different ecosystems, as opposed to focusing solely upon the ecosystems with the longest species lists."

High biodiversity wilderness areas

In fact, Conservation International does not advocate an exclusive focus on hotspots. While arguing that hotspots should receive the highest priority, Conservation International calls for "a dual conservation strategy that always prioritizes endemic-rich areas and ensures that we protect the most threatened places with species that we will otherwise lose [i.e. the hotspots approach], while preemptively protecting equally unique places that are not yet under extreme threat."[187] To that end, they propose five "high biodiversity wilderness areas" for priority global conservation attention.

"Wilderness" overlaps with, but differs considerably from, biodiversity as a conservation objective. When one is concerned with biodiversity,

> targets can vary widely, ranging from deserts and forests to farms and horticultural gardens (e.g. if these two "unnatural" systems contain unique species) … Except perhaps for a few species, such as large, wide-ranging predators, there is no *a priori* reason to suppose that conservation of biodiversity requires wilderness, such as national parks that exclude humans … Wilderness preservation cannot be used as a surrogate for biodiversity conservation.[188]

[187] Conservation International 2004.

[188] Sarkar 1999.

Box 2.4 Ecuador versus Montana: implications of the hotspots priority-setting methodology

In their critique of the use of hotspots to set global conservation priorities, Kareiva and Marvier (2003a) offer the following hypothetical situation: Ecuador and the US state of Montana are roughly the same size. Ecuador is a key biodiversity hotspot, with 2,466 vertebrate species and 19,362 vascular plant species. Montana, in contrast, is a "biodiversity coldspot", with only 12% of Ecuador's species richness. The hotspots approach would suggest ignoring Montana and prioritizing conservation in Ecuador. But consider the following:

Assume that our goal is to ensure protection of a total of 20,000 species from these two regions. This could be done by preserving 18,000 in Ecuador and 2,000 in Montana or, alternatively, 19,000 in Ecuador and 1,000 in Montana. If our only goal is total number of species protected, either combination will serve our goal equally well. In reality, these two choices would have vastly different consequences on the ground.

Either choice would leave Ecuador with the bulk of its biodiversity intact (82% or 87% of vertebrates and vascular plants in this hypothetical), and the difference between the two would be difficult to detect, even through rigorous scientific monitoring. But shifting to the second strategy would cut the fraction of species protected in Montana from 74 to 37%, a severe cut that would be immediately noticeable to even a casual observer, and would likely have significant impacts on whole ecological communities. The Yellowstone ecosystem, for example – part of which lies in Montana – is relatively species-poor, but contains the last assemblage of large mammals and carnivores in the lower 48 US states.

> This example illuminates a major flaw with approaches to conservation that are solely based on hotspots. If we measure success simply by tallying up total species protected, we risk the folly of allowing major ecosystems to degrade beyond repair simply because they do not provide lengthy species lists … The hotspot approach would result in high levels of protection for a few species-rich areas to the neglect of many others. Thus, setting conservation priorities using only hotspots as a guide could well bring on an unfortunate side effect: more degradation of global ecosystems than would take place if a more broadly based strategy were used.

Mittermeier *et al*. (2003b) respond to this criticism by proposing another hypothetical, applying this argument to poverty:

> Montana has 100,000 people in poverty, Ecuador has seven million. The local priority of both is to reduce their number of poor people to zero, but the global priority would never treat a 50% reduction in each (50,000 in Montana, 3.5 million in Ecuador) equally. Clearly, priority lies overwhelmingly with Ecuador – as it does for conservation.

Conservation of wilderness areas, however, also serves distinct and important purposes:

> The ecosystem services they provide have enormous value, for example, through hydrological control, nitrogen fixation, pollination, and carbon sequestration, in addition to providing destinations for ecotourism and adventure tourism. The wilderness areas serve as valuable controls against which to measure the health of the planet. The coincidence between areas of biological and cultural diversity, at least in Africa, also means that the high-biodiversity wilderness areas provide the last strongholds for many of the world's languages. Finally, there are strong aesthetic, moral and spiritual values of wilderness, permeating all cultures and religions, and providing a firm imperative for its conservation.[189]

Using the WWF-US ecoregions framework, Mittermeier *et al*. (2003a) set out to identify the planet's remaining major wilderness areas. Criteria included a minimum size of 10,000 km^2, human population densities outside of urban areas of <5 people per km^2, and retention of at least 70% of its historical habitat extent (500 years ago). These criteria yielded 24 areas with a total historical habitat extent of 76 million km^2 – 52% of the Earth's land area – of which 65 million km^2 remains, covering 44% of the planet. The total human population of these areas is 204 million (3% of the global total), reduced to 83 million (1.4%) when urban areas are excluded.

About 55,000 vascular plant species (18% of the global total) and 2,800 terrestrial vertebrate species (10%) are endemic to these wilderness areas. These percentages are lower than would be expected if endemic were equally distributed across ecoregions in proportion to land area. Furthermore, the vast majority are concentrated in only five "high biodiversity wilderness areas" – Amazonia, the Congo forests of Central Africa, New Guinea, the Miombo-Mopane woodlands of Southern Africa (including the Okavango Delta), and the North American desert of northern Mexico and the south-western USA. The intact parts of these five areas total 8,981,000 km^2 (76% of their original extent) – 6.1% of Earth's land area.

While these areas, between them, harbor more than 51,000 endemic vascular plant species (17% of the global total) and 2,300 endemic terrestrial vertebrates (8% of the global total), "the concentration of biodiversity pales in comparison to the 25 biodiversity hotspots,[190] which hold nearly three times as many endemics in an area on-fourth as large." This finding reinforces the point made by Sarkar (1999), above, that biodiversity and wilderness conservation targets are quite different. And while Mittermeier *et al*. (2003a) argue that "the unfortunate coincidence among biodiversity, threat and human populations means that most conservation should remain concentrated … in the hotspots of biodiversity … ", they also argue that the relatively low cost of conservation in wilderness areas (they estimate US$10 billion for the five areas), and the many ecosystem services and other values they hold for humanity justify a priority focus on these five high biodiversity wilderness areas.

"The Global 200": WWF's ecoregional conservation priorities

The development and widespread utilization of the WWF ecoregional classification system has already been discussed. WWF has gone on, however, to use the ecoregional framework to derive global conservation priorities in a manner quite different than the hotspot and high biodiversity wilderness approaches:

> Tropical rain forests rightfully receive much conservation attention as they may contain half of the world's species. A comprehensive strategy for conserving global biodiversity, however, must strive to save the other 50% of species and the distinctive ecosystems that support them. For example, while they may not support the rich communities seen in tropical rain forests or coral reefs, tropical dry forests, tundra, polar seas, and mangroves all harbor unique species, communities,

189 Mittermeier *et al*. 2003a.

190 At the time this study was published (2003), the expanded Hotspots analysis (Conservation International 2004) which increased the number of hotspots to 34 had not yet been completed.

> adaptations, and phenomena. Some of these biomes, such as tropical dry forests and Mediterranean-climate shrublands, are more threatened than are tropical rain forests and require immediate conservation action. To lose examples of these assemblages would represent an enormous loss of global biodiversity.[191]

Out of the 867 ecoregions identified across the globe, WWF's analysis asked "which regions should be a priority for conservation action (e.g. designating and strengthening protected areas) because of their outstanding biodiversity features or their representation value." To answer that question, WWF used the following criteria:

- Species richness and endemism, with *a priori* selection of widely recognized global and regional centers of richness and endemism;
- Higher taxonomic uniqueness;
- Unique ecological or evolutionary phenomena (e.g. extensive intact habitats, large vertebrate assemblages, long-distance migrations);
- Global rarity (i.e. ecoregions whose biome or major habitat type was represented in fewer than eight distinct regions around the world);
- Intactness (i.e. for ecoregions in the same biome assessed at a similar level of biological importance, the more intact ones were selected);
- Representation (i.e. ecoregions that were the best example of their biome within a realm in situations where no other ecoregion had been selected due to its outstanding biodiversity).

Application of these criteria yielded a set of 238 ecoregions – the Global 200 – comprised of 142 terrestrial, 53 freshwater, and 43 marine priority ecoregions. WWF argues that the Global 200 goes beyond the conservation targets of other prominent global priority-setting efforts by explicitly incorporating representation guidelines for biomes within realms.

Because the Global 200 encompass a very large area and utilize criteria common to other priority-setting methodologies, there is considerable overlap between the 238 Global 200 ecoregions and the priorities identified by other methodologies. More than 90% of the biodiversity hotspots are nested within the Global 200, which also accommodate the majority of Endemic Bird Areas identified by BirdLife International,[192] and extensively overlap with the high Biodiversity Wilderness Areas, discussed above, and the world's remaining "frontier forests" mapped by the World Resources Institute.[193]

While the congruence of all these priority-setting methods is a welcome sign that conservationists are collectively on the right track, the Global 200 cover a vast area of the Earth's surface. It can steer priorities in the right direction but it only sets the context for actual decisions about where new protected areas should be sited, and which existing protected areas deserve increased support. Like the hotspots and high biodiversity wilderness approaches, however, it does not provide very definitive guidance for

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191 Olson and Dinerstein 2002.

192 Stattersfield *et al*. 1998.

193 Bryant *et al*. 1997.

conservation planners working to establish protected area sites and systems at the national level.

In this regard, two aspects of the Global 200 selection process are noteworthy, particularly when one thinks about applying the results at national levels. First, habitat loss and human disturbance were generally not taken into account. Rather, the selection emphasizes biodiversity features that were in place prior to major human impacts on natural habitats and species populations. For on-the-ground conservation priority-setting, however, the level of anthropogenic threat and the relative intactness of an area are central concerns.

Second, the analysis "purposefully did not use ecological function [i.e. ecosystem services], conservation feasibility [i.e. political, social, economic, cultural factors], or human utility as discriminators to identify the Global 200 as these features are either difficult to measure or are highly fluid."[194] These factors may be fluid and hard to measure from a global perspective, but they are the very factors that drive conservation decisions and determine conservation costs on the ground in most places.

The Global Gap Analysis

At the 2003 World Parks Congress, a team of scientists led by Conservation International presented the most comprehensive analysis of gaps in the world's protected area system to date.[195] This Global Gap Analysis (GGA) was initiated in order to respond to the view of many scientists that the current global distribution of protected areas coverage did not take into account "one of the most fundamental laws of ecology, that biodiversity is not evenly distributed over the surface of our planet. This simply means that some regions require much more protected area coverage than others to ensure that their full range of life forms is represented." That being the case, the GGA asked, which elements of biodiversity are already included within protected areas, and which elements – the gaps – are not?

To begin answering this question, the GGA was able to utilize four new datasets compiled by large networks of specialists working under the IUCN umbrella. Essentially, the GGA overlaid three species distribution maps onto maps of protected areas derived from the World Database on Protected Areas (WDPA). These included draft distribution maps for all mammal and amphibian species compiled by the IUCN Species Survival Commission (IUCN/SSC) Global Mammal and Amphibian Assessments, and maps of the distribution of all threatened bird species, compiled by BirdLife International. (Distribution data for all bird species are not yet available.) In all, distributions of 11,633 terrestrial vertebrates were analyzed.

The GGA was a two-stage process. The first stage – identifying the gaps – provides an overview of the coverage of analyzed species by protected areas. The second stage – filling the gaps – gave recommendations for establishment of priority new protected areas.

Two scenarios were utilized to identify gaps. Under Scenario A, a species was considered to be covered if any protected area overlaps its range. This scenario,

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194 Olson and Dinerstein 2002.

195 Rodrigues *et al*. 2003.

however, is dependent on two "unrealistic" assumptions: first, that all protected areas are equally adequate for the protection of each species; and second, that species can be equally well protected in any part of their range, and by the protection of only a fraction of that range. Scenario B therefore utilized more demanding criteria for considering a species covered, by excluding from consideration all protected areas <100 ha (46,825 records), and all "point" records with no associated area data (10,995 records).

These exclusions, by themselves, only increased the number of gap species over Scenario A by 7%. A more serious issue arises from the cases where a species' range thought to be present in a protected area is either actually absent or only marginally covered. Scenario B therefore established a representation target for each species – the percentage of a species' extent of occurrence that must overlap protected areas in order for the species to be considered covered – and allowed for partial gaps where only a portion of a species' representation target was met. More demanding targets were also set for species with more restricted ranges.

Overall, Scenario A identified 1,310 gap species (12% of all species analyzed). Scenario B identified 1,652 gap species (15% of all species analyzed), and identified only 2,613 species (23% of all species analyzed) that fully met their representation targets. The general conclusion of the first part of the GGA, therefore, is that global terrestrial protected areas coverage is far from complete, even with respect to representation of the best known of all species.

The second part of the GGA – filling the gaps – recommends priorities for both strengthened conservation action at existing protected areas and establishment of new protected areas. These priorities were established based on analysis of levels of irreplaceability – regions for which there are few options for replacement elsewhere – and threat – regions for which there are few opportunities for conservation in the future unless urgent action is taken. GGA priority sites, therefore, are those where options for replacement are unavailable either spatially or temporally, and thus require urgent conservation action to prevent the loss of unique biodiversity values. This analysis was carried out for both protected and unprotected sites, for each of the higher taxa assessed.

Details of the priority sites thus identified can be found in Rodrigues *et al*. (2003). The sites shared the following common characteristics:

- *Size of protected sites*: Although the range of protected sites is wide (from 1 km^2 to 439,104 km^2), urgent sites tend to be much larger than the typical protected area for each global biological realm.
- *Geographic location*: Most urgent sites lie in the tropics: 77% of the area and 82% of the number of urgent protected sites, and 80% of the area and 87% of the number of urgent unprotected sites. By comparison, the fraction of Earth's land area in the tropics is only 39%, while most current protected areas are outside the tropics (53% of area and 74% of sites).
- *Insularity*: Islands constitute only 5.2% of the Earth's land area, but hold a disproportionately large share of terrestrial vertebrate diversity, and are also areas of high endemism. Current protected areas in islands constitute 6.5% of the total and 7.6% of currently protected areas highlighted as urgent by the GGA. 27.6% of urgent unprotected sites, however, are in islands, underscoring their conservation importance.

- *Topography*: Many of the sites identified as urgent are in mountainous areas, particularly regions of tropical montane forest, where complex topography promotes high speciation rates, resulting in high levels of endemism and irreplaceability.

Adding all of the additional urgent unprotected sites identified by the GGA would increase the size of the global protected area network from 10.8% to 13.4% of the Earth's land surface, but these extra 2.6% would reduce the number of absolute gaps (species with current 0% coverage) by more than two-thirds, and would raise the percentage of species meeting the GGA representation targets from 9% to 55%. The GGA stresses, however, that even this expansion would not be sufficient to fill the representation gap for all of the species analyzed. "That is, these sites need to be seen as *priorities* for expansion of a global network … but cannot be interpreted as all that it takes to finish the job (a prioritization, not triage)." The GGA also cautions that its analysis was carried out at a coarse scale requiring further refinement:

> [T]he data available at a global scale are still coarse, and assessments such as this global gap analysis merely provide the first cut towards a global framework, from which detailed regional and local analyses form the key. Hence, this assessment cannot replace on the ground efforts facilitated by expert knowledge … [A]reas highlighted as urgent should be priorities for finer-scale assessments, to investigate the feasibility and viability of consolidating/ expanding the global protected area network while effectively protected the species in each site that trigger their high values of irreplaceability and threat.

The urgent priorities recommended by the GGA overlap considerably with those arising from the priority-setting exercises previously discussed. 77% of urgent protected sites lie within hotspots, which is not surprising, since both the GGA and hotspots analysis are based on the same premise – that priority should be given to sites of high irreplaceability (endemism) and high threat. Nearly all of the urgent protected and unprotected sites are included in the Global 200, although the reverse pattern is not found. Given that threatened bird species was one taxonomic group analyzed by the GGA, a high degree of overlap with Endemic Bird Areas is also not surprising.[196]

From a national perspective, the GGA provides a valuable first cut at identifying priority conservation targets for both protected and unprotected areas – based on irreplaceability and threat criteria. Finer-grained analysis is of course needed, as noted above, and national priorities may be based on additional criteria – such as the provision of ecosystem services or habitat representation – but the GGA provides protected areas planners with a clear and methodologically transparent starting point for identifying priorities at the national level in many countries.

2.3.4 The politics of global conservation priority setting

Despite differences in overarching goals and methods, conservation biology has clearly come a long way in providing a better scientific basis for making choices about where conservation action is most needed and would have the greatest impact. But do these

[196] Stattersfield *et al*. 1998.

global priority-setting schemes actually affect protected areas decisions on the ground? Ultimately, priorities for establishing and investing in protected areas are set at the national level, where the views of both scientists and protected area managers are often trumped by the priorities of more influential government agencies and powerful business interests in sectors such as agriculture, forestry, fisheries, mining and energy. As a result, the growth of knowledge about biodiversity and how best to conserve it has run in parallel with accelerating biodiversity destruction.

Some commentators therefore question whether the growth of conservation biology as a scientific discipline – and, in particular, the plethora of global priority-setting methodologies it has spawned – is really making a significant contribution to combating biodiversity loss. Lamenting the rapid decline of Indonesia's forests over the same three decades that conservation biology has grown into an established and active scientific discipline, Whitten *et al*. (2001) ask what the point of it all?

> Is [conservation biology] merely another scientific discipline, safely nestled within the confines of academia? Or is it a mission concerned with conservation in the context of judicial reform, political economy, other peoples' spatial planning, community participation, poverty alleviation, human and institutional capacity, consumption, population growth, and agricultural production? … Perhaps conservation biology is merely a displacement activity for concerned biologists within the academic system. Deep inside they would really love to attack the alpha male of conglomerate-led forest destruction, but a lack of access to funds, and the political and social complexities of conservation management, means they huddle together, metaphorically scratching their backsides and snorting.

This may be partially true, but it is also the case that some conservation biologists – specifically those working for the major international conservation NGOs – also "huddle together" with the funding agencies that finance much of the conservation activity in developing countries. Global priority-setting systems championed by these organizations thereby significantly influence the allocation of international protected areas funding, as well as internal NGO decisions about where they will work and invest their own considerable technical and financial resources.

The Critical Ecosystem Partnership Fund (CEPF), for example – a US$125 million consortium including Conservation International, the Global Environment Facility (GEF), the Government of Japan, the MacArthur Foundation and the World Bank – was established in 2000 with an explicit mission to support conservation efforts in 19 biodiversity "hotspots" in developing countries, as identified through Conservation International's hotspot methodology.[197] The Chicago-based MacArthur Foundation, which gave over 1000 biodiversity conservation grants totalling US$207 million between 1987 and 1999, uses the hotspots methodology to guide its biodiversity grant-making decisions.[198]

Overall, the financial and political clout of the large international conservation NGOs has grown considerably over the past decade. A study carried out for the Ford Foundation (Khare and Bray 2004) concluded that:

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[197] Arensberg 2003.

[198] MacArthur Foundation website: www.macfdn.org/programs/gss/csd/about_csd/history.htm.

> At a time when there is a discernible decline in the finances available for conservation, the large NGOs have emerged as the most powerful financial players. They have not only obtained a greater share of the declining conservation resources but also spectacularly increased their investment in the conservation field in absolute terms.
>
> As a group, these NGOs are now the biggest investors in conservation, almost twice as big as the Global Environmental Facility of the World Bank. By forging strategic alliances with donors, they also control and channel a substantial portion of funds going to local and national NGOs. The sheer size of their finances and spread of their activities establish them as key players and their policies, programs and methods of working are likely to influence and shape the conservation field in the coming decade.

One important example of this growing power is the influence that the Conservation International Hotspots and WWF Ecoregions priority-setting methodologies have over the priorities of the Global Environment Facility (GEF), which has provided over US$1.5 billion in biodiversity grant funding to developing countries since 1991. At its mid-2004 governing Council meeting, the GEF Secretariat proposed a draft methodology to the Council for measuring countries' potential to deliver global biodiversity benefits (as well as the degree to which they meet various "global standards" with respect to good governance, macro-economic management, and other factors.)

The biodiversity-related aspect of this methodology essentially proposes combining the WWF ecoregions/Global 200 approach with the Conservation International Hotspots approach, broken down into five weighted variables, to derive an aggregate score for each country eligible for GEF funding. This score would then form an important part of an *ex ante* performance-based allocation system by which GEF biodiversity funds would be allocated.[199] This issue is quite contentious within the GEF Council, and will likely not be resolved for some time. What is interesting, from a political perspective, is that the priority-setting conservation science upon which the biodiversity elements of this proposed GEF allocation methodology is based has been almost wholly generated by international conservation NGOs.

The growing dominance of conservation NGOs over the applied aspects of conservation science is a relatively recent trend. Rather than serving as "consumers" of science produced by academic institutions and government research agencies, conservation NGOs are increasingly employing their own scientists and publishing their results in the peer-reviewed scientific literature. Some argue that this is a healthy trend, strengthening linkages between research and practice, and improving the professionalism of NGOs' conservation work. "Arguably, today much of the new and exciting research is being generated by NGOs, not only strengthening conservation science but also improving the soundness of their own operations."[200] Others are more skeptical, questioning the objectivity of a scientific agenda set by largely unaccountable (except to the donors – whom they are advising) international organizations with specific agendas and interests of their own.

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[199] GEF 2004.

[200] Fonseca 2003.

2.4 Protected area priority setting and system planning at the national level

The conservation priority-setting methods discussed in the previous section provide useful information upon which to base coarse-grained conservation decisions at the global and, in some cases, regional levels. But they generally cannot, by themselves, guide the establishment of national-level protected area systems, or assist in the selection of sites to be included within such systems. What parts of a "hotspot", "high biodiversity wilderness area", or "ecoregion" should be selected as new areas for protection? What about countries whose territories may not qualify as globally significant under any of these methods, but which still wish to establish protected area systems to conserve nationally-significant species, habitats, and ecosystem services?

Furthermore, while these methods have been developed largely to respond to the challenge of biodiversity loss, they do not respond systematically to the other global change factors highlighted in Chapter 1. How should national protected area planners and managers respond to climate change and other biophysical change factors? How should they deal with the range of socio-economic pressures that have increased by an order of magnitude in just a few generations, and continue to accelerate?

Considerable progress has been made recently in developing systematic conservation planning methods, animated largely by the need to respond to biodiversity loss, and extensive practical guidance is available. IUCN's World Commission on Protected Areas has published widely-used guidelines for national system planning,[201] and has delineated the key elements of such a system (see Box 2.5).

This section summarizes the "state of the art" in systematic conservation planning, and reviews what is known about how to incorporate consideration of a number of biophysical global change factors into that process. Subsequent chapters deal with how to incorporate the socio-economic and institutional global change factors, although they are also touched on here.

2.4.1 Slowing biodiversity loss: The promise of systematic conservation planning

As stressed in Chapter 1, rapid biodiversity loss is one of the most destructive biophysical global changes affecting out planet. The good news is that conservation science and management have taken up this challenge, providing increasingly sophisticated and powerful tools to counter it.

The previous section revealed that we are developing a far better global sense of where biodiversity is being lost, and where the highest priorities for its conservation lie, despite data gaps and some disagreement about ultimate goals and indicators for measuring progress. Progress has also been made in developing tools for finer-scale systematic planning of protected area systems, based on explicit and quantifiable biodiversity conservation criteria. Margules and Pressey (2000) – and much

[201] Davey 1998.

Box 2.5 WCPA guidelines on essential elements of a national system plan for protected areas

- Clear statement of objectives, rationale, categories, definitions, and future directions for protected areas in the country;
- Assessment of conservation status, condition and management viability of the various units;
- Review of how well the system samples the biodiversity and other natural and associated cultural heritage of the country;
- Procedures for selecting and designing additional protected areas so that the system as a whole has better characteristics;
- Identification of the ways in which activities undertaken at national, regional and local levels interact to fulfill national and regional objectives for a system of protected areas;
- A clear basis for integration and coordination of protected areas with other aspects of national planning (e.g. with national biodiversity strategies, but also with land use, economic and social planning);
- Assessment of the existing institutional framework for protected areas (relationships, linkages and responsibilities) and identification of priorities for capacity building;
- Priorities for further evolution of the protected areas system;
- Procedures for deciding the management category most appropriate to each existing and proposed unit;
- Identification of investment needs and priorities;
- Identification of training and human resource development needs for protected areas management;
- Guidelines for preparation and implementation of management policies and site-level management plans.

Source: Davey 1998.

complementary work by them and others – provide one of the clearest articulations of the process of systematic conservation planning, one which has been utilized by numerous conservation organizations including Conservation International,[202] IUCN[203] and The Nature Conservancy.[204]

Systematic conservation planning, in this formulation:

- Requires clear choices about the features to be used as surrogates for overall biodiversity in the planning process;
- Is based on explicit goals, preferably translated into quantitative, operational targets;

[202] Rodrigues *et al*. 2003.
[203] Davey 1998.
[204] Groves *et al*. 2002; Groves *et al*. 2000.

- Recognizes the extent to which conservation goals have been met in existing reserves;
- Uses simple, explicit methods for locating and designing new reserves to complement existing ones;
- Applies explicit criteria for implementing conservation on the ground, especially with respect to phasing actions when (usually) not all candidate areas can be secured at once;
- Adopts explicit objectives and mechanisms for maintaining conditions in reserves required to foster the persistence of key natural features, monitoring, and adaptive management.

Drawing on Margules and Pressey (2000) and the detailed handbook on systematic ecoregional conservation planning developed by The Nature Conservancy,[205] the process of designing a comprehensive national (or sub-national) protected area system for the purpose of conserving biodiversity can be divided into six stages.

***1. Getting started*:** At the outset, planners need to establish a core planning team, determine how decisions will be made, and create a realistic budget and timeline. Financial, human and data resources need to be assessed. In addition, planners will want to determine what goals in addition to a protected areas plan they would like the process to accomplish. The planning process may, for example, be an opportunity to fill data gaps, develop partnerships, or catalyze funding for implementation.

Planners also need to systematically assess the range of relevant stakeholders and partners, and review the likely role of key socio-economic issues such as land tenure patterns, decentralization of government powers, the location of key resources such as timber or minerals, present and likely future infrastructure development (e.g. roads) and demographic factors. The planning process in a unitary state where most existing and potential protected areas are uncontested public land, for example, will be significantly different from that in a country with a decentralized governance structure and large areas of potential conservation area under private or indigenous tenure. Similarly, the location of significant timber or mineral reserves will significantly affect the feasibility of establishing strict reserves in those areas.

2. Choosing conservation indicators (surrogates): Since biodiversity is too complex and unknown to directly measure and map, conservation planners must establish a set of biodiversity surrogates to serve as their conservation targets. Surrogates may be species, communities or habitats, or environmental features related to vegetative cover and geographic features (see Box 2.6). The choice of surrogates will vary based on the availability of various types of data and the geographic scale of the planning exercise. The choice may also be influenced by the overall conservation goals that have been set, as discussed below, and some goals may not be related primarily to biodiversity conservation *per se*.

***3. Establishing conservation goals*:** The overall goals of systematic biodiversity conservation planning are (a) *representativeness* – the need for reserves to sample the full variety of biodiversity, ideally at all levels of organization – and (b)

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[205] Groves *et al*. 2002.

Box 2.6 Measuring and mapping biodiversity: what are the best indicators?

We cannot directly measure biodiversity. Because biodiversity is so complex and our knowledge of it is so incomplete, efforts to assess the nature and distribution of biodiversity within a particular territory are reliant upon the selection of particular sub-sets of species, species assemblages, or environmental features that can stand in as surrogates for biodiversity as a whole. In short, we need to use partial measures of biodiversity – surrogates – to represent biodiversity as a whole, so we can compare different areas and make decisions about where to prioritize conservation interventions.

Ideally, conservation efforts would protect both patterns of biodiversity (e.g. species diversity) and ecological and evolutionary processes. Methods for measuring and mapping ecological and evolutionary processes, however, are in their infancy. Conservation planners have therefore focused on developing and using surrogates for biodiversity pattern. Realistically, there are three approaches to doing this.

Species are the usual unit with which diversity has been measured, despite the fact that species distribution data are largely limited to vascular plants and vertebrates, and are prone to sampling bias. Working from the available universe of species data, researchers have therefore focused on "focal taxa" (those for which we have good information, such as vascular plants and birds), and on "target taxa" – species that can be demonstrated to be better than average indicators of wider biodiversity. Unfortunately, as Margules *et al*. (2002) point out, "there is no compelling evidence that sub-sets of taxa can represent biological diversity as a whole, even if the practicalities of conservation planning require their use."

Assemblages – classifications of co-occurring species including community, association, or habitat type – have also been used as a biodiversity surrogate. Although these classifications are poorly defined, assemblages have the advantage of representing alternative combinations of species and the interactions between them, and therefore can represent greater ecological complexity than individual species, including associated smaller, less known, but very diverse groups such as insects, fungi, and bacteria. On the other hand, it is very difficult to determine whether a particular area, chosen to protect an assemblage, is in fact an adequate representation of the whole.

Environmental information can also be used as a surrogate for biodiversity. Fine-resolution maps of abiotic information (e.g. temperature, geology, relief) and of habitats and vegetation classes are now widely available in standardized, comparable formats. Different kinds of environments are assumed to represent different set of species, and species distribution patterns can therefore be linked to variations in environment. A network of protected areas representing the range of environmental classes within a territory is therefore likely to encompass both known and unknown species. The drawback of this approach, as with assemblages, is that we don't know what percentage of an environment constitutes a representative sample.

Given that each of these approaches has strengths and weaknesses, and that resources for acquiring new data are limited, even for these three surrogates, Margules *et al*. (2002) argue that a combination of these three approaches is the most practical approach. Brooks *et al*. (2004), do not wholly disagree, but stress that since species are the fundamental unit of biodiversity, the species-based approach must remain the central approach, complemented by broader-scale surrogates: "[F]or both fundamental and practical purposes, investment should be made in improving the quality and availability of species data. There are two avenues for doing so: improving primary data on species directly and making the best use of additional biotic and abiotic information improve the quality of existing species data."

Sources: Margules *et al*. 2002; Brooks *et al*. 2004.

persistence – the long-term survival of species and other elements of biodiversity by maintaining natural processes and viable populations over the long term and by excluding threats.[206] Planners, however, have to translate these goals into quantifiable, operational targets.

Specifically, planners need to determine how much or how many of each element of biodiversity (i.e. surrogate) needs to be conserved, and how should conservation units to do so be distributed across a region or country. Special goals may also need to be set for wide-ranging, migratory and endemic species. This is a difficult process, since there is no scientific consensus on how many populations of a species are needed, or how large these populations should be to conserve a target species, and similar uncertainties apply to the conservation of species assemblages and environment/habitat types.

Because of this uncertainty, as well as the need to keep options open for alternative solutions, planners may wish to consider setting a number of numeric targets. In the Cape Floristic region of South Africa, for example, planners set three goals – 10, 25 and 50% of the original extent of each vegetation type within the planning area – and then examined alternative protected area options corresponding to these different goals.[207]

***4. Assessing existing protected areas*:** Once conservation goals and targets are established, it is essential to determine the extent to which they being met within existing reserves. This initially requires a seemingly straightforward overlay of protected areas and areas identified as necessary for achievement of those goals and targets. The US Geological Service National Gap Analysis Program (GAP) provides perhaps the most advanced example of this process, which was carried out in four steps:

- Create a map of land use/land cover that maps vegetation at the level of natural assemblages of plant species;
- Map predicted distributions of vertebrate species, extrapolated from known records;
- Classify the study area according to type of land tenure, stewardship and management status;
- Analyze the representation of vertebrate species and vegetation assemblages in areas managed for conservation.[208]

This was essentially the process used by the Global Gap Analysis, discussed in the previous section.

It is crucial in this process to not only assess the presence of target elements of biodiversity within protected areas, but to also assess the likelihood of their viability and persistence over time. Protected areas in many parts of the world lack effective protection on the ground and are being progressively degraded. It is therefore important to assess the extent to which conservation targets are actually being met within existing reserves (see Chapter 5). In some cases, target species may be vulnerable to extinction without conservation action (such as endemic species occurring in a single site). "Because features that are under-reserved according to representation targets vary in

[206] Margules and Pressey 2000.
[207] Groves *et al*. 2002.
[208] Jennings 2000.

their exposure and vulnerability to threatening processes, some gaps are more important than others."[209] In addition:

> Although most planners would agree that large size, connectivity and integrity are generally desirable, many species and vegetation types now exist only in remnants of habitat that are altered and surrounded by intensive land uses. The criteria for assessing gaps in coverage will be different in fragmented landscapes than in landscapes in which large contiguous tracts of habitat remain.[210]

***5. Selecting additional protected areas*:** Once the extent to which existing protected areas include planners' target biodiversity features, gaps become apparent. The next step, therefore, is to systematically select additional areas for protection. This is done most effectively using an *algorithm*. An algorithm is a step-by-step problem solving procedure, usually a computational process defined by rules. Because of the complexity of the task, there are considerable advantages to using computerized algorithms in combination with GIS. The primary advantage of this method is that it allows planners "to delineate explicit 'rules' to identify a set of conservation areas and to assess alternative portfolios of conservation areas by making changes in these rules."[211]

All such algorithms use *complementarity*, "a measure of the extent to which an area, or set of areas, contributes unrepresented features to an existing area or set of areas … Most simply, it can be thought of as the number of unrepresented species (or other biodiversity features) that a new area adds."[212] Species richness does not necessarily yield a high complementarity value, since an area might contribute a small number of species and habitat types, but they may nonetheless be poorly represented in current protected areas. Another important aspect of complementarity is its dynamic nature, as it recognizes that the targets within an unselected area may be partially or completely fulfilled by previous selection of another area. Complementarity thus needs to be recalculated for all unselected areas each time a new area is added to the proposed protected areas system.[213]

Margules and Pressey (2000) note a number of "constraint rules" that generally need to be factored into site selection algorithms:

- *Irreplaceability*: In some cases, alternative areas may be available to meet a particular conservation target, but in others, areas will have no replacements, such as those that hold one or more endemic species confined to that single site.
- *Costs*: The selection of an area for protection generally constrains commercial (and possibly subsistence) use, thereby incurring opportunity costs. Land acquisition and other start-up costs for potential reserves will also vary from place to place. If a conservation target can be met equally well in two or more potential reserves, the least-cost option should therefore be favored.

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209 Margules and Pressey 2000.

210 Margules and Pressey 2000.

211 Groves *et al*. 2002.

212 Margules and Pressey 2000.

213 Margules and Pressey 2000. Also see Justus and Sarkar 2002.

- *Commitments*: Some areas will need to be selected regardless of the relative contribution to conservation targets. Existing reserves are the most obvious example, although degazettement of existing reserves – because they have been degraded or can be "traded off" for more valuable areas – is sometimes a possibility. Other examples might include areas containing rare and threatened species or areas of high endemism.
- *Masks*: Some areas, such as very small blocks of habitat or intensively-farmed tracts may be excluded from consideration altogether, at least at the outset of the site selection exercise.
- *Preferences*: Some areas may be preferred over others for certain characteristics, such as low human population density or previous identification by experts as high-priority areas.

If the selection of potential new conservation areas is to be more than an academic exercise, it is essential that the full range of current and potential conservation managers – as well as stakeholders who will be substantially affected – be involved in the application of algorithms used to do so. The Nature Conservancy, for example, has carried out this process for more than 45 ecoregional and regional conservation plans in the USA, Latin America, the Caribbean, Micronesia and China, and concluded that "managers and conservation practitioners who do not understand the algorithms or why a particular place has been identified for conservation will be less supportive … than they otherwise might be."[214]

***6. Setting priorities for action on the ground*:** Assembling a theoretical portfolio of conservation areas is a very different exercise than implementing it on the ground, for at least two reasons. First, some selected areas may prove, on closer inspection, to be either too degraded or too difficult or expensive to protect, necessitating a return to the previous stage of analysis to revise the portfolio. Second, such planning exercises typically identify far more sites than can be immediately conserved with available resources, so priorities must be set: which sites should receive the highest priority for immediate action, and which ones can wait? What balance should be struck between strengthening and expanding existing areas versus establishing new ones?

Groves *et al*. (2000) recommend use of a combination of five priority-setting criteria to make these decisions:

- *Degree of protection*: To what extent, and how effectively, are target biodiversity features represented and conserved within existing areas? Higher priority should be given areas with features that are not already represented.
- *Conservation value*: Higher priority should be given to areas that contain more target biodiversity features, more diversity among those features, and a higher chance that they will persist over the long term.
- *Threat*: The greater the threats to an area, the higher priority it should receive.

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[214] Groves *et al*. 2002.

- *Feasibility*: This criterion measures available organizational capacity – in terms of staff, funding and other resources – to actually secure protection of an area.
- *Leverage*: This refers to the extent to which taking conservation action in one area will positively affect conservation action in adjacent or other areas.

A complementary approach to setting site priorities in protected area system design at the ecoregional or national level is provided by the "Key Biodiversity Areas" (KBA) concept.[215] The KBA approach essentially extends the Important Bird Area (IBA) methodology, which was developed by BirdLife International in the early 1980s and since been used to produce IBA directories for 48 countries and regional inventories for Europe, the Middle East. The KBA approach essentially extends the IBA methodology to multiple taxa, to provide finer-scale (site-level) priority-setting nested within the broader priority-setting approaches discussed in the previous section.

The KBA approach uses four criteria for setting priorities which stress irreplaceability and vulnerability:

- *Globally threatened species*: Sites in which a global threatened species (as defined in the IUCN Red List) regularly occurs in significant numbers;
- *Restricted-range species*: Sites in which one or more species with restricted range regularly occur in significant numbers. Stattersfield *et al*. (1998) defined this range for terrestrial bird species as those with a historical breeding extent of 50,000 km^2 or less, which incorporates some 25% of all birds. Eken *et al*. (2004) note that an agreed definition of a "restricted range species" does not exist for other taxa, but propose the same 50,000 km^2 limit as "a sufficiently robust prototype threshold" for all taxa, based on analysis of the IUCN-SSC-led Global Mammal and Amphibian Assessments.[216]
- *Congregatory species*: Sites in which 1% or more of the global population of a congregatory species occurs on a regular basis. These may include breeding colonies, non-breeding sites used for foraging and roosting, and "bottleneck sites" where significant numbers of species pass through over a concentrated period of time.
- *Biome-restricted assemblages*: Sites that hold a significant component of the group of species whose distributions are restricted to a biome or a sub-division of it. This criterion is based on the fact that assemblages of species endemic to individual environmental domains represent an additional component of irreplaceable biodiversity. Eken *et al*. (2004) propose inclusion of any site with >25% of the species restricted to a given environmental domain, utilizing the WWF ecoregional approach[217] for classification.

KBA proponents note that while these criteria need to be set and agreed internationally to ensure consistency, "the process itself must be led at a local or national level to ensure use of the best available data and ownership of the resulting priorities."[218] Indeed,

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215 Eken *et al*. 2004.

216 Personal communication with Güven Eken, July 2004.

217 Olson *et al*. 2001.

218 Eken *et al*. 2004.

all of these systematic methods for setting priorities and designing protected area systems are only relevant to the extent that they can contribute to bottom-up design and management on the ground. As Margules and Pressey (2000) note:

> There is a world of difference between the selection process … and making things happen on the ground. Implementation is usually complicated by the variety of people, agencies and commercial interests in the region and by the time needed to apply conservation management to particular areas … [As a result] … the eventual system of reserves can be very different from the one designed …

Site planning and establishment requires a more finely-focused and detailed process of ecological and socio-economic assessment than does system planning. In developing a system plan, planners are merely identifying, across a country or ecoregion, the sites of highest conservation value. Once those areas are identified, plans must be developed for each of them and their legal status needs to be established or clarified. In many cases, key sites will already have been established as protected areas, and the task in such cases is to assess their current condition, boundaries and management status in order to determine whether changes are needed to better serve the objectives of the overall system plan. Determination of governance arrangements and processes for stakeholder participation (discussed in detail in Chapter 3) become extremely important in this process, since the design and legal designation of a particular site can have significant impacts on local people's livelihoods and access to resources.

Most countries already have methodologies for protected area site planning written into relevant legislation and regulations. New site planning methodologies may have many logical advantages and may be built on a foundation of the latest conservation science, but they need to integrate – not supplant – existing ways of doing things, if their proponents are to gain the support of protected areas policymakers and planners. Experiences with use of The Nature Conservancy's site planning methodology in Madagascar and Latin America are instructive in this regard.

The Nature Conservancy (TNC) has developed a comprehensive framework and methodology for site conservation planning, called *The Five-S Framework for Site Conservation,*[219] which is now being applied in many countries in collaboration with government and non-governmental partners. Based on TNC's own site planning experience over decades as well as the work of many other organizations, the Framework has strongly influenced the development of other organizations' site-planning methods, including Parks Canada and WWF. General steps in the method include identifying the key targets for conservation at a site, analyzing threats, evaluating capacity, devising management strategies, and establishing systems for monitoring the effectiveness of site management over time.

The *Five-S Framework* has been widely and effectively used in the USA. But it can be a complex process, requiring considerable technical and financial resources that many developing countries may not possess. Madagascar has successfully adapted and used this methodology (see Box 2.7), but receptivity has been more variable in Latin America. While it has been enthusiastically adopted in some countries, resistance to its adoption has arisen in others. The main reason for this resistance is that most countries in

[219] TNC 2000.

Box 2.7 Protected area site planning: Adapting an international methodology for national objectives in Madagascar

In 2000, Madagascar's protected area service (PNM) carried out an assessment of its national protected area systems plan, using the WCPA system planning guidelines as a model. The national system, it was determined, conformed closely to the WCPA guidelines, and PNM then moved on to adopting a framework for site planning and management. After reviewing available frameworks, PNM decided to model its approach on The Nature Conservancy's *Five-S Framework*, which it viewed as the most exhaustive, science-based, field-tested system available.

While the Framework was at first "highly complex and difficult to grasp" for many participants in the process, it was successfully adapted and used to develop management plans and monitoring systems for the country's protected areas. One key change was modification of the framework's terminology to conform to existing national terms, making the whole system easier to understand and apply. Another important change was the addition of a category for ecological functions (i.e. ecosystem services such as hydrological function) as a conservation target. Overall, the exercise not only developed site management plans, but assisted PNM in identifying capacity-building needs for implementing the plans.

Source: Nicoll 2002.

the region already have guidelines for preparation of protected area management plans written into their legislation. It is thus natural that resistance would arise to the promotion of a "new" methodology that is seen as a competitor to established ways of doing things, even if the old methods may no longer be congruent with current conservation science and evolving national conservation goals.[220] It is also important to remember that national governments – unlike conservation organizations – have to balance many competing priorities – such as poverty alleviation and the promotion of agriculture and industry – against biodiversity conservation objectives.

Another framework for site planning has been developed by BirdLife International, and applied in a number of African countries in collaboration with the Global Environment Facility (GEF). Key elements of this framework include: establishing the time frame; determining the institutional focal point, its mandate and expertise; analyzing tenurial and legal status issues; analyzing key threats and developing responses; developing a monitoring system; promotion of the site plan; assessment of available data and data gaps concerning biological and socio-economic information; assessment of financial resources; and integration of the site into wider conservation networks and frameworks.[221] The BirdLife International framework also includes a useful set of lessons learned, which are equally applicable to all site planning exercises (see Box 2.8).

In summary, many useful tools and methods are already available to assist in the development of national or regional protected area systems and sites. Almost uniformly, however, their overriding objective is biodiversity conservation with a strong emphasis on species conservation and the prevention of extinctions. These approaches thus

220 TNC nd.

221 BirdLife International 2001.

Box 2.8 Lessons learned in the development of Important Bird Area site action plans

- **Adequate time** should be allocated to planning. This is important to ensure that the planning process is done fairly and adequately in order to address all pertinent issues.
- **Stakeholder participation and mobilization** are essential at all times. Involvement of stakeholders ensures that the process, plans developed and implementation are "owned" by the stakeholders. Undertaking stakeholder analysis is essential.
- **Understanding the socio-economic context** is essential in order to sufficiently integrate socio-economic concerns into the plans. Issues of livelihood are important and they must be integrated in the plan if they are to succeed.
- **Baseline information and data** (ecological, socio-economic, history, management regimes and practices, indigenous knowledge and traditional management systems, geophysical, etc.) must be collected. Site plans must be based on good information.
- **Resources** (funds, logistics, and manpower) for undertaking site plans should be identified or earmarked prior to implementation. This helps avoid frustration that will arise if the plan is not implemented due lack of funds.
- **Close linkages between site plans and wider conservation strategies** are essential so as to keep the plan relevant to priority conservation needs and approaches. Failure to achieve this often leads to plans that are not supported or simply not popular.
- **Use of local expertise** is important for sustainability and relevance. Local expertise should include both indigenous and scientific experts.
- **Land and natural resource tenure (ownership, access and control)** are important when determining which conservation options to pursue.
- **Awareness** is an important tool for bringing stakeholders on board and broadening political support for conservation of the site.

Source: BirdLife International 2001.

address one biophysical global change factor – biodiversity loss – that is obviously central to the mission of protected areas. They do not, however, sufficiently integrate consideration of other biophysical global change factors. The remainder of this chapter therefore considers what is known and what can be done to bring these other factors into the process of building comprehensive protected area systems.

2.4.2 Building climate change adaptation into protected area systems

As previously discussed, climate change is already having impacts on many habitats and ecosystems, and these impacts are projected to intensify in coming decades. Climate change therefore has enormous implications for protected areas. Given uncertainties about the intensity of climate change and the specific nature of its impacts on different species and habitats, we need to manage adaptively and proactively, continuously monitoring progress to adjust management, and, in some cases, taking a more active hand in shaping ecological processes.

Box 2.9 Planning protected areas for climate change in South Africa

The Botanical Institute of South Africa has conducted one of the only efforts to explicitly incorporate climate change-induced range migration shifts into systematic protected area selection, using data for 363 species of the family *Proteaceae* (proteas), as well as several hundred other species of plants, birds, herpetofauna, and invertebrates. The database models present and future (doubled CO_2) ranges for these species using models that incorporate local soil conditions and land use. Using WORLDMAP, a software program, Midgeley *et al*. (2002) defined minimum-area sets needed to be added to existing protected areas in the Cape Floristic Province to represent all present and future modeled ranges of the proteas.

This analysis revealed six primary relationships between reserves and a species:

- Present and future ranges were both represented in the same existing reserve;
- Present and/or future ranges were both represented in existing reserves; but the preferred location, representing both present and future ranges in a *single* reserve, was unprotected. A new reserve is therefore preferred;
- Either present or future range (but not both) was protected in an existing reserve. A new reserve and connectivity are therefore required;
- Present and future ranges were represented in existing reserves (but not together in a single reserve). Connectivity is therefore required;
- Present and future ranges were represented in existing reserves, but the preferred location minimizing distance of connectivity was unprotected A new reserve is therefore preferred and connectivity required;
- Neither present nor future range was protected. New reserves and connectivity are therefore both required.

This analysis demonstrates the importance of locations where species could persist despite climate change, i.e. existing or potential reserves containing both the present and future ranges of a species. It also underscores the importance of upland conservation in response to climate change. Where reserves are sufficiently large and topographically varied, existing reserves are able to absorb most required range adjustments. Where upland sites are poorly represented in the existing protected area system, however, more extensive addition of new sites may be required.

Sources: Hannah and Salm 2003; Midgley *et al*. 2002.

Hannah and Salm (2003) point out that "the effects of climate change on biodiversity cannot be systematically incorporated into the [protected area] selection process unless the biodiversity itself is treated systematically." Thus, adoption of systematic conservation planning, as discussed in the previous section, is in fact the first step necessary for integrating climate change impacts into protected area system design.

Climate change considerations need to be integrated into each step in the system and site planning process. When "getting started", for example, planners need to incorporate techniques to determine and map likely movement of habitats and species ranges over time, under different climate change scenarios. This means that the relevant expertise to carry out this work needs to be built into the core team at the outset. These scenarios then need to be built into the choice of conservation goals. Species representation goals, for example, can be adjusted for range and abundance shifts predicted to take place due to climate change (see Box 2.9). The guiding principles of representation and persistence do not change, but rather take on added importance. Increased redundancy may be

necessary to achieve representation when climate change impacts are taken into account, and requirements for persistence are likely to change when expected range shifts and migration needs are considered. Resilience to climate change and ability to adapt to it need to be taken onboard as explicit goals.

Climate change adds a crucial element to the review of existing protected areas, since the biodiversity features conserved in a particular area may move beyond its boundaries in a few decades. Thus, the analysis needs to ask not only which biodiversity features does a protected area currently encompass, but also which of those features will no longer lie within its boundaries in the future – and which new features may move into it?

The same issues apply to the selection of potential new areas. Rules that include factors such as potential species range, precipitation and fire-regime shifts need to be incorporated into site-selection algorithms and the decision-making processes they support. Potential new protected areas should be selected to conserve the future location and needs of priority biodiversity features, not only their present location, and they need to be chosen with regard to their contributions to climate change resilience and adaptation, not just their contributions to biodiversity conservation *per se*.

Climate change factors will also affect the setting of priorities for action on the ground. Consideration of likely shifts in species and habitat ranges, for example, may alter the balance of priority given to expanding the size of new sites versus establishing new sites. Alternatively, climate change may decrease the future integrity and utility of some existing sites, and increase the priority that should be given to new sites. In virtually all cases, the importance of connectivity to allow movement of species and habitats is likely to grow.

WWF has produced a comprehensive guide to building resistance and resilience to climate change into natural systems, with particular emphasis on the practical implications for protected areas design and management.[222] Noting that climate change impacts – and the strategies to adapt to them – vary considerably among ecosystems, the guide deals in detail with grasslands, forest, alpine/montane systems, the arctic, temperate and tropical marine systems, and freshwater ecosystems, stressing three principles across all ecosystems: (a) protect adequate and appropriate space; (b) limit all non-climate stresses; and (c) use active and adaptive management and strategy testing. The guide's prescriptions for forests provide an example of how this can be done:

1. **Reduce present threats not related to climate change:** Forest resilience to climate change is strongly influenced by the quality of forest structure, composition and function. Promoting overall ecosystem health by addressing non-climate threats such as conversion, fragmentation and degradation is therefore the first line of defense.

2. **Avoid fragmentation and provide connectivity:** The negative impacts of ecosystem fragmentation have been widely documented.[223] "Edge effects" threaten forest stability as the ratio of edge to interior habitat increases, eventually destroying forest resistance to impacts such as climate change. Fragmentation also contributes to a loss of biodiversity as exotic, weedy species with high

[222] Hansen *et al*. 2003.

[223] Noss 2001.

dispersal capacities are favored over native species. Expansion of road networks is particularly destructive in this regard, exacerbating the effect of warmer temperatures to increase invasions by pests, diseases, and invasive species, and restricting dispersal of less mobile native species.

3. **Maximize the size of management units:** Since species adapt to changing climates by shifting their ranges, protected areas established to conserve a particular species may not contain appropriate habitat for that species within the next few decades. Planners can overlay different climate change scenarios upon existing protected areas to get an idea where habitats may shift to, and thereby gain a basis for revising boundaries. Given the many uncertainties inherent in applying such scenarios at the site level, the prudent and precautionary approach is to give forests maximum protected habitat within which to migrate, in terms of both latitude and altitude. More broadly, of course, the need to provide sufficient space for forest ecosystems and species to migrate cannot be met within the boundaries of protected areas alone, and instead requires a broader landscape or bioeregional approach encompassing lands outside of protected areas.

4. **Provide buffer zones and land-use flexibility:** Dynamic range shifts cannot be contained within fixed protected area boundaries unless protected areas are very large, which is often not the case. Buffer zones – areas adjacent to protected areas where multiple land uses are adapted to serve both conservation and sustainable use objectives – can expand a protected area's de facto ecological boundaries, and where buffer zones overlap, they can provide migratory possibilities for some species.

5. **Represent forest types across environmental gradients:** "Representing the full range of habitat types is a traditional conservation method, to set aside areas for scientific study, as a node of comparison against disturbed areas, and as a means of conserving species that may be too difficult to manage separately. The uncertainty about the precise type and distribution of impacts necessitates maintaining a full spectrum of forest types within protected areas to enable some resistant and resilient types to persist."

6. **Protect mature forest stands:** Primary forests of mature trees are more resilient to climate change impacts than recently-established forests. Mature stands thereby provide a refuge for species reproduction to continue once favorable climatic conditions return. Although shifts in composition are still expected in mature forests, the effects are slower, giving species more time to adapt.

7. **Protect functional groups and keystone species:** Maintaining the natural diversity of forest species and functional groups strengthens both resistance and resilience to climate change. Recent studies demonstrate increased tolerance to environmental extremes and recovery potential as species richness increases, and species diversity in turn promotes the "redundancy" or number of species present in critical functional groups (e.g. producers, pollinators, seed dispersers, predators, parasites, decomposers, etc.) "Thus, it is not just species diversity that matters, but also species composition. Both may enhance the stability of a forest ecosystem."

8. **Protect climatic refugia:** Climatic refugia are important for maintaining assemblages of species typical of past climates. Identifying and protecting these areas from non-climate stresses can enhance their chances to survive as refugia during present and near-future climate change.

9. **Maintain natural fire regimes:** Forest fire suppression has been shown to decrease biodiversity in some areas, whereas in others, particularly in the tropics, anthropogenic fires have had very destructive effects on biodiversity. Regional differences in fire ecology imply that fire policies established in response to concerns about climate change should not be uniform; rather, they should be established based on what is known of the fire ecology of each region and forest type. "A mixed strategy in which managers let many natural fires burn, protect old growth from stand-replacing fires, and manage other stands through prescribed burning and understory thinning, is probably the optimal approach."[224]

10. **Actively manage pests:** Climate change has been associated with increased infestations of insects, disease, and exotic species in forests, particularly in cooler climates. Where this is a case, protected area managers need to adopt an active strategy for combating pests, which may involve prescribed burning, and a variety of chemical and non-chemical pesticide options.

11. **Maintain genetic diversity and promote ecosystem health via restoration:** Genetic variation is essential for selection of species resilient to climate change. Protected area managers therefore need to conserve forest genetic as well as species diversity. In degraded landscapes, this will require restoration, especially using seed from lower elevations or latitudes. In some cases, species that are known to be more resilient to impacts in a given landscape can be specially selected such as trees with thick bark in areas where climate change may increase the frequency of fire.

12. **Assist migration with species introductions into new areas:** Where particular tree species are "climatologically trapped" by climate change, it may be necessary to introduce the species into more suitable habitats, which may lie outside of the species' present range.

13. **Protect the most highly threatened species in *ex situ* facilities:** For some forest ecosystems, such as the tropical montane cloud forests, climate change are already becoming so severe that *ex situ* solutions may be necessary to prevent extinctions. *Ex situ* collections of such species should include sufficient genetic diversity to maximize chances of successful adaptation under a variety of conditions at future reintroduction sites.

A similar set of climate change-related considerations need to be factored into the design of marine protected areas (MPAs) established to conserve coral reef ecosystems. Climate change-induced rises in sea surface temperatures have increased the frequency and severity of coral bleaching episodes.[225] Considerable expert guidance is available on

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[224] Noss 2001.

[225] Buddemeier *et al*. 2004; Wilkinson 2002.

the design of MPAs and MPA networks,[226] but the question of how best to design coral reef MPAs in ways that enhance their resistance and resilience to coral bleaching has only recently begun to be addressed.

West and Salm (2003) identify local environmental factors that are predictors of greatest resistance and resilience to coral bleaching, in order to help MPA managers "identify, design, and managed networks of MPAs in order to maximize overall survival of the world's coral reefs in the face of global climate change." There are two main reasons for identifying such sites and affording them a high priority for protection. First, protection of these sites will maximize biodiversity conservation by securing the most bleaching-resistant sites. Second, such sites can serve as sources of larvae to support recovery of down-current areas that are more susceptible to bleaching.

Resistance, in West and Salm's usage, refers to the ability of individual corals to resist bleaching or to survive after they have been bleached. Surveying case studies and literature from around the world, West and Salm identify four broad environmental factors that appear to increase resistance to coral bleaching:

- Physical factors that reduce temperature stress, specifically cold-water upwelling;
- Physical factors that enhance water movement and flush toxins;
- Physical factors that decrease light stress, such as shading by topographic features, turbidity in the water column, or cloud cover;
- Factors that correlate with bleaching tolerance, such as pre-adaptation to regularly stressful environmental conditions (e.g. high water temperatures due to causes other than climate change).

Resilience refers to the capacity of reefs to recover after bleaching mortality events, and key factors appear to be:

- Availability and abundance of local larvae;
- Recruitment success (i.e. locations with strong and reliable recruitment of all species within the community);
- Low abundance of bioeroders, corallivores and diseases;
- A diverse, well-balanced community (e.g. sufficient herbivores);
- Effective management regime in place to allow for recovery;
- Connectivity by currents (i.e. larval transport from other source reefs);
- Concentration of larval supply (e.g. concentration and settlement in eddies.)

Each of these factors needs to be ranked with respect to its reliability. Cloud cover, for example, is a far less reliable source of shade than are topographical features. Such an assessment must be made locally, however, since some factors, such as turbidity, may be reliable in one place but not in another. West and Salm stress that much work needs to be done before these factors can be extensively applied to management decisions, and

[226] Salm *et al*. 2000; Kelleher 1999.

recommend that first, "a targeted monitoring program should be implemented to determine whether the identified factors really are reliable and have a significant effect on bleaching resistance or resilience."

While our knowledge of the site- and system-specific impacts of climate change is still scant and patchy, tools and methods are rapidly being developed to assist in incorporating climate change considerations into protected areas planning and management. The good news is that many of the general measures needed to improve protected area management in today's world are the same steps needed to prepare for climate change. Systematic conservation planning for representation and vulnerability, connectivity, and mitigation of localized threats, to name just a few, are "no regrets" strategies for building comprehensive protected area systems that respond to both today's and tomorrow's challenges.

2.4.3 Responding to landscape fragmentation

The goal of protected areas is often to conserve large, intact and functioning ecosystems and manage them to sustain their species and ecological communities. The progressive fragmentation of suitable natural habitat makes this ideal an exception to the rule in today's world. Protected area managers must increasingly find ways to knit together an assortment of habitat patches into a viable whole, utilizing both remaining patches of natural habitat and a variety of modified and semi-modified landscapes where people live and work.

The Convention on Biological Diversity (Decision V/6) calls this "the ecosystem approach",

> a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way … An ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems.
>
> The ecosystem approach does not preclude other management and conservation approaches, such as biosphere reserves, protected areas, and single-species conservation programmes, as well as other approaches carried out under existing national policy and legislative frameworks, but could, rather, integrate all these approaches and other methodologies to deal with complex situations.[227]

As a result of the widespread adoption of the ecosystem approach – at least at the level of scientific and conservation policy debate – reconciling tensions between biodiversity conservation targets and the use of biodiversity's components across the surrounding landscape has emerged as a key challenge for protected areas policy and practice. As Redford and Richter point out, " … biodiversity in its entirety can be conserved only in areas of limited human use. But the majority of both the terrestrial and aquatic world

[227] For a detailed discussion of the ecosystem approach, see Smith and Maltby 2003.

have been, and will continue to be, vital sources of resources for the human population. We live in a world of use."[228]

Three broad strategies can be built into protected area systems to respond to habitat fragmentation in a world of use. Essentially, we need to secure the remaining pieces, buffer them against negative external impacts on their borders, and then knit them together.

First, fragmentation of remaining patches of high quality natural habitat – especially large areas – need to be protected as the "core" of the system. To that end, the Programme of Work on Protected Areas of the Convention on Biological Diversity (Decision VII/28) urges Parties "as a matter of urgency", by 2006, to "take action to establish or expand protected areas in any large, intact or relatively unfragmented or highly irreplaceable natural areas ..."

Smaller patches of habitat – all that is left in many places – also have value. "Indeed, even as isolated patches they contribute by protecting critical habitats, and retaining those species that have more limited home ranges. They may also contain important water catchment basins, wetlands and other sites critical for their ecological functions and ecosystem services to the region."[229]

Second, further fragmentation of both large and small natural habitats can be reduced through designation of surrounding "buffer zones"[230] to ameliorate external pressures. The buffer zone concept first came into wide use through its inclusion in the "biosphere reserves" designated under the UNESCO Man and the Biosphere Programme in the 1970s. Buffer zones can be defined as "areas adjacent to protected areas, on which land use is partially restricted to give an added layer of protection to the protected area itself while providing valued benefits to neighboring rural communities."[231] Miller (1999) elaborates this definition, noting that buffer zones are areas immediately surrounding core areas

> where public, private and communal landowners and users are encouraged through legal and policy instruments and economic incentives to manage their resources in ways that minimize negative impacts upon the core areas ..As a *quid pro quo*, core area managers agree to minimize the negative impacts that the plants and animals of the wild core areas can have upon neighboring farmers, foresters and residents, including predation upon livestock, transfer of diseases and trampling or raiding of gardens and crops.

Buffer zones, and the *quid pro quo* that Miller identifies, have been central to the large "integrated conservation and development projects" (ICDPs) funded by the World Bank and other donors over the past few decades in many developing countries. ICDP projects have been widely criticized for confusing conservation and development objectives – thereby achieving neither – and for assuming that the greatest threats to protected areas arise from local people living in buffer areas.[232] These are

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228 Redford and Richter 1999.

229 Miller 1999.

230 For an extensive review of the buffer zone concept, see Martino 2001.

231 Wells and Brandon 1993.

232 See, for example: Worah 2002; Wells *et al*. 1999. On ICDPs generally, see: Wells and Brandon 1992; Hughes and Flintan 2001; Mogelgaard 2003.

has been carried out in certain projects. Wells and Brandon (1992) argue that buffer zones can have significant biological benefits as a result of keeping human influence further away and providing:

- A physical barrier against human encroachment;
- Protection from storm damage;
- Enlargement of natural habitat and reduction of edge effects;
- Enhancement of environmental services provided by the reserve.

Heinen and Mehta (2000) point out, however, that "there are few studies that test the effectiveness of buffer zones, and most of those have focused on the socioeconomic as opposed to the ecological buffering functions."

Third, linkages to maintain *connectivity* between these core units need to be established or strengthened. The concept of connectivity refers to "how the spatial arrangement and the quality of elements in the landscape affect the movement of organisms among habitat patches."[233] It is based on the premise that "populations, communities and natural ecological processes [are] more likely to be maintained in landscapes that comprise an interconnected system of habitats, than in landscapes where natural habitats occur as dispersed ecologically-isolated fragments."

Connectivity has both a structural and a behavioral dimension. The structural component concerns the spatial arrangement of different types of habitat across the landscape, including factors such as the continuity of suitable habitat, extent and length of gaps and other mappable, spatial habitat attributes. The behavioral component concerns the behavioral response of species to the physical structure of habitat on the landscape. The level of connectivity experienced by different species thus varies, depending on factors such as degree of habitat specialization, mobility, tolerance for disturbed habitats, and the like.

Efforts to enhance landscape connectivity occur in a social, political and economic context, of course, and these factors are often more determinative of linkage design and effectiveness than are the principles of ecological theory. As is the case with protected areas generally, biologically-derived priorities are an essential starting point, but they will rarely be the only consideration when taking action on the ground.

Bennett (2003) provides a detailed guide for enhancing connectivity in protected area systems, although he warns that:

> [I]t is neither possible nor desirable to provide specific uniform guidelines for the design and management of habitat links because they will depend on the proposed scale and function of a particular linkage. A more useful approach … is to discuss biological issues that have a strong influence on the way in which linkages function and on their effectiveness. These issues should be considered and evaluated for particular situations, in relation to the identified function of the proposed link.

Key biological and socio-economic considerations that protected area managers will

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[232] See, for example: Worah 2002; Wells *et al*. 1999. On ICDPs generally, see: Wells and Brandon 1992; Hughes and Flintan 2001; Mogelgaard 2003.

[233] Bennett 2003.

Table 2.2 Measures to enhance protected area connectivity

Issue	Measures to enhance conservation value of linkages
Purpose of the linkage	■ Clearly define the purpose of the link as a basis for management actions and goals
Ecology and behavior of species	■ Match linkage design with ecology and movement patterns of target species ■ Plan landscape links to provide habitat and resources for entire faunal assemblages, with particular attention to species having specialized requirements
Structural connectivity	■ Manage habitats to minimize gaps in linkages ■ Monitor external disturbances that potentially may damage sections of links ■ Develop networks of links to provide alternatives in case of unforeseen disaster ■ Incorporate nodes along linkages to provide additional habitat
Quality of habitat	■ Manage habitats to ensure appropriate resources (food, shelter, refuge, breeding sites) are present for all species using the link ■ Establish new linkages based on existing areas of natural or semi-natural vegetation rather than disturbed land ■ Recognize the need to manage linkages and their habitat resources over time
Edge effects	■ Evaluate likely edge effects and their potential impacts on wildlife ■ Maximize the width of linkages to minimize edge effects ■ Seek ways to reduce disturbance close to or within linkages ■ Incorporate buffer zones along edges to limit impacts of external disturbance sources
Width	■ Match the width of the linkage to its biological purpose ■ Assess the area requirements of key species using the link ■ Maximize width wherever possible to increase the total size and diversity of habitats for fauna ■ Ensure that width is sufficient to counter severe edge disturbances
Location	■ Use knowledge of animal pathways to locate linkages ■ Avoid establishing linkages across natural ecological barriers ■ Locate linkages along environmental contours to maximize continuity of homogeneous habitat (unless the goal is to deliberately link across contours) ■ Locate linkages to complement other resource conservation strategies
Monitoring	■ Include monitoring as an integral part of the management of linkages ■ Design monitoring procedures to assess the effectiveness of linkages for fauna ■ Use the results of monitoring to improve ongoing management
Land tenure	■ Ensure security of land status and tenure to avoid future detrimental changes in land use ■ Ensure that the location and extent of the linkage are clearly marked on maps, planning documents and land-use strategies
Management responsibility	■ Specify responsibility for management ■ Ensure agreement on management goals among all responsible land managers ■ Ensure adequate financial and human resources and skills are available ■ Anticipate likely changes in land use that could affect the link
Support from local communities	■ Involve local communities in decisions, management and monitoring ■ Encourage sympathetic management of adjacent lands ■ Be aware of the wider concerns of local people
Integration with other sustainable land management programmes	■ Investigate ways to integrate linkages with other programmes in natural resource management ■ Identify and communicate the wider ecological and social benefits of linkages

Source: Bennett 2003.

want to take into account in developing connectivity linkages among protected areas are summarized in Table 2.2.

The establishment of "Protected Landscapes/Seascapes" – IUCN Category V – provides protected area planners and managers with another important tool for combating the effects of fragmentation and enhancing connectivity. IUCN defines a Protected Landscape/Seascape as:

> [An] area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.[234]

Category V protected areas are thus lived-in, working landscapes that have been extensively modified by people over time. Originally a Euro-centric idea, born of Europe's lack of extensive natural habitats and intensive traditional rural land uses, the concept is now viewed as more widely applicable for a number of reasons:

- Many other parts of the world have now lost a majority of their natural habitats to the extent that Europe did in the past;
- Conservation biology has demonstrated that biodiversity cannot be adequately conserved in strictly protected natural habitats alone;
- Combating fragmentation requires connectivity between natural areas across modified landscapes;
- Modified landscapes managed in part for conservation objectives can buffer and support more strictly protected areas;
- Modified landscapes contain a great deal of agricultural genetic diversity that is an important conservation target in its own right;
- Large-scale bioregional management[235] of natural resources is impossible without inclusion of well-managed modified landscapes.[236]

As is the case for selection of natural habitats for protection, selection of Category V protected areas should be systematic, via a country- or region-wide analysis of the most suitable areas. Since such areas are by definition significantly modified and populated, socio-economic and political concerns will loom large in selection criteria. Multiple stakeholders and land uses means that the potential for conflict is greater than in less intensely modified areas, and there is a danger that political pressures can result in an area being declared "protected" under Category V status, when in fact it is not really serving valid conservation objectives. By the same token, however, this multi-stakeholder situation provides managers with a much greater set of participatory governance and management options (discussed in Chapter 3) than is often the case for strictly protected areas. IUCN has produced

234 IUCN 1994.
235 Miller 1996.
236 Phillips 2002.

detailed criteria and guidelines for selection and management of Category V protected areas.[237]

Ultimately, the growing fragmentation of the Earth's remaining natural habitats and resultant isolation of protected areas needs to be addressed at a spatial and planning scale that moves beyond protected areas and their linkages to encompass whole bioregions, which Miller (1996) defines as "a geographic space that contains one whole or several nested ecosystems. It is characterized by its land-forms, vegetative cover, human culture, and history, as identified by local communities, governments, and scientists." A bioregion thus shares ecological characteristics with the ecoregions discussed previously, but adds dimensions of economics, culture and history.

Bioregional planning and management are, by definition, beyond the scope of what protected area planners and managers can do on their own, but they can and should be important catalysts and leaders in mobilizing this process. Miller (1996) provides detailed guidelines for bioregional planning and management, the key characteristics of which are summarized in Box 2.10.

2.4.4 Protected areas and freshwater ecosystems

As noted in Chapter 1, the world faces an unprecedented freshwater crisis, with two interrelated dimensions. First, degradation of water resources – rivers, lakes and wetlands, and the catchments they rely on – has diminished provision of water-related ecosystem services (potable and agricultural water, recycling of nutrients, flood control, fisheries) even as demand for these services is accelerating at an unprecedented pace. The vast majority of human water use is for agriculture, but clean water is also critical for the growing proportion of the Earth's population that lives in cities. Protected areas play a crucial role in supplying the world's fresh water, a role that will increase as watersheds and aquifers in unprotected areas are increasingly degraded. Already, nearly one-third (33 out of 105) of the world's largest cities obtain a significant proportion of their drinking water directly from protected areas, and at least five others obtain water from sources that originate in distant watersheds that also include protected areas.[238]

Second, the unique – and mostly unknown – biodiversity of freshwater ecosystems is being lost at rates even faster than in terrestrial or marine ecosystems.[239] By one estimate, the future extinction rate of freshwater animals is predicted to be almost five times greater that that for terrestrial animals and three times that for coastal marine mammals.[240]

Despite the importance of freshwater ecosystems, they are poorly represented in the world's protected area network, particularly in terms of inconsistent regional coverage, gaps in coverage by ecosystem type, and the level and scale of protection.[241] Where freshwater habitats and species have been protected, it is usually the result of

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237 Phillips 2002.

238 Dudley and Stolton 2003.

239 Revenga and Kura 2003.

240 Ricciardi *et al*. 1999.

241 Coates 2004.

Box 2.10 Key characteristics of bioregional management

1. **Large, biotically viable regions –** Bioregional management programs embrace regions large enough to include the habitats and ecosystem processes needed to make biotic communities and populations ecologically viable over the long-term. These regions must be able to accommodate migratory patterns, anticipate nature's time cycles, and absorb the impacts of global change.
2. **Leadership and management –** The leadership to establish bioregional programs may come from public agencies or from the community of residents and resource users. The tasks of convening stakeholders, preparing and negotiating vision statements, planning and implementing agreed-upon activities can be shared cooperatively between public and private entities, or fully community-based.
3. **A structure of cores, corridors and matrices –** These programs include core wildland sites that feature representative samples of the region's biodiversity. Ideally such sites are linked by corridors or other linkages to enhance connectivity and enhance the conservation contribution of modified landscapes.
4. **Economic sustainability –** The livelihoods of people living and working within the bioregion are supported. Appropriate incentives to make optimal use of local resources, and apply sustainable technologies, are combined with a system for equitably sharing the costs and benefits of conservation.
5. **Full involvement of stakeholders –** All parties who can affect or benefit from the resources in the region develop skills, information, and opportunities to be fully involved in planning and management. Key here is building the local capacity to participate, negotiate, and perform the various tasks involved.
6. **Social acceptance –** Any proposals for changes in the local way of life and livelihoods need to be acceptable to those who would be affected.
7. **Solid and comprehensive information –** All stakeholders have at their disposal the critical information needed to participate effectively. GIS technology, for example, can be used to help stakeholders clearly envision their region, its distinctive features, and options and scenarios for the future.
8. **Knowledge, research and monitoring –** Scientific, local, and traditional knowledge are employed in planning and management activities. Biology, anthropology, economics, engineering, and other related fields are tapped. Research and inquiries focus on people/environment interactions, the development of innovative methods for managing natural resources, and the long-term monitoring of environmental factors and the impacts of management practices.
9. **Adaptive management –** Bioregional programs are operated on an experimental basis, from which lessons may be drawn from real-world experience to respond appropriately.
10. **Restoration –** Where the viability of some habitats or ecological functions have been impaired through excessive or inappropriate use, then these areas are to be restored.
11. **Cooperative skills development –** Communities and public and private organizations together locate and mobilize the skills, knowledge, and information needed to be able to manage the area.
12. **Institutional integration –** Alliances with other institutions and with local organizations are forged to close gaps, minimize overlap, and make management and investment in the region more efficient. Such alliances may, in some cases, span national boundaries, as in the case of transboundary protected areas and international research collaboration.

their coincidental inclusion in terrestrial reserves.[242] Remedying this gap is made more difficult by a lack of information. The extent and distribution of inland water ecosystems are not well documented at global or regional scales, and there is little comprehensive data at the national level in many cases. Nor are comprehensive data available on water availability and quality, or on the relationships between freshwater biodiversity and the livelihoods of people. Information on invertebrate species is particularly fragmentary, whereas it is somewhat better for waterbirds and freshwater fishes.[243] Unfortunately, relatively little scientific research is being devoted to filling these key data gaps.[244]

Protection of freshwater ecosystems must counter three main threats: increased sediment and nutrient loads from agriculture; altered hydrological regimes; and introductions of non-native species. Saunders *et al.* (2002) outline three strategies for expansion of freshwater protected areas (FWPAs) corresponding to these three threats.

Whole-catchment management: Freshwater systems are affected by activities upstream or uphill in water catchments. Land use changes can modify nutrient and sediment loads, change water temperature and increase pollution. Conservation of these systems therefore requires whole-catchment management. Ideally, FWPA boundaries would track catchment boundaries, but this is seldom possible, particularly for larger catchments. FWPAs therefore need to be accompanied by catchment-wide conservation strategies in adjacent multiple-use areas. This can be accomplished via a multiple-use zoning scheme in which a well-protected FWPA core is surrounded by a series of buffer zones in which varying intensities of human activity are permitted and managed under a variety of legal and governance arrangements (e.g. co-management with local communities.) FWPAs also need to be sited along those parts and elements of the catchment requiring the highest level of protection – headwaters and riparian vegetation further downstream. In some situations, vegetated buffer strips (e.g. 10–50 m wide) may be the only feasible strategy.

Natural flow maintenance: Streamflow has been called the "master variable" which limits distribution of riverine species and regulates the ecological integrity of flowing water systems.[245] Conservation of the hydrological elements of freshwater ecosystems needs to follow the natural flow paradigm,[246] which stresses "the importance of maintaining the full range of variation in natural hydrological regimes to sustain the native biodiversity and integrity of aquatic ecosystems."[247] Anthropogenic flow disturbances (e.g. dams, diversion for agriculture, groundwater abstraction, catchment land cover change) can dramatically alter key environmental variables (water temperature, dissolved oxygen levels, suspended sediment loads, nutrient availability and physical habitat structure). Changes in any of the five components of flow (magnitude, frequency, duration, timing, and rate of change) influence water quality and quantity, physical habitat, energy sources, species abundance and composition, and biotic interactions.

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242 Saunders *et al*. 2002.
243 Revenga *et al*. 2003.
244 Abell 2002.
245 Poff *et al*. 1997.
246 Poff *et al*. 1997.
247 Richter *et al*. 1997.

FWPAs should therefore be located in areas where natural flow is relatively intact or can be restored. Given the growing human demand for water, maintaining or restoring natural streamflow will often require active management interventions (e.g. reservoir releases, temporary drainages, weirs, embankments and sluices) to maintain or mimic natural water levels and discharge patterns. Vegetative buffer strips can also support more natural flow regimes. Since the great majority of a river's flow usually derives from catchment headwaters, streamflow conservation interventions should generally be directed to these areas. Since rivers and wetlands are more affected by seasonal water flow variations than lakes, streamflow interventions should prioritize rivers and wetlands over lakes.

Addressing non-native species: Introduction of non-native species is widely recognized as one of the major threats to freshwater biodiversity. Freshwater systems are particularly vulnerable to introductions because of the ubiquitous routine transport of potentially invasive species in ballast water, bait buckets, and live wells of boats. Intentional introductions of sport-fishing species (e.g. trout and salmon) have also had negative effects on native species. The most effective method of combating invasive alien species is to actively prevent introduction of all non-native species, including prohibiting intentional introduction of non-native species of all types. To this end, release of ballast water should be strictly controlled. Obviously these measures must be taken at the water catchment scale, not only within the boundaries of FWPAs. Where possible, FWPAs should incorporate use of natural barriers that preclude entry of non-native species but allow migration of native species. Where non-invasive species are already established, eradication is generally a preferable and more cost-effective approach than long-term control. General measures to incorporate invasive alien species strategies into all types of protected areas are discussed in the next section.

2.4.5 Combating invasive alien species in protected areas

Chapter 1 described the dramatic global increase in introductions of invasive alien species (IAS), and their severe negative biological impacts and high economic costs. Preventing new IAS is a global challenge that must be addressed at the international as well as national level, and is thus largely beyond the scope and powers of protected area managers. So too, successful initiatives to eradicate or control IAS cannot be confined to the boundaries of protected areas, but must encompass larger areas under multiple, sometimes multi-national jurisdictions. IAS have received increased attention over the past decade, due in large part to the work of the Global Invasive Species Programme (GISP), a collaboration between IUCN, the Scientific Committee on Problems of the Environment (SCOPE) and CAB International. The requirement in the Convention on Biological Diversity (Article 8(h)) that Parties take action "as far as possible and as appropriate, to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" has also raised the profile of the IAS challenge.

As a result of this increased international focus on IAS, extensive information resources and policy guidelines are now available, including the GISP *Global Strategy on IAS*,[248] IUCN *Guidelines for the Prevention of Biodiversity Loss Caused by IAS*,[249] an IUCN guide to designing IAS legal and institutional frameworks,[250] a detailed Toolkit of best prevention and management practices for IAS,[251] and a comprehensive analysis of the human dimensions of IAS and how to deal with them.[252]

While much of this and other[253] material draws on examples of IAS invasions and control initiatives from protected areas, there are no specific guidelines for dealing with IAS within protected areas *per se*. This is likely because, as noted above, IAS strategies must take place in large part at a broader scale than the protected area to be effective. In addition, general IAS strategies are, for the most part, equally applicable to protected areas.

Until quite recently, IAS were not viewed as a priority threat by many protected area managers, compared to habitat degradation, fragmentation, and poaching. One reason, according to a manager at South Africa's Kruger National Park (which has a significant IAS problem) is that

> The problem with invasive species is that they are not intrinsically interesting to most people, often including protected area managers and officers. They do not conjure up stories of excitement or the thrill and reward of catching an armed poacher with ivory in his hands. They do not have long flashing fangs that can shred you and sharp claws to rip. The invasion by alien species is often quite slow, unnoticeable and the impacts most frequently irreversible and immense.[254]

This perception is changing rapidly as the immense impacts of IAS on protected areas are more widely documented and publicized. At the 2003 IUCN World Parks Congress, IAS was identified as a key emerging issue for protected area management:

> Management of Invasive Alien Species (IAS) is a priority issue and must be mainstreamed into all aspects of PA management. The wider audience of protected area managers, stakeholders and governments needs urgently to be made aware of the serious implications for biodiversity, PA conservation and livelihoods that result from lack of recognition of the IAS problem and failure to address it. Promoting awareness of solutions to the IAS problem and ensuring capacity to implement effective, ecosystem based methods must be integrated into PA management programs.

To respond to this call, protected area managers should consult the extensive and authoritative body of information and guidance cited above to develop their own local and national responses to IAS. A number of general principles for protected area planners and managers, however, can be summarized, drawing on the IUCN Guidelines and GISP Global Strategy:

- Establish the prevention, detection and eradication or control of IAS as a priority objective for management of the protected area system;
- Raise awareness of IAS threats to protected areas with other government agencies, local communities, and relevant sectors of private business (e.g. agriculture and wildlife trade);
- Prevention of IAS introductions is the most effective strategy. Where IAS are

248 McNeely *et al*. 2001.
249 IUCN 2000.
253 See, for example, *Aliens* No. 17 2003.
254 Foxcroft 2002.

already established, eradication is the most cost effective strategy, when compared to long-term control strategies;

- Legally prohibit all introductions of alien species, whether intentional or not, into protected areas and adjoining parts of the same ecosystem (e.g. river basins);
- Early detection of IAS, and a quick response, is essential to maximize chances of successful eradication and minimize costs;
- Prioritize prevention, detection and eradication efforts in protected areas encompassing especially vulnerable habitats (e.g. islands, lakes and other and isolated habitats), and areas of high native biodiversity value (e.g. high numbers of endemics and threatened species);
- In developing a local eradication or control strategy, consult systematically with local stakeholders, including those who may oppose eradication for ethical or self-interested reasons (e.g. as is sometimes the case for feral or game animal species), to ensure local support and participation;
- Eradication and control methods should be socially, culturally and ethically acceptable, and should not adversely affect native flora and fauna, or human health and domestic crops and livestock in areas adjacent to the protected area;
- Where appropriate, systematically link eradication of IAS to reintroductions of native flora and fauna, utilizing the IUCN Guidelines for Re-introductions[255] for guidance;
- Share detection and other IAS information from particular sites with all managers within the protected area system, and with other relevant agencies.

2.5 Summary

The world now has more than 100,000 protected areas, covering nearly 12% of the Earth's land surface, a dramatic increase from just 20 years ago. Despite this expansion, most protected area systems do not adequately conserve the many values, goods and services that protected areas provide. As our understanding of those values has improved, so too has our knowledge of how protected area systems need to be designed in order to conserve those values.

It is widely accepted that the current global protected areas network is deficient in many ways: Some ecosystems – notably marine and freshwater – are under-represented and overall, the network does not adequately protect a representative sample of the planet's distinctive ecological regions; many biodiversity "hotspots" of high endemism and under high levels of threat are not protected; the role of protected area in maintaining key ecological services is insufficiently appreciated; and global biophysical changes such as climate change and habitat fragmentation have not been sufficiently taken into account in system design.

An international consensus is emerging that protected areas need to serve conservation on a variety of levels, including conservation of endangered species; protection of viable representations of all habitat types, with a particular focus on large, relatively

intact natural areas, unique habitats, and areas facing serious threats; and those values of biodiversity important for humanity, including ecosystem services, economically useful species, and sites and species of particular social and cultural value.

While this emerging consensus provides an important framework for deciding *what* protected areas should conserve, it does not yield concrete geographic priorities for *where* conservation resources and energies – always in short supply – should be invested. Numerous methods for setting priorities have emerged, including "biodiversity hotspots", "priority ecoregions", "key biodiversity areas", and the like, each based on particular assumptions about what is most important to conserve. To be effective, however, all such methods need to balance ecological priorities with a wide range of socioeconomic, political and practical considerations. In addition, the current and future impacts of biophysical change factors such as climate change and habitat fragmentation need to be fully considered and built into protected area system design.

The growing fund of knowledge and experience in global-level priority setting can provide some guidance for national protected area system design, but ultimately, systems and sites are designed and managed at national and local levels, and must respond to national and local priorities and concerns as well as global ones. Systematic conservation planning methods developed over the past few decades provide important new tools for planners to establish conservation goals, assess the contribution of existing protected areas to those goals, identify gaps in coverage, and select priorities for strengthening existing protected areas and establishing new ones.

As with global priority-setting methods, specific measures need to be taken to build global change factors into national conservation planning processes. Climate change, for example, demands attention to potential shifts in species' ranges and their implications for protected area boundaries, which may need to shift over time as well. Addressing fragmentation requires much more attention to connectivity (as does climate change) and, therefore, to strategies for conservation in landscapes between existing protected areas where people live and work.

3. Parks and people in a world of changes: Governance, participation and equity[254]

3.1 The growing importance of equitable community-based approaches

Chapter 2 discussed strategies for building comprehensive protected area systems in light of the biophysical global change factors reviewed in Chapter 1. This chapter focuses on how protected area policymakers and managers can best adapt to the socio-economic and institutional global change factors that were also discussed in Chapter 1. Specifically, the chapter focuses on three broad propositions.

- First, expanding the world's protected areas and managing them effectively requires broadening the spectrum of governance models and mechanisms beyond the centralized, state-managed parks that currently dominate protected areas thinking and practice. Community-based management, in particular, is a vitally important strategy.
- Second, more effective and diverse protected areas governance and management requires more participatory decision-making and management processes that incorporate and respond to the interests of a broader range of stakeholders – particularly the indigenous and local communities living in and around protected areas.
- Third, these new models and methods for governance and participation need to result in – and be measured by – their ability to ensure that both the costs and benefits of protected areas are shared equitably.

More and more, conservation is about managing people, not just ecosystems. More to the point, a large part of the protected areas agenda in this new world of global change is about empowering and assisting people to manage themselves and the ecosystems upon which we all depend.

3.1.1 Community-based management in ascendance

People have protected particular natural sites for millennia for a variety of reasons, ranging from their cultural and religious significance to more prosaic concerns with over-exploitation of economically important species by hunting and gathering. While some forms of historical conservation – such as the declaration of royal hunting reserves – were certainly

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[254] **Author:** Charles Victor Barber, IUCN Consultant. The author would like to acknowledge the important contributions to this chapter of Grazia Borrini-Feyerabend and Ashish Kothari, Co-chairs, IUCN Theme on Indigenous and Local Communities, Equity and Protected Areas (TILCEPA).

quite centralized and "top-down", much of humanity's conservation history has involved community-based systems. These community-based conservation practices have persisted up to the present in many places, and numerous studies have documented their strengths and successes.[255] Reasons behind the frequent effectiveness of community-based conservation include the following:

- Contrary to some popular images, there are very few places where wild biodiversity exists in isolation from human communities and activities, and this has been true for millennia.
- Because of this lengthy coexistence, maintainence of current patterns of biodiversity often depends on the continuance of certain anthropogenic disturbances (e.g. animal grazing). Conversely, overly-strict protection measures may, in some cases, have negative impacs on biodiversity.
- Through long experience of coexistence with natural resources, traditional rural communities developed specialized knowledge, skills and management institutions through adaptive processes. In many places, these capacities still exist and can be an important basis for conservation if properly recognized and supported.
- Indigenous and local communities in many parts of the world depend on the resources and ecological services provided by the ecosystems in which they live, and therefore have direct incentives to conserve them, if they can reap a fair share of the ensuing benefits.
- Modern-day conservation management authorities – such as national park services – are often unable to cope with both the costs as well as the logistics of day-to-day field management, and community-based approaches are therefore often attractive to such agencies.

Despite the long pedigree and frequent effectiveness of community-based conservation practices, state-designated and managed protected areas have emerged as the dominant approach over the past century. Yosemite and Yellowstone National Parks, established in the late 19th Century in the USA, are early examples of the traditional model of state-owned and managed parks set aside for conservation of nature and specific geographic features, with strong restrictions on human occupation and use. Over the past 50 years, this "Yellowstone model" has also been adopted by many developing countries.[256] The paradigm of "fortress conservation" is not monolithic – in Europe, for example, protected areas frequently incorporate local human use and activity – but it has been pervasive in much professional thinking and government policy in the recent past.

Faced with the multiple global change factors reviewed in Chapter 1 and the mandate to expand protected areas out across ever-more crowded landscapes discussed in Chapter 2, protected area practitioners increasing agree that a renewal of community-based approaches to conservation must be a major part of a successful strategy for the coming decades and beyond. As a result, a new protected areas paradigm is emerging in response

[255] See, for example: Western and Wright 1994; McNeely 1995; Jaireth and Smyth 2003; Borrini-Feyerabend 2003.
[256] Phillips 2003.

to these trends and pressures, an approach that is more sophisticated and attuned to the realities of the new world of change that we live in (see Box 3.1). This paradigm is, however, far more complex to implement than the traditional model of a "fortress" park. Issues of governance, participation, and equity are integral to this new paradigm, and are at once a cause for its complexity yet fundamental to its success.

This new vision for protected areas has been substantially adopted by the 188 governments that are Parties to the U.N. Convention on Biological Diversity (CBD). At the 7th

Box 3.1 Elements of the modern paradigm for protected areas

Objectives:

- Includes social, economic, conservation, recreation, restoration and rehabilitation objectives;
- Often designated for scientific, economic and cultural reasons, with a more sophisticated rationale for establishing protected areas;
- Managed to ensure that local people benefit from, and are not adversely affected by tourism;
- Recognizes that so-called wilderness areas are often culturally important places.

Governance:

- Run by many partners, thus different tiers of government, local communities, indigenous groups, the private sector, NGOs and others are all engaged in protected areas management.

Relationship to local people:

- Run with, for, and in some cases by local people, who are no longer seen as passive recipients of protected areas policy but as active partners, even initiators and leaders in some cases;
- Managed to help meet the needs of local people, who are increasingly seen as essential beneficiaries of protected area policy, economically and culturally.

Context and perceptions:

- Viewed as a community asset, balancing the idea of a national heritage;
- Management guided by international responsibilities and duties as well as national and local concerns, leading to transboundary protected areas and international protected area systems;
- Planned as part of national, regional and international systems, with protected areas developed as part of a family of sites.

Management and finance:

- Managed adaptively in a long-term perspective, with management being a learning process;
- Selection, planning and management viewed as essentially a political exercise, requiring sensitivity, consultations and astute judgment;
- Managed by people with a range of skills, especially people-related skills;
- Values and draws on the knowledge of indigenous peoples and local communities;
- Paid for through a variety of means to supplement – or replace – government subsidies.

Source: Phillips 2003.

meeting of the CBD Conference of the Parties in early 2004, Parties adopted a Programme of Work on Protected Areas[257] that endorses this new paradigm, including a distinct Element on "Governance, Participation, Equity and Benefit-Sharing" with the following goals and associated targets:

> **Goal 2.1 – To promote equity and benefit-sharing**
>
> **Target:** Establish by 2008 mechanisms for the equitable sharing of both costs and benefits arising from the establishment and management of protected areas.
>
> **Goal 2.2 – To enhance and secure involvement of indigenous and local communities and relevant stakeholders**
>
> **Target:** Full and effective participation by 2008, of indigenous and local communities, in full respect of their rights and recognition of their responsibilities, consistent with national law and applicable international obligations, and the participation of relevant stakeholders, in the management of existing, and the establishment and management of new, protected areas.

This intergovernmental consensus in the CBD process reflected the outcomes of the Vth IUCN World Parks Congress, held in 2003 which included the following "Key Targets" in its Action Plan:[258]

> **Key Target 8:** All existing and future protected areas shall be managed and established in full compliance with the rights of indigenous peoples, mobile peoples and local communities.
>
> **Key Target 9:** Protected areas shall have representatives chosen by indigenous peoples and local communities in their management proportionate to their rights and interests.
>
> **Key Target 10:** Participatory mechanisms for the restitution of indigenous peoples' traditional lands and territories that were incorporated in protected areas without their free and informed consent established and implemented by 2010.

Perhaps more importantly, protected areas policymakers and managers, together with indigenous and local communities, non-governmental organizations (NGOs) and other stakeholders, have been taking steps to put these principles into practice on the ground in literally thousands of protected areas and communities throughout the world. The protected areas community has thus moved well beyond the stage of formal international commitments, and can learn from and build on these diverse and innovative efforts to reconcile nature's imperatives and human needs in the face of accelerating global change.

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[257] UNEP/CBD/COP/7/21 Annex VII/28.

[258] IUCN 2003.

3.1.2 Understanding equity in the protected area context

One of the major themes running through these recent developments is the need for more explicit consideration of equity in the establishment and management of protected areas. "Equity" can be broadly defined as "the state, quality, or ideal of being just, impartial, and fair." What, then, can make protected areas management more "just, impartial and fair" in the context of the day-to-day decisions facing protected area policymakers and managers? Three approaches are particularly important.

First, equity implies the existence or establishment of institutions of *governance* that respect existing rights, adhere to the rule of law and embody principles of transparency, accountability, predictability and performance.

Second – and central to good governance – equity implies a just and impartial process of *participation,* i.e. fair stakeholder representation, in making and implementing decisions regarding protected areas, a process in which all parties whose interests will be significantly affected by such decisions have a fair chance to voice their concerns and seek protection of their rights.

Third, equity implies justice and fairness in the *outcomes* of decision-making processes and institutions with respect to sharing both costs and benefits of protected area establishment and management. Substantive outcomes are, ultimately, what institutions of governance are held accountable for.

Improving these three dimensions of equity will strengthen protected area design and management systems and make them more effective in achieving their conservation objectives. This is because, in most cases, protected areas cannot be effective conserved or managed without the support (or at least the consent) of the individuals and communities living in and adjacent to them. To the extent that decision-making processes, governance institutions, and substantive allocations of costs and benefits are perceived as inequitable, local communities will be more likely to oppose protected areas and impede achievement of their objectives. Furthermore, inequity often leads to civil conflict, which negatively affects both human welfare and protected area sustainability. Conversely, more equitable participation and governance, leading to more equitable substantive outcomes, will increase local community support for protected areas, and thereby improve the effectiveness of their management.

3.1.3 The special case of indigenous peoples

Millions of indigenous people (see Box 3.2 for a definition) live within protected area boundaries. One review concluded that 86% of protected areas in Latin America, 69% in India, and 70% worldwide are inhabited, and the great majority of these inhabitants are indigenous, with 80% of protected areas in South America – and 85% in Central America – having indigenous peoples living inside them.[259]

In the past, however, indigenous peoples have often been seen as an impediment to conservation and expelled from their ancestral territories when the lands were brought

[259] Colchester nd.

Box 3.2 What does "indigenous" mean?

The term "indigenous", as used in this chapter, stands for "indigenous and tribal", according to the definition in Article 1 of the International Labor Organization's Convention 169 on Indigenous and Tribal Peoples in Independent Countries (ILO 169), which states that the Convention applies to:

(a) Tribal peoples in independent countries whose social, cultural and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partially by their own customs or traditions or by special laws or regulations;

(b) Peoples in independent countries who are regarded as indigenous on account of their descent from the populations which inhabited the country, or a geographical region to which the country belongs, at the time of conquest or colonization or the establishment of present State boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions.

Article 1 of ILO 169 also states that "Self-identification as indigenous or tribal shall be regarded as a fundamental criterion for determining the groups to which the provisions of this Convention apply." These criteria are followed in various other international instruments and by many indigenous and tribal peoples themselves.

Official as well as self-appellation preferences for the use of "indigenous" vs. "tribal" (as well as others such as "native", "aboriginal", "ethnic minority", etc.) vary from one region of the world to another. A highly simplified description is to say that there is a general tendency toward the use of "indigenous" (or variants thereof) to refer in particular to the original inhabitants of the Americas, Australia and the Pacific, while the terms 'tribal' or 'ethnic minority' are more common in Africa and Asia.

Source: Oviedo *et al*. 2000.

under state control and designated as protected areas. This view is summed up in the words of Bernard Grzimek, who campaigned to conserve wildlife on the Serengeti plains by excluding the native Masai herders, arguing that "a national park must remain a primordial wilderness to be effective. No men, not even native ones, should live inside its borders."[260]

This view conflicts with the perspectives of many indigenous peoples, who view themselves, their cultures and ways of obtaining their livelihood as inextricably linked to what others may perceive as "wilderness."[261] As conceptions of protected areas have broadened, and indigenous rights over lands, waters and natural resources have received more political recognition, the views of conservationists and government conservation agencies have begun to move closer to the indigenous view.

Specifically, what many indigenous and traditional peoples' organizations demand is that protected areas established on their domains:

- Effectively protect those domains, as well as the people and cultures they contain, from external threats, and in particular reinforce traditionally-protected areas;

[260] Adams and McShane 1992.

[261] For numerous examples of indigenous perspectives on nature and natural resources, see Kemf 1993.

- Recognize their rights to their lands, territories, waters, coastal seas and other resources;
- Recognize their rights to control and co-manage these resources within protected areas and allow participation of traditional institutions in co-management arrangements;
- Recognize the rights of indigenous and other traditional peoples to determine their own development priorities, as long as they are compatible with protected areas objectives;
- Be declared only at their initiative, and/or with their free and prior informed consent; and
- Incorporate sustainable use of natural resources using methods that maintain the integrity of the ecosystem and that have been used traditionally by indigenous peoples.[262]

In 1999, WWF and IUCN endorsed a set of principles and guidelines on indigenous and traditional peoples and protected areas (see Box 3.3), which are a considerable advance on past practice, and provide useful guidance for all protected areas managers. A review of case studies in Africa, however, concluded that practice on the ground is still far from implementing these principles:

> A shocking conclusion of this project is that the WCPA/WWF/IUCN Principles and Guidelines on Protected Areas and Indigenous/Traditional Peoples are not being followed in any of the ten cases that were examined. Not only are the principles being ignored, but before this project, conservation project managers were largely unaware of the suggested guidelines for enabling the principles to be put into practice, and in most of the cases indigenous peoples' rights to their lands continue to come under increasing pressure from conservation agencies in their areas.[263]

3.1.4 The limits of community-based protected area management

History shows that the traditional paradigm of state-run, exclusionary "fortress conservation" protected areas has often led to the inequitable and sometimes forced displacement of local and indigenous communities, and, as an outcome of the resulting conflicts, has often failed to meet conservation objectives. A more participatory, equitable approach to protected area management that respects and works with indigenous peoples and local communities is therefore not only desirable on moral grounds – it is also necessary for practical reasons.

It should not be assumed , however, that indigenous peoples and local communities living in and around protected areas are inherently more virtuous than other people, that local, community-based management will always lead to better outcomes, or that there is no place in the landscape for strictly protected, state-run reserves. The pendulum should

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[262] Beltrán 2000.

[263] Forest Peoples Project 2003.

Box 3.3 IUCN/WWF Principles on indigenous/traditional peoples and protected areas*

Principle 1
Indigenous and other traditional peoples have long associations with nature and a deep understanding of it. Often they have made significant contributions to the maintenance of many of the earth's most fragile ecosystems, through their traditional sustainable resources use practices and culture-based respect for nature. Therefore, there should be no inherent conflict between the objectives of protected areas and the existence, within and around their borders, of indigenous and other traditional peoples. Moreover, they should be recognised as rightful, equal partners in the development and implementation of conservation strategies that affect their lands, territories, waters, coastal seas, and other resources, and in particular in the establishment and management of protected areas.

Principle 2
Agreements drawn up between conservation institutions, including protected area management agencies, and indigenous and other traditional peoples for the establishment and management of protected areas affecting their lands, territories, waters, coastal seas and other resources should be based on full respect for the rights of indigenous and other traditional peoples to traditional, sustainable use of their lands, territories, waters, coastal seas and other resources. At the same time, such agreements should be based on the recognition by indigenous and other traditional peoples of their responsibility to conserve biodiversity, ecological integrity and natural resources harboured in those protected areas.

Principle 3
The principles of decentralisation, participation, transparency and accountability should be taken into account in all matters pertaining to the mutual interests of protected areas and indigenous and other traditional peoples.

Principle 4
Indigenous and other traditional peoples should be able to share fully and equitably in the benefits associated with protected areas, with due recognition to the rights of other legitimate stakeholders.

Principle 5
The rights of indigenous and other traditional peoples in connection with protected areas are often an international responsibility, since many of the lands, territories, waters, coastal seas and other resources which they own or otherwise occupy or use cross national boundaries, as indeed do many of the ecosystems in need of protection.

* These principles are complemented with 22 more detailed guidelines.

Source: Beltrán 2000.

not swing too far the other way, and overly idealize "community-based conservation" as the panacea for the world's protected area challenges, for a number of reasons.

First, care must be used with the term "communities." Not all groups of people who live in the same place (say, in settlements on the edge of a national park) constitute a "community" in the sense of having a cohesive identity, shared values and goals, and the capacity and institutions for collective action. Particularly on natural resource frontiers, what may appear to an outsider as a "local rural community" may in fact be an aggregation of migrants from many different cultures and communities, drawn together by a transient economic opportunity – such as small-scale mining, logging, fishing, or slash-and-burn agriculture.

Second, the quality of environmental stewardship varies greatly among even well-established, cohesive indigenous and traditional communities. Technology change, access to markets, and growing demand for new consumer goods, combined with population growth and externally-imposed restrictions on access to land and resources, for example, can rapidly undermine formerly sustainable "traditional" resource-use practices. In many indigenous communities, a long history of oppression, displacement and exploitation by external forces has weakened – and sometimes destroyed – many elements of traditional culture and society, including natural resource management traditions and practices. Whether a particular community's protection and use of natural resources support a protected area's conservation objectives is an empirical question that must be answered mainly by assessing their present biological impacts, not only by looking at the community's past traditions and practices.

Third, the sum total of a local community's objectives for a protected area does not inevitably encompass all of the values the protected area may be needed to defend. Many components of biodiversity can be of national or global value – an endangered, endemic species, for example – but be of little or no economic or cultural value to local communities. If protected areas only conserve what is useful and valuable to the people living directly around them or in them, they will not, in many cases, achieve objectives valuable to other stakeholders.

Fourth, a distinction must be drawn between ensuring that the costs and benefits of protected areas are equitably distributed, and the claim that protected areas must take on poverty reduction as one of their central *raisons d'etre* (see Section 3.4.3). It is unrealistic to expect the planet's last few bits of relatively undisturbed nature to bear the burden of alleviating the world's poverty. Protected areas can and do make a contribution to increasing local incomes in some places – such as area where wildlife tourism or scuba diving are big business – and poverty alleviation concerns should inform protected areas management wherever possible. At a minimum, the establishment of protected areas should never be the catalyst for *increasing* poverty.[264] But as a general matter, wholesale attempts to refocus protected areas on an anti-poverty agenda will not significantly contribute to poverty alleviation, and may compromise key conservation objectives.

Fifth and finally, the substantial focus in this discussion on community-conserved areas and co-management does not imply that these approaches can necessarily serve the goals that strictly protected areas containing large, contiguous areas of relatively undisturbed natural ecosystems and processes can. There are exceptions, of course. Some of the largest undisturbed portions of the Amazon basin, for example, coincide with the territories of relatively uncontacted indigenous peoples. In other cases, however, conservation of some of the planet's last relatively intact large wildernesses will require strong, centralized management and restrictions on further intensification of current human occupation and use.

Bearing those caveats in mind, it is nevertheless clear that it would be neither practical nor morally defensible to return to the old model of exclusionary "fortress conservation."

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[264] On the relationship of poverty and protected areas, see "Poverty and Protected Areas", Recommendation 5.29, Vth IUCN World Parks Congress, Durban, South Africa, 8–17 September 2003.

Successful protected areas management in the 21st Century must be built on a foundation of trust and cooperation with local communities and other stakeholders, which in turn can only be established with redoubled attention to the intertwined issues of governance, participation and equity.

3.2 Protected area governance: Towards quality and diversity

Governance refers to the combination of policies, practices and institutions, both explicit and implicit, which regulate public life. With respect to protected areas, both the quality and the structure of governance are central determinants of equity.

3.2.1 What is "good protected area governance"?

There are many existing and potential types of protected area governance, as discussed below. Whatever the governance type, however, certain principles of good governance apply, as they do in all areas of public affairs. Generally recognized attributes of "good governance" include respect for existing rights and the rule of law, as well as procedural elements such as informed public participation in decision-making processes, transparency in the provision of information, effective and impartial application and enforcement of rules by governing authorities, and systems by which authorities can be held accountable for their actions by the public. Good governance also implies a reasonable level of performance, implying vision, a clear sense of direction, and predictability with respect to both rules and decisions, to allow people to plan their affairs without the institutional ground shifting under them without warning.

Rigid adherence to rules and procedures, however impartial, does not in itself guarantee good governance. Substantive outcomes must be reasonably equitable as well, and this requires maintaining a constant balance between what is often termed the "letter" and the "spirit" of the law. In addition, good governance requires sufficient capacity to govern. Rules without the authority and resources to back them up are of little use. A weak protected area governing authority, even with the best of intentions, will generally fail to meet its objectives.

The importance of good governance for protected areas was extensively discussed at the Vth World Parks Congress, which set out five general good governance principles in one of its Recommendations: "Legitimacy and voice"; "accountability"; "performance"; "fairness"; and "direction." The Recommendation goes on to urge all those involved in the establishment and management of protected areas to implement those principles with particular attention to:

- Recognition of the diversity of knowledge systems;
- Openness, transparency, and accountability in decision-making;
- Inclusive leadership;
- Mobilizing support from diverse interests, with special emphasis on partners and local and indigenous communities;

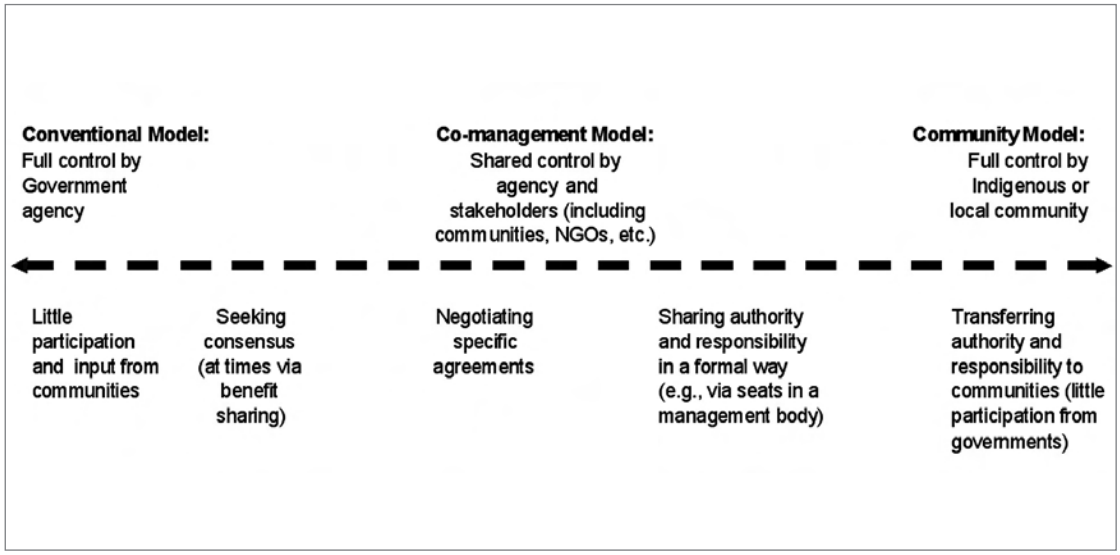
- Sharing authority and resources and devolving/decentralizing decision-making authority and resources where appropriate.[265]

3.2.2 Varieties of protected area governance

Ultimately, the effectiveness of protected areas comes down to questions of governance and management. Who has the authority over the area, what are their responsibilities, and who is accountable to whom? The classic model of a single national protected areas agency managing parks comprising lands or waters owned by the state – albeit still important – is only one governance and management option along a continuum of possibilities (see Figure 3.1) that currently exist. Other governance types exist and have proven effective in many cases around the world:

- Decentralized management by provincial/state or local government units;
- Co-management arrangements between governments and other stakeholders, including local communities;
- Community-conserved areas voluntarily established by indigenous peoples and local communities, whether legally recognized by governments or not;
- Protected areas owned and managed by private sector entities (both non-profit and for-profit).

Figure 3.1 Protected areas governance and management continuum



Source: Borrini-Feyerabend 1996.

These protected area governance types do not replace or conflict with the recognized IUCN categorization of protected areas by management objective. Rather, they provide

[265] "Good Governance of Protected Areas." Recommendation 5.16, Vth IUCN World Parks Congress, Durban, South Africa, 8–17 September 2003.

a useful second dimension of categorization as suggested in Figure 3.2. In the quest for effective and equitable management in an increasingly complex world, protected areas policymakers can draw on this growing wealth of options to develop a mixed "portfolio" that effectively responds to both conservation imperatives and the local socio-economic, political and cultural context. This new reality was internationally recognized by the 2004 protected areas decision of the Convention on Biodiversity, which called on Parties to:

> Recognize and promote a broad set of protected area governance types related to their potential for achieving biodiversity conservation goals in accordance with the Convention, which may include areas conserved by indigenous and local communities and private nature reserves. The promotion of these areas should be by legal and/or policy, financial and community mechanisms.[266]

Figure 3.2 A bi-dimensional model for classifying protected areas by IUCN Management Objective Categories and governance types

Governance type	A. Government Managed Protected Areas			B. Co-managed Protected Areas			C. Private Protected Areas			D. Community Conserved Areas	
IUCN Category (key management objective)	Federal or national ministry or agency in charge	Local/ municipal ministry or agency in change	Government-delegated management (e.g. to an NGO)	Trans-boundary management	Collaborative management (various forms of pluralist influence)	Joint management (pluralist management board)	Declared and run by individual land-owner	...by non-profit organisations (e.g. NGOs, universities, etc.)	...by for profit organisations (e.g. individual or corporate land-owners)	Declared and run by Indigenous Peoples	Declared and run by Local communities
I - Strict Nature Reserve/ Wilderness Area											
II – National Park (ecosystem protection; protection of cultural values)											
III – Natural Monument											
IV – Habitat/ Species Management											
V – Protected Landscape/ Seascape											
VI – Managed Resource											

Source: Borrini-Feyerabend 2004.

[266] UNEP/CBD/COP/7/21 Annex VII/28. See also "Recognising and Supporting a Diversity of Governance Types for Protected Areas." Recommendation 5.17, Vth IUCN World Parks Congress, Durban, South Africa, September 8–17 2003.

Decentralized government management

Many countries are undergoing a process of decentralizing authority and responsibility for the management of biodiversity and natural resources to sub-national levels of government such as states, provinces, districts and municipalities.[267] Often this is part of a more general decentralization of governmental powers and responsibilities. Protected areas have long been established and managed to some extent at sub-national and local levels, but this trend is accelerating rapidly, placing new responsibilities on local government units that are sometimes not prepared to carry them out.

Decentralization of protected areas governance and management has considerable potential advantages. Local governments may be more sensitive to the local situation and the needs and interests of key stakeholders. Management and enforcement may be more effective when their locus is closer to the ground. Local government officials are likely to be more aware of the local benefits of ecosystem services – such as watershed and coastal protection and soil retention – than are bureaucrats in a distant capital. Boundaries are likely to be set in greater conformity to local resource use. And, where local governments receive the rights to collect protected areas revenues along with the responsibility to manage them, their incentives to support protected areas may increase. Decentralization can also improve the efficiency and effectiveness of protected areas governance and management as some responsibility may be delegated to private entities, civil society organizations, or NGOs that have relevant capacity or expertise.

Decentralization can also, however, pose considerable threats to protected areas. In Indonesia, for example, rapid government decentralization over the past five years is widely cited as a major reason for rapidly increasing rates of illegal logging, agricultural encroachment and wildlife poaching in protected areas.[268] National or global conservation values are likely to be much less important to local officials than short-term revenues that may be obtained from logging, fishing and other uses of protected area resources. Financial and human resources may be severely limited, particularly when a system is in transition from a formerly centralized, top-down model. Lack of coordination among provincial/state governments can result in habitat fragmentation if central governments do not provide a unifying hand. And local government agencies may be less able to resist pressures from both business interests and local communities trying to encroach into protected areas for commercial or subsistence activities.

Most national governments therefore try to retain a clear role in setting management standards, ensuring that land allocation decisions are made in line with the ecological characteristics of the area, and providing a venue for appeals by disaffected stakeholders from local decisions and actions they perceive as inequitable or illegal. Thus, national governments usually maintain a functional, institutional link between parties responsible for national level policies and those responsible for planning and implementation at the local level.

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267 Gregersen *et al*. 2004; Dupar and Badenoch 2002; Ribot 2002; Wycoff-Baird *et al*. 2000; Lutz and Caldecott 1997.

268 Simarmata 2002; World Resources Institute/Forest Watch Indonesia 2002.

Co-management with various stakeholders, including local communities

Co-management can be generally defined as "a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources."[269] With specific reference to protected areas, it generally refers to:

> a partnership by which various stakeholders agree on sharing among themselves the management functions, rights and responsibilities for a territory or set of resources under protected status. The stakeholders primarily include the agency in charge and various associations of local residents and resource users, but can also involve non-governmental organizations, local administrations, traditional authorities, research institutions, businesses, and others.[270]

Co-managed protected areas (CMPAs) are characterized by a pluralist governance model, which can take many forms. There is tremendous variation in co-management arrangements, ranging from situations where local stakeholders essentially govern and manage a protected area with government only providing technical advice and support, to situations where most protected area functions are carried out by government, and local communities and other stakeholders sit on a management oversight board.

Establishment of CMPAs usually involves a process of negotiation among relevant parties that develops specific co-management plans for the protected area at stake and, usually, associated agreements, initiatives, by-laws, and multi-stakeholder management institutions. (See Box 3.4 for an example from Ecuador.) Typically, parties to the negotiation will bring to the table their varying perspectives on conservation objectives, the desirable nature and extent of power-sharing arrangements, and the equitable distribution of relevant costs and benefits. Parties to a co-management agreement can include state agencies, indigenous and local communities, NGOs, research institutions, tourism operators and other private sector interests. Negotiation of the relationship between the state on the one hand, and indigenous and local communities on the other, lies at the core of most co-management arrangements, particularly where long-standing local tenurial rights, livelihood needs, and cultural connections to the area are involved.

The process by which a protected area acquires co-management status may be more or less conflict-ridden. In many countries, and typically in Europe, co-management is enshrined in the legislation that establishes and regulates protected areas. Management boards are prescribed to have a certain composition, reserving representation to the social actors considered by the legislators to be the bearers of the most relevant entitlements and concerns. In other countries, co-management only comes about through protests and pressure on the state by other concerned parties, indigenous and local communities in particular.

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269 Borrini-Feyerabend *et al*. 2000.

270 Borrini-Feyerabend 1996.

Box 3.4 Co-management arrangements for the Galapagos Marine Reserve, Ecuador

Located approximately 1,000 km from the Ecuadorian mainland, the volcanic Galapagos Islands contain remarkable terrestrial and marine ecosystems and became, some years ago, the focus of complex and violent multi-stakeholder conflicts. Rapid economic and demographic change, the presence of unregulated industrial fishing, the appearance of high-value fisheries for Asian markets, state-imposed policy and regulations and general non-compliance with the management plan of the Marine Reserve were all factors fuelling conflict. In 1998, in response to national and international concern about the threats facing the islands, Ecuador passed innovative legislation through a Special Law that, among other measures, introduced controls on migration within the country, created one of the largest marine reserve in the world (*c*. 130,000 km²), prohibited industrial fishing, and established institutions for participatory management of the reserve. The creation of the Galapagos Marine Reserve was the fruit of an exhaustive local participatory planning process, which took two years (74 meetings of a multi-stakeholder planning group, two fisheries summit meetings and three community workshops) and produced a consensus management plan. The implementation of this plan, through a legally based participatory management regime, has been in progress now for more than five years.

The Galapagos co-management institutional arrangements include a local Participatory Management Board (PMB), an Inter-institutional Management Authority (IMA) and the Galapagos National Park (GNP). The PMB is made up of the primary local stakeholders whilst the IMA comprises both representatives of government agencies and local stakeholders. In the PMB, the members present specific management proposals (e.g. concerning regulations of fisheries and tourism) which are analyzed, negotiated and eventually agreed upon by consensus. The consensus-based proposals are forwarded to the IMA, and then to the GNP for implementation. Proposals that have gained consensus in the PMB carry significant weight at the IMA level. However, if no consensus is reached in the PMB, the different stakeholder positions are submitted to the IMA, where the decision is left in the hands of a majority of mainland ministerial officials. Local incentives to agree at the PMB level are therefore compelling. Nearly 100% of consensus-based PMB proposals are approved without modification by the IMA.

Source: Heylings and Bravo 2001.

The extent to which decision-making power is shared varies widely among different co-management arrangements. In some cases the contributions of non-state actors are invited only in the form of consultation (local social actors are informed and consulted, possibly through a council or other consultative body). In others, they are included in the management organization and given the opportunity to influence decisions, but only as a minority voice. In the strongest cases, indigenous and local community representatives – and other stakeholders – are included as members of a local management organization or board with decision-making capacity. In such cases, decision-making may be by majority vote or by consensus, a distinction with important implications. Where decisions are taken by vote, the composition of the voting membership is crucial to how, and to what extent power is shared.[271]

There is an extensive literature of analysis and case studies on both terrestrial and marine protected areas co-management,[272] including numerous testimonies to the efficacy

[271] Borrini-Feyerabend 2003.

of the approach. There is also a great deal of literature criticizing "Integrated Conservation and Development Projects", a model which is sometimes mistakenly taken as a synonym for co-management and/or community-based conservation (see Box 3.5).

Box 3.5 Are "Integrated Conservation and Development Projects" community-based conservation?

Some conservation professionals view community-based conservation approaches rather skeptically. Worah (2002) observes that "to a certain extent, skepticism is justified as, in recent years, there appears to have been far more rhetoric and enthusiasm about community-based conservation than practical and credibly documented examples on the ground." One reason for this situation is over-reliance by high-profile development agencies and some governments on the "Integrated Conservation and Development Project" (ICDP) model, which uses economic incentives to generate local support for protected areas.

The ICDP approach is based on the hypothesis that increasing incomes of local people automatically leads to reduced impacts on protected areas, but "in fact, the underlying assumption of such initiatives – that most biodiversity loss is caused through local overuse of natural resources by local communities – is flawed." While local economic incentives, properly understood and designed, certainly have a role to play, "it is well documented that wherever community involvement in protected area management has worked well, it has been facilitated by enabling policy and legislation, usually at the national level." It is thus best to:

> focus on the basic principles of community-based conservation which are to decentralise resource management to the local level, to put the appropriate system of incentives and the policy environment in place to enable this and to build capacity for local stewardship of natural resources. This would imply that the focus of community-based conservation initiatives needs to be on facilitating equitable negotiations between interest groups based on incentives and disincentives, check and balances and a supportive policy environment.[273]

A comprehensive study of ICDPs in Indonesia reached similar conclusions, arguing that:

> Most ICDPs are proceeding as if protected areas are failing because of increasing pressure from local people alone. This study suggests that the problems in protected areas run much deeper than this and will not be adequately addressed by community-level approaches that are not linked to broader reforms in protected area management – if not natural resource management in general.[274]

The well documented problems with many donor-funded ICDP projects, however, should not be taken as a condemnation of co-management and community-based approaches *per se*. ICDP projects make extensive use of "community-based" rhetoric, but often miss the point that a truly effective shift to community-based conservation is more about the sharing of power – and policy and institutional reforms to facilitate that sharing of power – than it is about the distribution of income.[275]

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[272] See Western and Wright 1994; McNeeley 1995; Borrini-Feyerabend 1996. For analysis of marine protected area co-management, see: White *et al*. 1994; Pomeroy *et al*. 1998; Parks and Salafsky 2001; and the links and resources available from the Locally Managed Marine Area Network at www.lmmanetwork.org.

[273] Worah 2002.

[274] Wells *et al*. 1999.

[275] Borrini-Feyerabend 2001.

Community-conserved areas

While government declaration and management – or co-management – of protected areas has been the norm in most countries, there are also significant numbers of "community-conserved areas" (CCAs) in many countries, where local and indigenous communities – not the state – have taken the initiative and declared what is, in effect, a protected area. CCAs can be defined as "natural and modified ecosystems including significant biodiversity, ecological services and cultural values voluntarily conserved by concerned indigenous and local communities through customary laws or other effective means."[276]

CCAs have three essential characteristics. First, the relevant local or indigenous communities are concerned about conservation and sustainable use of the ecosystem or ecosystems in their area, usually because they have either cultural significance or importance for local livelihoods. Second, the decisions and actions of the community result in effective conservation, although protection status may have been established for a variety of objectives, possibly unrelated to conservation *per se*. Third, the indigenous and local communities hold the decisive power over decision making and implementation of decisions regarding the ecosystems at stake, implying that some form of community authority exists and is capable of enforcing regulations.

The most distinctive element of CCAs is the fact that institutions of the community – not the state – hold legitimate authority, in the eyes of the community – over an area's conservation status and the actions taken to conserve it. In some countries – such as Australia and some countries in the Pacific and South America, the state has recognized CCAs and provided useful supporting measures, such as legislation prohibiting fishing in a community-declared marine sanctuary. In other cases, however, government "recognition" has meant the dilution of community authority or even supplanted CCAs with superimposed state forms of protected area status.[277]

Other common features of CCAs include the following:

- ***CCAs usually relate closely to the community's sense of identify and culture.*** The establishment of a CCA is closely linked to the purposes and aspirations of an indigenous or local community, and the CCA is part of their ethics, culture and approaches to livelihoods and maintenance of resources for future generations.
- ***CCAs are generally linked to the community's long-term livelihood strategies.*** CCAs are usually embedded in local strategies for broader land management, which means protection measures are often closely linked with spaces and activities dedicated to material and cultural production. Such strategies often safeguard complex ecological processes (migrations, genetic flows, etc.) that go beyond the border of protected areas, offering safeguards that can positively complement the conservation impacts of official protected areas.
- ***CCAs usually involve areas and resources under common property tenure and possess relatively simple procedures for administration and decision-making.*** CCAs are handled and sanctioned within community institutions, where the

[276] Borrini-Feyerabend 2003; Kothari 2004.

[277] Borrini-Feyerabend 2003.

community discusses the benefits and losses or trade-offs of different initiatives and makes decisions that are soon integrated into community norms. This concrete form of governance, effective as long as the community is culturally cohesive, does not substantially depend on external factors or structures.

- ***CCAs tend to safeguard the structural and functional features of ecosystems and the landscape.*** The identification of areas for protection in a CCA is not usually based mainly on valuation of biodiversity "exceptions" and uniqueness (endemism, rare species, etc.) but on values related to safeguarding structural and functional processes of ecosystems (wide strips of forests, zones of recharge, migration areas, etc.), which allow for the provision of goods and services to the community. In this sense, CCAs tend to ensure the conditions for the continuation of long-term evolutionary processes.
- ***CCAs keep financial and other costs at relatively low levels.*** CCA maintenance costs are normally covered for the most part by the economic activities, systems and structures of communities themselves. These costs, and especially the costs for surveillance and protection, are low compared to the costs of official, state-managed protected areas systems. Community labor inputs can be significant, however, and tangible benefits need to be achieved to justify such social investments by communities.[278]

Private ownership and/or management

In some parts of the world, private landholders allocate property for conservation purposes, sometimes incorporating tourism. In Natal Province in South Africa, for example, some 8% of the land is in publicly-managed protected areas, but an additional 14% is under conservation management by private landowners.[279] Such privately-owned or -managed protected areas are generally established in areas where there are sufficient attractions (such as coral reefs or visible wildlife) to ensure that non-consumptive use of the area's resources is a commercially attractive land use.

In the USA and some other countries, private land trusts are a significant and growing form of privately-owned and -managed protected area. The U.S. Land Trust Alliance defines a land trust as "a nonprofit organization that, as all or part of its mission, actively works to conserve land by undertaking or assisting direct land transactions." While land trusts use a variety of methods to protect land, two of the most commonly used are the purchase or acceptance of donations of land and the purchase or acceptance of donations of a "conservation easement" – a legal agreement that permanently restricts the development and use of land to ensure protection of its conservation values. Some land trusts acquire land and then convey it to another nonprofit organization or a government agency for permanent protection and stewardship.

As of 31 December 2000, some 2.5 million ha of land in the USA had been protected by 1,263 local and regional land trusts, a 226% increase over the 770,000 ha protected in 887 trusts as of 1990. Of the 2.5 million ha permanently protected, just over one million

[278] Borrini-Feyerabend 2003.

[279] McNeely 1999.

ha have been protected by more than 11,600 conservation easement agreements, a 475% increase over the 182,000 ha protected by conservation easements as of 1990.[280]

While not involving outright private ownership, there has also been considerable recent interest in the idea of private "conservation concessions" as a protected areas management strategy. In one formulation, "under a conservation concession agreement, national authorities or local resource users agree to protect natural ecosystems in exchange for a steady stream of structured compensation from conservationists or other investors."[281] In its simplest form, therefore, a conservation concession is like a logging or fishing concession, except that the investor pays the government to manage the area for conservation purposes rather than resource extraction.

3.2.3 Property rights and protected areas: The importance of tenure

Devolution (or restoration, in some cases) of tenurial rights over land and resources is a key element of many new approaches to protected area governance. Apart from the strong equity and rights-based arguments for restoring indigenous lands to their indigenous owners, it is also often argued that tenurial security – not only for indigenous peoples but also for local communities who may not hold the long-standing claims of indigenous groups – is an important incentive for conservation at the local level. Those with a long-term property interest, it is argued, are more likely to be good stewards of resources, avoiding the "open access" free-for-all that characterizes publicly-controlled but scantily-managed parks and other public lands, particularly in developing countries.[282] Under many co-management schemes, conservation agencies explicitly trade greater community tenurial control for community commitments to conservation objectives such as coral reef protection or reforestation.

The idea that granting communities tenurial rights in exchange for their commitment to observe certain rules and restrictions in the exercise of those rights – the *quid pro quo* that is at the heart of many co-management agreements – makes intuitive sense. In the case of long-standing indigenous and traditional land and resource rights, however, the argument is increasingly heard that "ownership is ownership": if a community's traditional claims over territory or resources are indeed valid, then the community has the right to do as it pleases with the area, regardless of the impacts on biodiversity and other factors valued by outsiders. It is understandable that many indigenous communities would be skeptical of such restrictive arrangements: for decades, they have watched while the state parceled out their territories and resources to outsiders who plundered timber, fisheries and other resources without regard for "sustainability" and without interference from the state. Now, suddenly, just as the state decides to recognize long-standing local claims, it puts forward a whole series of restrictions on those claims. There is no short-term solution for this problem: it will take years of good-faith actions by the state to help indigenous communities overcome the legacy of mistrust.

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280 Land Trust Alliance. www.lta.org/aboutlt/census.shtml. Accessed 23 April 2004.

281 Rice 2002.

282 See, for example: Lynch and Talbott 1995.

But the assertion that "ownership is ownership" is an oversimplification. Whether one looks to Western systems of property law or to the rich legacy of customary property law in indigenous communities, there are numerous shades and varieties of "ownership" over land and resources. Property rights may be bounded in time, restricted to certain uses, and limited in many other ways. And everywhere, the exercise of property rights is limited by considerations of public interest. One may hold full title to a house and land, for example, but not have the right to establish a toxic waste dump in the front yard. Similarly, an indigenous community might be granted a strong property right over forest in or adjacent to a protected area, but not the right to clear-cut watershed slopes, set fires during droughts, or exterminate protected species of fauna and flora.[283] Or, an NGO or other private entity may be granted a long-term lease, including significant management rights and powers, over a protected area that nevertheless firmly remains the property of the state. The Nature Conservancy, for example, in a joint venture with an Indonesian tourism venture, is testing this model at Komodo National Park in Indonesia.[284]

Bearing in mind that property rights are variable and rarely if ever absolute, it is clear that greater tenurial security for local and indigenous communities does create incentives for conservation, when tenurial rights are nested within an overall policy structure that enforces both tenurial rights and responsibilities. But tenurial security is not a panacea for conservation, as Sanderson and Bird point out in an extensive review of people-protected area interactions in Latin America:

> Tenure is not homogeneous, it does not revolve around purely economic models of transactions, and it does not necessarily yield better environmental outcomes under private regimes. Or at least the evidence is not strong or systematic enough to reach such categorical conclusions … Tenure security as a variable leading to better park protection should continue – not as an article of faith but as an interesting hypothesis, treated skeptically by policymakers.[285]

3.3 Participation: Recognizing rights and reconciling divergent interests

The nature and extent of participation in decision-making is perhaps the most important single element of protected areas governance, whatever the governance model. With respect to equity concerns, participation is both an end in itself – the equitable distribution of decision-making power – and an important means for ensuring that the costs and benefits of protected areas are shared equitably.

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283 Barber and Schweithelm 2000.

284 For information on the Komodo concession, see www.komodonationalpark.org. This initiative has caused considerable controversy. See, for example, WALHI, JATAM and AMAN 2004; "Jurassic Showdown", *Far Eastern Economic Review*, 16 May 2002.

285 Sanderson and Bird 1998.

3.3.1 Defining participation in the protected area context

Because the establishment of protected areas affects the livelihoods and interests of many people, groups and institutions, it is widely recognized that local participation is a key ingredient for success in protected area planning, design and management. Participation can take many forms, however, ranging from passive pseudo-participation to proactive self-mobilization (see Box 3.6).

Different levels of participation are appropriate for different communities and situations, but the key questions remain the same: "Does the participation enable the communities to have their voices heard? Does it enable them to assert their own ideas about what their needs and problems are, what solutions need to be found, and what resources made available? Does it enable the creation of a shared reality or system of

Box 3.6 A typology of participation

Passive "participation"	People participate by being told what is going to happen or has already happened. It is unilateral announcement by an administration or programme management without listening to people's responses. The information being shared belongs only to external professionals.
Participation in information giving	People participate by answering questions posed by extractive researchers and programme managers using questionnaire surveys or similar approaches. People do not have the opportunity to influence proceedings, as the findings of the research or programme design are neither shared nor checked for accuracy.
Participation by consultation	People participate by being consulted, and external agents listen to views. These external agents define both problems and solutions, and may modify these in the light of people's responses. Such a consultative process does not concede any share in decision-making and professionals are under no obligation to take on board people's views.
Participation for material incentives	People participate by providing resources, for example, labor, in return for food, cash or other material incentives. Much *in situ* research and bioprospecting falls into this category, as rural people provide the fields but are not involved in the experimentation or the process of learning. It is very common to see this called participation, yet people have no stake in prolonging the development activities when the incentives end.
Functional participation	People participate by forming groups to meet predetermined objectives related to the programme, which can involve the development or promotion of externally initiated social organization. Such involvement does not tend to be at the early stages of programme cycles or planning but rather after decisions have been made elsewhere. These institutions tend to be dependent on external initiators and facilitators but may become self-dependent.
Interactive participation	People participate in joint analysis, which leads to action plans and the formulation of new local groups or strengthening of existing ones. It tends to involve interdisciplinary methodologies that seek multiple perspectives and make use of systematic and structured learning processes. These groups take control over local decisions, so people have a stake in maintaining structures and practices.
Self-mobilization	People participate by taking initiatives independent of external institutions to change systems. Such self-initiated mobilization and collective action may or may not challenge inequitable distributions of wealth or power.

Source: Pimbert 2003.

meaning among the key players – as they work together in the mutual construction of a project?"[286]

The steps that need to be taken to ensure effective participation vary with different kinds of protected area decisions and interventions. The need for effective stakeholder participation arises, for example, at the stage of protected area system planning, when potential protected areas are being identified across a whole region or nation. To be realistic, system planning needs to take local socio-economic and political factors into account, not just ecological criteria. This can only be done effectively through systematic consultation with key local stakeholders, particularly local and indigenous communities.

At the level of a national systems plan, such participation is likely to be fairly general and cursory, due to the scope of systems planning exercises. At a minimum, protected area managers need to assess who are the key stakeholders, the nature of their resources uses and livelihood strategies, the existence of pre-existing rights (such as indigenous territories), and local views towards protection of a particular area.

As protected areas planning moves to the site level – and the objective moves from merely identifying areas of importance to planning and designing particular protected areas sites – the need for participatory processes becomes more acute, for several reasons. First, the decisions taken (e.g. where, if anywhere, hunting or fishing will be permitted) will often have concrete impacts on people's lives and livelihoods. Second, local communities are often in a position to ensure that a protected area will fail if they oppose its objectives and regulations. Third, local communities often possess detailed knowledge that can be crucial to successful management.[287]

Effective planning, design and legal establishment of protected areas must therefore be carried out through a governance structure and process that allows meaningful participation by all interested parties, and meaningfully responds to their concerns. "Consulting" an interested party – but then going ahead to do what was originally planned, regardless of opposition – is not an adequate strategy for resolving potential conflicts and eliciting the societal support that a successful protected area requires.

This is particularly the case today, where the varieties of protected areas governance and management extend beyond the model where a national government agency administers and manages an area of land or water owned and controlled by the national government. In short, planning and design of protected areas needs to encompass not just *what* needs to be done *where*, but must also address *who* will have the authority and responsibility to do it. To the extent that local or indigenous communities, local government agencies, or the private sector may in fact be the governing authority – or co-governing authorities under a co-management scheme – it is imperative that these stakeholders be involved in the initial planning and design of the protected area.

Gaining the consensus of key stakeholders, particularly local communities, in support of a protected area intervention is obviously very important for management effectiveness. At the same time, however, participatory planning processes carry risks: for

286 Pyhala 2002.

287 Davey 1998.

example, they can "trap managers between the 'unrealistic' aspirations of some groups, 'rigid' legislation, 'distant' supervisors and the impossible demands of donor and pressure groups."[288]

Participatory processes can also take a good deal of time, and can, in some cases, be self-perpetuating to the point where the clarity and finality of management decisions is compromised. Protected area policymakers and managers therefore need to carefully set out the parameters and processes for participation in ways that are sufficiently inclusive and accountable on the one hand, and adequately systematic and time-bound on the other.

3.3.2 Identifying and differentiating "stakeholders"

The first step in establishing a participatory process is determining who the relevant stakeholders are. "Stakeholders" in protected areas decisions might include: local and indigenous communities; protected area management authorities; other government agencies with natural resource portfolios; local administrative authorities (e.g. district or municipal councils and governments); local businesses and industries (e.g. tourism, water users); scientific research institutions; and non-governmental organizations. Referring to all such interested parties as undifferentiated "stakeholders," however, implies that all of their concerns and claims may be of equal strength and legitimacy, when this is rarely the case: "Not all stakeholders are equally interested in conserving a resource nor are they equally entitled to have a role in resource management. For the sake of effectiveness and equity, it is necessary to distinguish among them on the basis of some agreed criteria. Social actors who score high on several accounts may be considered 'primary' stakeholders. 'Secondary' stakeholders may score high only on one or two."[289] Some criteria for distinguishing among stakeholders are presented in Box 3.7.

In many cases, the most important distinction among types of stakeholders revolves around the question of pre-existing rights over territory or resources. Indeed, many indigenous peoples resist being categorized as just another "stakeholder", arguing that in fact, they are actually "rights-holders" based on long histories of traditional occupation, use of a particular area and its resources and, in some cases, treaties signed with occupying powers in the past.[290] In some countries, indigenous land and resource rights have been recognized in national law.[291] International law and some regional legal instruments also provide some support for this position.[292]

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[288] Scholte 2000, quoted in Thomas and Middleton 2003.

[289] Borrini-Feyerabend 1996.

[290] "The Indigenous Peoples' Declaration to the World Parks Congress." Vth IUCN World Parks Congress, Durban, South Africa, 8–17 September 2003.

[291] Some countries where indigenous rights over their traditional lands and resources have been recognized in national law include Australia, Brazil, Canada, Fiji, Finland, New Zealand, Papua New Guinea, South Africa, the USA, and a number of countries in Latin America.

[292] McKay 2002; Posey 1996.

Box 3.7 Possible criteria to distinguish among protected ares stakeholders

- legally recognized rights to land or resources
- customarily recognised rights to land or resources
- specific mandate by the state
- proximity to the resources (residents or neighbours)
- direct dependence for subsistence and basic economic resources
- historical, cultural and spiritual relations with the natural resources at stake
- continuity of relationship
- social equity (fairness) in access to resources and distribution of benefits from their use
- number of people bringing forth the same interests and concerns
- unique knowledge and skills for the management of the resources at stake
- losses and damage incurred in the management process
- degree of commitment, effort and resources invested in natural resource management
- actual or potential impact of the activities of the social actor on the resource base
- general recognition of the value of the perspective or position brought forward by the stakeholder (e.g. scientific validation, fitting the local knowledge system, aiming at sustainable use, following the precautionary principle, etc.)
- compatibility with the country's policies and body of law
- compatibility with international conventions and agreements

Source: Borrini-Feyerabend *et al.* 2004.

3.3.3 Facilitating participation

There is no one right way to facilitate effective stakeholder participation, since countries, cultures, and protected areas vary so greatly across the planet. The Philippines provides one interesting and relatively advanced model (see Box 3.8). There are, however, a number of considerations that protected areas planners may wish to take into account:

- **Defining problems and objectives:** All too often, the "conservation problem" in a particular area is defined solely by outsiders, without adequate discussion with local inhabitants and stakeholders. Problem definition leads, in turn, to identification of management objectives and the tools to reach those objectives. When scientists from outside an area define the problem as "biodiversity loss due to habitat degradation by local communities", for example, the proposed solution is often to establish a protected area and limit local consumptive uses of its resources. The scientists may be partly right, but an alternative local perspective – "the problem is that we are very poor, and are obliged to cut trees for the rich businessman in town who is a crony of the mayor, to make a living, even though it is destroying our water supply" – will lead to a very different set of management interventions. Protected area managers need to define problems and objectives jointly with local people and other stakeholders at the outset, if they are all going to speak the same language during further processes of participation and planning.

Box 3.8 Protected Area Management Boards in the Philippines: A model for participatory protected area governance?

Under the 1992 National Integrated Protected Areas System Act (NIPAS), the Philippines devolved primary responsibility for management of nationally-designated protected areas to multi-stakeholder Protected Area Management Boards (PAMBs). While many protected areas in the system do not yet have functioning PAMBs, the number is increasing. Where PAMBs are adequately funded and the full range of stakeholders is actively involved, they offer the best hope for instituting effective governance for the country's protected areas. The PAMBs may also offer a model that could be applied to a broad range of natural resource management concerns.

The country's protected area management authority, the Department of Environment and Natural Resources (DENR), does not have the capacity to effectively manage the nation's 360 protected areas, which cover 3.8 million ha and often suffer from serious land use conflicts and encroachment threats. PAMBs offer a model through which the DENR can enlist a wide range of stakeholders to support protected areas and provide concrete assistance for their protection and management. The PAMBs have been relatively successful in bringing together stakeholders in a forum where decisions are made in a transparent and accountable manner.

Most PAMBs have not, however, achieved a truly multi-stakeholder identity. The DENR is the chair of the PAMBs and executing body for the NIPAS Act, as well as the regulatory body issuing land and resource use permits. Thus at the local level, PAMBs are perceived as extensions of the DENR rather than as joint enterprises of local stakeholders, each with an equal say in its deliberations and decisions. One result is that local governments generally perceive protected areas as the responsibility of the DENR rather than as a responsibility of their own.

And although participation by community organizations, indigenous peoples' representatives, and local government officials is still limited, it is better than in the past – and in many cases is contributing to better working relationships. Increased discussions of protected areas and their problems among these stakeholders have also reduced broader conflicts over natural resource management.

Although PAMBs provide a potential model for local institutional coordination and stakeholder involvement in natural resource management – as well as the best hope for more effective governance and protection of the country's beleaguered protected areas – severe governance challenges remain:

- No mechanism defines and facilitates functional coordination among the DENR and other government entities and NGOs for protected area management.
- Overlaps persist between the Local Government Code and NIPAS Act with respect to the granting of resource use permits, collection of fees, and land-use development and enforcement.
- Local governments show limited willingness to give protected area management the same priority as other activities.
- The central government provides limited financing for protected area management, leading to heavy dependence on donor-assisted projects to finance most aspects of management – including the costs of making PAMBs functional.
- Mechanisms are general lacking to ensure coordination and harmonization between the decisions of protected area management boards and municipal councils.

Source: World Bank 2003.

- **Providing adequate information:** Participation needs to be informed, and this requires the provision of adequate information to stakeholders in advance of consulting with them. In doing so, planners need to remember that different stakeholders will have different levels of technical expertise and local knowledge. Biologists, for example, may know very little about the socio-economic situation in an area, while local and indigenous communities are likely to have little background in conservation science. In many cases, language may be a barrier, and key materials will need to be presented in appropriate local languages.
- **Community engagement in action research:** Provision of information through written materials and briefings may not be adequate to level the participatory playing field for some local and indigenous communities. One way to do so is through the various forms of "participatory rural appraisal" and community-based mapping that have been utilized in many countries and communities. By catalyzing a process and providing methods by which local communities can themselves analyze the condition and uses of – and threats to – their natural resource base, local capacities to articulate community interests and proposals can be significantly boosted.[293]
- **Fair representation in decision-making fora:** It is not always the case that a person or organization claiming to "represent" a particular stakeholder group is accurately representing the views of that group. This situation can arise, for instance, where NGOs claim to speak for local communities, indigenous leaders claim to speak for their peoples, or private sector industry association representatives claim to speak on behalf of their membership. This can cause problems later on, when, for example, protected areas authorities claim to have "consulted" with a local or indigenous community, but the community does not in fact feel that it was fairly represented in the planning process.
- **Facilitation:** The persons or organization facilitating the participatory process must be perceived as objective and fair. If the convener or facilitator is viewed as biased towards the interests of one or another group, the whole process will likely be dismissed by other stakeholders as "fixed" and therefore illegitimate.
- **Time and travel constraints:** Participation is expensive, particularly for local and indigenous communities. Taking time off from work for meetings is not an option for many rural people, unless the process is designed with their particular needs in mind, such as harvest or fishing times, key religious or cultural events, and the difficulty and expense of traveling, particularly in the remote rural areas where many protected areas are located. Local officials of poorly-funded protected area agencies and local government units may face similar problems.
- **Feedback and follow-up:** Effective participation in protected area planning cannot be conducted as a one-off event, after which planners can tick off the "participation" box on their list and get back to work. Participation needs to be viewed and managed as an ongoing process, in which planners listen to stakeholders' views and concerns and meaningfully respond to them. Participation is not a matter of holding a meeting; it involves establishing a credible and ongoing

[293] For an extensive library and links on participatory rural appraisal methods, see www.eldis.org/participation. For information on community mapping methods, see Poole 1995 and Momberg *et al*. 1996.

relationship among the key stakeholders. This is particularly important for situations where engaging the local community in managing the protected area under a "co-management" regime is the ultimate management objective.

3.4 Sharing protected area costs and benefits: Substantive equity

Good governance and effective participation are important preconditions for equitable protected areas management, but equity is manifested, in the final analysis, by substantive impacts on people's lives. This requires that that both the costs and benefits of establishing and managing protected areas are equitably distributed. In particular, local and indigenous communities should not be obliged to disproportionately bear the costs that establishment of a protected area may give rise to, while the benefits are enjoyed by others. So too, the benefits that may arise from a protected area – such as wildlife tourism revenues – need to be equitably shared.

There is no fixed definition of what is "equitable." Equity will vary depending on circumstances, and the purpose of effective participation, embedded within an effective and fair governance structure, should be to arrive at equitable and durable compromises through a process of negotiation. Reaching a mutual understanding of the full extent of existing and potential costs and benefits, however – and looking for ways to minimize the former and maximize the latter – is an important basis for reaching equitable outcomes.

Equity also has a dimension of scale. At the most local level, the concern is ensuring that those local communities in and adjacent to a protected area do not bear an undue share of the area's costs, and receive a fair share of any benefits it generates.

But local stakeholders are not the only actors who count. Downstream agricultural and urban water users, for example, reap very direct benefits from watersheds conserved in protected areas, but are rarely obliged to pay for this ecological service. Taxpayers may subsidize the operations of a national park, and have a legitimate interest in seeing it conserved and in enjoying its attractions as tourists. Conservation of globally important ecosystems and symbolic species like tigers and elephants are benefits legitimately valued by people who may live thousands of miles from a protected area, in another country.

Finally, equity demands not only fairness in the present and future allocation of costs and benefits, but also redressing past inequities. Many protected areas have been established through the displacement of local and indigenous peoples from their ancestral domains, or have severely restricted local uses of important livelihood resources. The slate of the past can never be thoroughly cleansed of past injustices, but neither should it be wiped clean without a fair effort to redress those injustices.

3.4.1 Minimizing and equitably sharing the costs of protected areas

Because many economic values of protected areas – such as ecosystem services and local uses of wild resources – do not register in formal markets or official balance sheets, protected areas are frequently viewed as incurring significant costs, primarily the cost of resource exploitation opportunities restricted or foregone.[294] This is particularly true in developing countries, where limiting the use of biological resources by putting them in a protected area:

> may be perceived by both land owners and the host country government as a foregone development opportunity, one of the few such opportunities available, and should be treated as such by its advocates and beneficiaries rather than as a global resource that the host country has an obligation to protect. To a tropical developing country facing limited options, a development opportunity may be as scarce and its loss as irreversible as endangered species and habitats are to the developed world. Once biodiversity conservation is viewed as a foregone development opportunity by both sides, the critical question is what would it take to compensate the host country for the lost opportunity.[295]

These opportunity costs are not as great as they are perceived to be by governments, of course, if they accept that protected areas have tangible economic values such as tourism revenues and the provision of ecological services. Some governments have come around to this perspective, particularly in countries such as those in Africa where wildlife tourism is big business. In other cases, governments realize the value of protected areas when they are confronted by the very real economic losses that arise when ecosystem services such as hydrological function and soil retention fail, resulting in floods, droughts, and water shortages.

Local and indigenous communities, however, often suffer direct economic losses when their access to biological resources (such as bushmeat, timber, non-timber forest products and access to agricultural land) is cut off by establishment of a protected area, or increased enforcement of an existing area's resource-use prohibitions. In many cases, as noted above, local and indigenous communities have been forcibly expelled from newly-established protected areas covering territories they had long inhabited, as happened to the Karrayu people in Ethiopia (see Box 3.9), and has been documented in many other cases throughout the world.[296]

While a protected area may produce considerable economic benefit for society at large in the form of ecosystem services or ecotourism revenues, the affected local people are in essence subsidizing those flows of values to the state and the wider society. Ensuring that the burdens of protected area establishment are not disproportionately visited on local communities bears a tangible financial cost that must be factored into management decisions. "Hence, conserving relatively intact habitats will often require compensatory mechanisms to mitigate the impact of private, local benefits foregone, especially in developing countries."[297]

Participatory and systematic protected areas design can minimize economic costs to local communities. Current protected area strategies, as embodied in the IUCN protected area categorization system, encompass a range of natural resource and human settlement intensities across the landscape, ranging from strict protection to "Category V" protected landscapes and seascapes where people live and use natural resources.[298] It is increasingly common for protected areas to be sub-divided into a number of zones within which

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[294] Barber 2004.

[295] Panayotou and Glover 1995.

[296] See, for example, the cases discussed in Colchester 1995; Borrini-Feyerabend 2003; and Cernea and Schmidt-Soltau 2003.

[297] Balmford *et al*. 2002.

[298] Phillips 2002.

Box 3.9 The Karrayu people and the Awash National Park, Ethiopia

The Karrayu are an Oromo pastoral group living in the upper Awash Valley, in the northern section of the Rift Valley. Traditionally they used three ecological zones: *ona ganna*, an open grassland used as a summer wet season grazing zone; *ona birra* a riverine strand of land along the Awash river used as autumn dry season grazing zone and including more than 15 holy grounds; and *ona bona* (winter dry season grazing zone), a shrub and grassland between the two. The movements of people and their livestock followed a cyclical pattern regulated by ritual requirements.

From the 1950s onwards, Karrayu land was leased by the government to private enterprises for sugar production and, later on, growing portions of riverine land were irrigated for commercial agriculture. Workers and farmer migrated into the area, while the Karrayu were deprived of their dry season pastures. In 1969 a hunting reserve was gazetted as national park. The Karrayu and their northern neighbours, the Afar pastoralists, were displaced from an area of about 76,000 ha, most of it in the critical *ona bona* and *ona birra* grazing area, with little compensation. As a result, Karrayu lands were reduced from 150,000 to 60,000 ha, much of that lying within the marginal *ona ganna* ecological zone. The rotational grazing pattern was disrupted as a result, producing serious ecological degradation on the Karrayu lands outside the national park boundaries.

To survive, both the Karrayu and the displaced Afar clans are periodically forced to lead their herds into the park, resulting in perennial conflict with the park managers. Shooting between the park guards and the pastoralists, and between the Afar and Karrayu pastoralists competing for the remaining pastoral resources, is taking place on a near-daily basis. Pastoral life has become totally unsustainable, and the Karrayu are taking up farming on unsuitable land or on the margins of the irrigated areas. Having completely lost access to their ceremonial grounds along the river, they have all converted to Islam.

The Karrayu are now caught in a permanent food crisis. The debate between stakeholders, mainly the park's management and representatives of pastoralists, has focused on access to water for livestock, with no agreement reached so far. Meanwhile, commercial farming is expanding inside the park's boundaries.

As the values and practices of the Karrayu are being eroded by an exclusionary model of conservation, the potential for effective conservation is being squandered as well. The area has good prospects for nature-based tourism, including a volcano, hot springs and wildlife. It also had immense potential for development of a co-management agreement that could build upon both park conservation objectives and Karrayu traditional management practices, restore and respect their sacred sites, re-establish sustainable grazing patterns, and develop new sources of tourism-based income.

Source: Bassi 2003.

different types of human occupation and use are allowed. Australia's Great Barrier Reef is one large-scale example of this approach. This kind of zoning is most likely to be successful when arrived at through a participatory process of community consultation. Community-based mapping methodologies are important tools for developing a zoning plan that local stakeholders will support and enforce.

It is naïve, however, to assume that conservation objectives and community rights and interests can always be resolved with a "win-win" solution. Tigers, for example, just do not get along with farmers and herders, and tiger conservation requires that quite large areas be essentially free of significant human pressure and habitation. Local fishing pressures on many coral reefs have reached unsustainable and destructive

levels, a situation that can only be reversed through the reduction in levels of local fishing effort and the establishment of "no-take" zones. As Redford *et al*. argue, the oft-heard generalization that "biodiversity *per se* can be both used and preserved" is all too often no more than a politically expedient cliché:

> The term biodiversity has very frequently been appropriated from its biological roots by political actors less interested in conserving the biosphere than in who gets to use the biosphere, under what property rules, and with what allocation of the losses and gains from use. As a result … [the term's uncritical use ignores] … the fact that biodiversity has different components (genetic, population-species, community-ecosystem), and different attributes (structure, function, composition) … [each of which is] … differentially affected by different types and intensities of human use. Ignoring the complexity of the term allows the politically expedient conclusion that humans can both use and save "biodiversity."[299]

As previously discussed, some types of anthropogenic disturbance are integral to the maintenance of biodiversity patterns of some ecosystems. But in many other cases, conserving biodiversity requires restrictions on human uses of natural resources, particularly where those uses are of a different type or at a higher intensity than traditional uses. If the state, conservation organizations, and the international community see tiger or coral reef conservation as a priority, they must be willing to compensate those communities who will thereby be left with fewer economic options and opportunities.

The rationale for providing compensation rests on two main arguments. First, local people should not have to bear major economic sacrifices to protect biodiversity resources of global benefit. Second, compensation (or appropriate substitutes) will reduce local people's economic need to exploit protected resources.

Compensation usually takes the form of cash payments, goods or services, which are provided in exchange for local people agreeing to relinquish their rights to exploit protected resources. In addition to compensation, other options include providing substitutes for specific resources to which access has been denied. For example, if a protected area was a former source of fuelwood or used for livestock grazing, wood lots and fodder banks outside the protected area might be considered adequate substitutes. Other forms of non-cash compensation and substitution include alternative sources of income to replace those no longer available due to the protected status of an area, species or resource. For example, direct employment for local people (e.g. wardens and guides), promotion of small enterprises, new skills training and low-interest loans are all being provided by the WWF Korup and Oban projects in Cameroon and Nigeria, and by the WWF Kikori Project in Papua New Guinea.[300]

Establishing mechanisms for compensation is not, however, an easy task, even when the political will and financial resources to do so exist. First, it is not always easy to determine which communities or individuals within communities will bear the costs of a protected area. As soon as word of potential compensation reaches a community, the line of claimants – some legitimate, some probably less so – will always grow

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[299] Redford *et al*. 1998.

[300] Spergel 1997.

quickly. If the government decides who will be compensated, it will be accused of being arbitrary by those who are left out. If the decision is delegated in whole or in part to traditional or other community authority mechanisms, however, it may well reinforce inequities of power within the community along lines of gender, caste, or local political power.

Second, establishing the level of costs to be compensated is not always straightforward. If people hold legal title to land that is to be included in a park, its fair market value can be assessed relatively easily. But whether people should be obliged to sell their land at market value, whether they want to or not, is a sticky legal and political question that will vary from country to country and place to place. The situation becomes even more complicated when the communities in question do not hold formal legal rights over land (as is the case for many indigenous land rights claims), or the costs relate to use of particular resources (such as bushmeat or timber) rather than to land itself.

Third, there is no one "best" method for delivering compensation. Cash payments to individuals may be appropriate in some cases, but in others, where traditional communities may live largely outside the cash economy, cash payments can have significant negative cultural repercussions. Cash payments through community institutions may work in some cases, but only where appropriate institutions exist (or are established, such as trust funds), and are trusted by their intended beneficiaries. Payments in kind – such as the provision of community health and education services, or improved transportation infrastructure – may be a more cost-effective long-term investment in the community as a whole, but will not compensate particular families for their short-term losses of livelihood resources.

Fourth, not all the costs that a protected area may visit on local communities are economic. It is difficult to assign a "market value" to, for example, an indigenous sacred site, and even the attempt to do so strikes many people as inappropriate. One could easily quantify the market economic value, for example, of Notre Dame Cathedral in Paris, in terms of the building, its furnishings, the land that it stands on, and the economic activity it generates as a religious facility and tourist attraction. One could then make a judgment that its economic value is less than an alternative use of that site, such as a high-rise office tower or amusement park, but such a proposal would strike most people as absurd and offensive. Denying an indigenous community access to one of their sacred sites (or denying them the right to deny access by outsiders) because it is included within a protected area is equally offensive in the eyes of that indigenous community. This is not a cost that can be compensated with money.

Finally, as noted above, many indigenous and local communities have already suffered considerable losses in the past due to the establishment of protected areas, and indigenous peoples in particular have increasingly called for restitution. This was recognized by the Vth World Parks Congress *Durban Action Plan*, which calls for "participatory mechanisms for the restitution of indigenous peoples' traditional lands and territories that were incorporated in protected areas without their free and informed consent [to be] established and implemented by 2010."[301]

[301] IUCN 2003.

Restitution for past injustices is intuitively essential to equity in some degree, but governments are largely reluctant go down that path, with a few exceptions.[302] There are many practical problems as well. How far into the past should such an inquiry stretch? Can sufficient evidence be offered, particularly when looking back 50 years or more? Who in this generation should benefit – and who should pay – for wrongs committed long ago? In addition, indigenous lands have been taken by dominant cultures for many reasons – primarily agriculture, mining, commercial forestry, and other large-scale economic activities. Singling out protected areas in this regard therefore appears to be mainly a strategy of convenience, in light of the political weakness of protected areas agencies relative to large-scale agricultural and industrial interests and the government agencies concerned with them. Nevertheless, as the South African example discussed in Box 3.10 illustrates, restitution can be done in ways that both redress past injustices and establish a more durable basis for a protected area's future integrity.

Compensating indigenous and local communities for the costs they may incur from the establishment of protected areas is clearly not a simple matter, nor is it one for which there are guidelines of general application. As discussed earlier, the legal and political situation of each country is different, as are the cultures and histories of local communities and the characteristics of protected areas. At a minimum, though, protected area managers and policymakers need to establish the principle and policy that costs should be equitably distributed, and put in place mechanisms to determine those costs, identify those who are bearing them, and find mutually agreed solutions for compensation.

3.4.2 Sharing protected area benefits

The complex question of equitably distributing costs is made somewhat simpler when the distribution of benefits is factored in, since distribution of benefits that a protected area produces can, in many cases, help compensate for the costs. While costs and benefits are separated here for analytical purposes, they will almost always be dealt with simultaneously in the real world.

Protected areas provide a wide variety of direct and indirect values, only some of which are captured by markets.[303] A sub-set of these provide tangible economic benefits that either generate income or have the potential to do so. These benefits are of most interest to protected areas managers and local stakeholders alike. They can be divided into values that directly generate cash benefits, and the values of some ecosystem services which have that potential, although it has not been exploited in most cases.

Direct income-generating benefits

Recreation and tourism: Many protected areas have considerable direct economic value that arises from their use by tourists such as hikers, campers and scuba divers. While park entry fees are one obvious indicator of this value, it is also important to consider the total

[302] McKay 2002.

[303] See: Barber 2004; IUCN 1998.

Box 3.10 Restitution for indigenous lands and resources incorporated into protected areas: A South African case

The Khomani San people were evicted from the Kalahari Gemsbok National Park (GKNP) – now renamed the Kgalagadi Transfrontier Park – soon after its establishment in 1931 and were dispersed over a wide area today comprising South Africa, Botswana and Namibia. The Khomani San initiated legal proceedings in South Africa's Land Claims Court under the post-apartheid Restitution of Land Rights Act of 1994. In their pleadings, they claimed traditional rights in and to a vast area of some 4,000 km^2 based on the anthropologically-proven hunting and gathering territories of the Khomani San, including about half of KGNP, where they claimed 125,000 ha of "ownership rights." The case was concluded in 2002, with the Khomani San being granted the following rights:

- ***Ownership*** of 25,000 ha on the southern boundary of the Park, within which area they will be relatively free, within the limits of a "contract park agreement", to carry out cultural practices, to hunt, collect bush foods, and conduct ecotourism ventures. It is accepted by the Khomani San that no permanent settlements will be allowed in the Park.
- ***Priority commercial use*** of the area between the owned area and the Auob River. In this Zone the Khomani San are entitled, in addition to all cultural practices, to formulate and conduct ecotourism projects, in partnership with South Africa National Parks (SANP) or other partners.
- ***Symbolic and cultural use*** of an area comprising about one half of the South African section of the Park, namely about 4000 km^2 in the southern section of the Park. This right means in effect that the Khomani San are able to use the entire area of their traditional and ancestral use for non-commercial purposes.
- ***Commercial opportunities***. SANP has recognized that the Khomani San heritage is and should be inextricably linked with the identity of this section of the Kalahari ecosystem, and intend to find ways to give substance to that notion. A jointly-owned (Khomani San and SANP) commercial lodge at the confluence of the Auob and Nossob rivers has been agreed in principle, at which Khomani San will be employed not only as trackers but also in other capacities. Further commercial opportunities are being discussed at present, where guests will be able to explore the Kalahari through the eyes and experience of the Khomani San.

The entire Khomani San/SANP enterprise is now subject to a contractual "joint management" regime comprised of elected Khomani San individuals with appropriate skills, as well as representatives from a council of elders who bring their deep knowledge of the traditional areas and cultural practices to the management partnership. The effort is drawing on joint management partnership experiences from other countries, such as Australia, Canada and New Zealand.

This case illustrates that restitution of indigenous lands previously appropriated for a protected area can indeed be carried out, even when dealing with events of 70 years ago. Furthermore, it illustrates that the equitable resolution of such claims can form the basis for co-management arrangements that strengthen local support for conservation objectives, while improving local livelihoods.

Sources: Chennells 2002; McKay 2002.

economic input of tourists into regional and local economies, including travel and accommodation costs, and employment generated in local communities.

Sustainable use of renewable resources: Some categories of protected areas permit the sustainable harvesting of certain renewable natural resources. Such activities may

include: grazing of livestock; fishing; hunting; the collection of non-timber forest products; agriculture; water extraction and the collection of genetic resources for both scientific and commercial purposes. Many of these values are of particular importance for local and indigenous communities living within or adjacent to protected areas, especially in developing countries.

Education and research: Protected areas offer some of the best opportunities to understand and explain natural ecosystem processes. They also offer a natural baseline against which to measure environmental change. Scientific and academic institutions are therefore often willing to pay for the opportunity to conduct research within protected areas. Some protected areas have also entered into contracts with researchers for exploration of genetic resources for the development of commercial products such as pharmaceuticals ("bioprospecting"), an option with some potential to generate significant financial benefits.[304]

Ecosystem services benefits

Water services: Protected areas are widely used as a form of watershed protection, guaranteeing the supply of water to adjacent populations. Many wetland areas and other natural ecosystems have been observed to play a role in water purification. The presence of natural vegetation, notably forests and wetlands, also reduces extremes of water flow and hence plays a role in flood control. These water services have very tangible economic value, but that value is seldom captured by markets in ways that would allow a financial benefit to be shared. Some innovative schemes are, however, beginning to charge downstream users for part of the cost of maintaining water services in protected areas and other upstream areas.[305]

Physical processes: Certain habitats such as saltmarshes, mangroves and coral reefs are widely cited for their role in coastal protection, with one study in Indonesia estimating the coastal protection value of coral reefs to be as high as US$550,000/km^2 in some areas.[307] In terrestrial areas the presence of protected areas, even relatively small areas along waterways or in strips along hillsides, has an important role in reducing soil erosion.

Climate influences: Protected areas play a critical role in mitigating the impacts of climate change, acting as carbon reservoirs or sinks. A number of efforts are underway to develop "markets" for carbon sequestration, a development which may result in a new benefit stream that protected areas can tap.[308] Many protected areas also play an important role in maintaining micro-climatic or climatic stability, including rainfall patterns.

Wider ecological influences: Spillover of animals from protected areas into adjoining land and water can support adjacent extractive uses. This is particularly the case in marine environments, where even relatively small marine protected areas have been shown to increase the abundance of fish and other marine life in adjacent fishing grounds.[309]

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304 Laird *et al*. 2003.

305 Pagiola *et al*. 2002; Johnson *et al*. 2002.

307 Cesar 1996.

308 Totten 2001; Davis 2000.

309 Gell and Roberts 2002.

Benefit-sharing mechanisms

Many of the methodological issues that attend the equitable distribution of protected areas costs also arise in the development of mechanisms to distribute benefits. Who is entitled to share the benefits? Should they be distributed to individuals, families, or community institutions? Should benefits be distributed in cash (e.g. a fixed share of entrance receipts), in kind (e.g. provision of community services and infrastructure), or by way of special rights and claims (e.g. ecotourism or sales concessions, or special rights to use certain resources within a park)?

More fundamentally, the extent and nature of benefits need to be negotiated, not imposed. Several recent studies of protected areas in Africa where conservation partnerships with local communities involved sharing of benefits revealed that "local communities were offered a predetermined package of privileges, which they have not truly been able to negotiate … equity [however] requires that a partnership is not dictated from above, but developed through a negotiated, joint decision-making process."[309]

As a general matter, it make sense to channel benefits more towards long-term, community-wide investments than through short-term cash payments to individuals or families – as opposed to where local costs are being compensated. This is because claims for losses suffered (e.g. loss of access to particular land or resources) are likely to be more specific to particular individuals and settlements than the more generalized claim for a more equitable share of benefits that a protected area generates. The Khomani San case in South Africa (see Box 3.10) provides a good example of how compensation of costs for past losses and allocation of future benefits can come together. The Khomani San's rights over their traditional lands were restored as a way of compensating them for their past losses. At the same time, they were also allocated a preferential opportunity to reap future benefits expected to arise from a growing ecotourism industry in the park.

3.4.3 "Pro-poor conservation"?

Some conservation and development practitioners argue that truly incorporating equity concerns into protected areas requires significant reorientation of objectives, not just the employment of novel methods and mechanisms for enhancing and distributing benefits. They argue for a new model of "pro-poor conservation", which emphasizes an approach that is locally driven, people-centered, and rooted in goals of improved local livelihoods. This approach seeks to redefine the goal of conservation, moving further along the continuum from "conservation through poverty reduction" – poverty reduction as a means for conservation – towards "poverty reduction through conservation" – conservation as a means to reduce poverty (see Box 3.11).

Pro-poor conservation is thus about harnessing conservation to deliver on poverty reduction and social justice objectives, and can be defined in a number of ways:

- By ***outcomes*****:** Conservation that delivers net benefits to poor people.
- By ***process*****:** A progressive change in the practices of conservation organizations

[309] Borrini-Feyerabend and Sandwith 2003.

Box 3.11 Continuum of approaches to conservation and poverty alleviation

Type	Components	Examples
Conservation through poverty reduction	Recognition that poverty issues need to be addressed in order to deliver on conservation objectives. Poverty is a constraint to conservation.	Alternative income generating projects; many integrated conservation and development projects; many community-based conservation approaches
Compensation for, and mitigation of, negative impacts of conservation on poor people	Conservation agencies recognise that conservation can have negative impacts on the poor and seek to provide full compensation where these occur and/or to mitigate their effects	Social impact assessments prior to protected area designations; compensation for wildlife damage; provision of *locally acceptable* alternatives when access to resources (water, grazing, fuelwood etc) lost or reduced or compensation for opportunity cost of land foregone.
Conservation that generates benefits for poor people	Conservation still seen as the overall objective but designed so that benefits for poor people are generated	Revenue sharing schemes around protected areas or wildlife tourism enterprises; employment of local people in conservation jobs
Poverty reduction through conservation	Poverty reduction and social justice issues are the overall objectives. Conservation is seen as a tool to deliver on these objectives	Conservation of medicinal plants for healthcare, wild species as food supplies, sacred groves, pro-poor wildlife tourism

Source: Roe and Elliott 2003.

– from using poverty reduction as a tool for better conservation to using conservation in order to deliver on poverty reduction.

- By ***actions:*** Conservation strategies that are explicitly designed to address the challenge of poverty reduction and development strategies that recognise the role of biodiversity conservation.
- By ***drivers*****:** Conservation that puts poor people and their priorities at the centre of decision-making.[310]

Extensive field research in Africa by DFID (the United Kingdom's foreign aid agency) indicates that in areas where wildlife "safari" tourism is big business, there is great opportunity to better address poverty reduction and at the same time improve protected areas effectiveness (see Box 3.12).[311]

There are both moral and practical reasons for protected areas policymakers and managers to move in the direction of more active "pro-poor" conservation. Morally, it is difficult to justify conservation for its own sake in places where local people are living in misery. Practically, as noted above, protected areas cannot long survive the pressures of impoverished adjacent populations. In addition, the international aid community has,

310 Roe and Elliott 2003.

311 DFID 2002. See also Koziell and Saunders 2001.

Box 3.12 "Pro-poor conservation" and wildlife tourism in East Africa

Wildlife tourism in East Africa has significant potential for growth, and could provide an important vehicle for sharing the benefits of protected areas, and wildlife conservation generally, with the region's poor. To realize this potential, governments and their aid donors will need to approach the development of the industry with a strategy containing the following elements:

- Tourism development objectives that include the goal of stimulating local economic development;
- Product development plans that include rural/cultural/adventure/community tourism, or other products suitable to development in poorer areas and by small scale entrepreneurs;
- Consultative tourism planning procedures that increase access by the poor to tourism markets, infrastructure and services;
- Concession or licensing procedures that include pro poor criteria in the allocation of bids/sites;
- Commercial regulations that (i) do not discourage development unnecessarily; (ii) are not biased against poorer (and less well-connected) entrepreneurs; and (iii) encourage pro poor measures in business practices;
- Land tenure and resource rights that give the poor an asset base of commercial value;
- Regional economic policies, rural regeneration policies, and local land-use planning that assess the potential for tourism and identify ways to develop it at priority sites;
- Devolution of rights and revenues across levels of government that provide incentives, not discouragement, for councils and local bodies to invest in tourism;
- A national economic policy framework that includes realistic assessment of comparative advantage in tourism;
- Effective linkages between tourism and economic development departments, and poverty reduction strategies and processes that set out how to make economic growth more pro-poor;
- Approaches to conservation and CWM that exploit the economic potential of wildlife in sustainable ways;
- Linkages between national protected areas and nearby entrepreneurs – in terms of transport, infrastructure,
- Procurement of local supplies for services within park boundaries, providing marketing and/or operational sites for local businesses (taxis, crafts), 2-way flow of information, and shared expectations of how park staff and any private concessionaires operate;
- National strategies that harness the international conservation agenda and flow of funds for international public goods, rather than let it dominate the agenda for wildlife use;
- Analysis of the trade-offs between meeting conservation commitments (huge protected areas and restrictions on wildlife use);and poverty goals, and of how tourism revenue can help balance the trade-off.

with the adoption of the UN Millennium Development Goals in 2000, largely united around an agenda that puts reduction of poverty, hunger and disease at the center of the international development agenda. Given the dependence of protected areas in many developing countries on continued international aid, protected areas policymakers ignore the anti-poverty agenda at their own financial peril.

Nevertheless, protected areas policymakers and managers should treat the call for pro-poor conservation with some caution. Some protected areas – such as those with significant wildlife- or dive-tourism potential – may indeed be able to serve a significant poverty reduction purpose while still meeting their biodiversity conservation objectives. In other cases, however, a protected area may not have significant commercial potential, due to lack of marketable ecotourism attractions, isolation, or the presence of especially sensitive or endangered species and habitats. And, as noted at the outset, protected areas should not be pushed into a situation where their whole rationale for existence is dependent on their ability to reduce poverty in surrounding human communities. As described in Boxes 3.10 and 3.12, however, there are a range of approaches for reconciling conservation and poverty reduction that can be fit to particular circumstances.

3.5 Summary

Establishing comprehensive and effective protected area systems requires responding to socioeconomic and institutional as well as biophysical global change. First, more attention must be paid to broadening the spectrum of governance models and mechanisms beyond the centralized, state-managed parks that currently dominate protected areas practice. Second, more effective and diverse protected areas governance requires participatory decision-making and management processes that incorporate and respond to the interests of a broader range of stakeholders – particularly the indigenous and local communities living in and around protected areas. Third, these new models and methods for governance and participation need to ensure that both the costs and benefits of protected areas are shared equitably.

A greater shift to community-based management is a central element of these transitions for numerous reasons, both moral and practical, although it should not be viewed as a panacea. The challenges facing protected areas in the 21st Century require a diversity of approaches, ranging from community-managed initiatives with a substantial focus on poverty alleviation to state-led efforts to conserve relatively unpopulated, undisturbed large tracts of natural habitat.

Planning and design of protected areas should encompass not just *what* needs to be done *where*, but must also address governance – *who* will have the authority and responsibility to do it. The classic model of a single national agency managing lands and waters owned or controlled by the state – albeit still important – is only one governance and management option. A number of other options exist, including decentralization to sub-national government units, co-management arrangements between government and other stakeholders, community-conserved areas governed by indigenous or local communities, and ownership or management by the private sector or NGOs. Questions of tenure – ownership, access and control – over conservation areas loom large in protected areas governance, and often influence the success or failure of conservation efforts.

Local participation is a key ingredient for success in protected area planning, design and management. There is no one right way to facilitate effective stakeholder participation, but there are a number of core issues that all protected areas managers will need to consider, including identifying and defining the roles and rights of various stakeholders,

defining issues and objectives, establishing a fair and effective participatory process, and devising mechanisms for follow-up to decisions reached in that process.

While appropriate governance models and effective participation are important preconditions for equitable protected areas management, equity ultimately depends on the equitable distribution of the costs and benefits of establishing and managing protected areas. At the most local level, the concern is ensuring that those local communities in and adjacent to a protected area do not bear an undue share of the area's costs, and receive a fair share of any benefits it generates. But local stakeholders are not the only actors who count. Protected areas provide a range of national and global benefits valued by people who may live far from a protected area, but who nevertheless have a legitimate interest in its conservation. In some cases, equity demands not only fairness in the present and future allocation of costs and benefits, but also redressing past inequities. Sharing protected area benefits requires the establishment of mechanisms to distribute benefits locally from income generating activities as well as education and research.

These issues of governance, participation and equity can be confusing and complex for protected area managers, who may lack the relevant background, training or inclination to deal with them, but they must deal with them nonetheless. As a society, we increasingly ask mining companies, for example, to consider the environmental impact of their activities, although they may feel that "we are miners, not environmental specialists!" By the same token, protected areas mangers and other conservation advocates must take up the challenges of governance, participation equity and benefit sharing if they are to succeed in what they may see as their core conservation mission.

They need not do it alone, however. Mining companies increasingly finding themselves working with environmental specialists and advocates – no matter how rocky that partnership can be – because it is in their own interest. So too, protected areas specialists need to reach out to those in the development community, organizations experienced in catalyzing participatory processes and, most importantly to the indigenous peoples and local communities whose good will and partnership are essential for the success of protected areas as we move into an era of unprecedented global change.

4. Building capacity to manage protected areas in an era of global change[312]

4.1 Introduction

Previous chapters have outlined the challenges to the future of protected areas posed by global change factors, and have discussed the types of action needed to meet those challenges. To take action, however, protected areas managers – and the systems and societies within which they operate – must possess appropriate and adequate capacities to do so. This chapter reviews the range of capacities that protected areas managers and policymakers need to develop in order to manage adaptively in the face of global change.

4.1.1 What is "capacity"?

Capacity can be defined as the ability to perform functions, to solve problems, and to set and achieve objectives. The capacity to manage protected areas must be strengthened at three distinct levels – societal, institutional, and individual. This includes (1) developing an enabling environment through sound legal and policy frameworks and through societal recognition of the benefits of protected areas and the value of the services they provide; (2) establishing and supporting institutions with adequate resources to implement management plans and strategies; and (3) enhancing knowledge, skills and competencies to identify and address threats and opportunities.

These layers of capacity are interdependent, and overall capacity is a function of all of them together. One way to visualize this complex structure is to see key elements such as policies, legal and institutional frameworks, personnel and financial resources and systems for planning and management as "building blocks." The "mortar" of supportive institutional cultures in turn holds these together, along with effective stakeholder participation, favorable economic conditions, and many other factors. The key to developing capacity over the long term is to build the whole structure by achieving a critical mass of these contributing elements. Focusing on just a few might be compared to laying a few strong "bricks" in a wall destined to crumble.

Capacity development is the process of "transformation or change by which individuals, institutions, and societies develop their abilities, both individually and collectively, to perform functions, solve problems, and set and achieve their own goals."[313] It can be defined only in relation to a desired outcome – that is, capacity *for*

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what? Developing capacity to manage protected areas effectively involves establishing objectives, identifying bottlenecks or capacity limitations that constrain the achievement of those objectives, and bringing appropriate resources to bear to overcome those constraints. The needed resources may include, but are not limited to, knowledge and skills, human, technical, and financial resources, societal support, and appropriate legal, judicial, and institutional frameworks.

Over the past four decades, much has been learned about how to develop capacity. In general, we can say that it is more useful to design programmes that help people acquire knowledge they perceive as needed, than to prescribe what they should know. We have learned that the circumstances of different countries are distinct, and the experience of one is seldom directly relevant to another. Thus, the process of capacity development involves continual adaptation and experimentation. Modern communication allows millions of individuals, organizations and even entire societies to share ideas, information and knowledge across traditional boundaries. The urgent questions now faced are how best to make information and knowledge available; how to help managers and stakeholders sort through the mass of existing information to connect with ideas and experiences that are of most significance to them; and how to promote the development of needed support systems that encourage innovation and creative solutions.

The need for ongoing learning and modification becomes particularly relevant when one factors in the increasing impacts and implications of global change. There are many immediate capacity-building needs for protected areas that would demand our attention even in the absence of rapid global change. The global change factors discussed in Chapter 1, however, demand the development of new skills and capacities often quite different from those needed by protected area managers of the past. Most broadly and fundamentally, we need to develop the capacity to manage not for a static world, but rather to manage adaptively in a world of continual and in some cases accelerating global change.

4.1.2 Adaptive management

Most fundamentally, protected area managers need to develop the capacity to manage flexibly and innovatively, modifying approaches and methods as required by the new challenges thrown up by processes of global change. "Adaptive management" is an approach to planning and management that analyzes problems systematically, and draws out lessons from experience. The three basic elements of adaptive management include:

- *Testing assumptions* – systematically trying different interventions to achieve a desired outcome;
- *Adaptation* – systematically using the information obtained through monitoring to take action that improves efficiency and effectiveness of management;
- *Learning* – systematically documenting actions, processes and results so that

[313] Hough 2003.

lessons can be integrated into institution-level decision making and shared with broader practitioner and academic communities.[314]

Although the concept has been in use for more than two decades,[315] adaptive management continues to evolve as it is applied to the context of conservation. Over time, the recognition that change in the natural environment affects how people use resources, and vice versa, has led to the need for innovative management systems that organize relationships between people and nature.[316] Adaptive management of protected areas, therefore, requires that managers and decision-makers study the changing relationships between ecosystems, social systems, and land and natural resource use, and apply this information to new strategies and actions for reaching conservation objectives. Managing protected areas adaptively promotes a style of management that welcomes and fosters experimentation, learning by doing, and sharing of experience with others facing similar challenges.

Building capacity for effective and adaptive management of protected areas requires action in five areas:

- Establishing a supportive policy and legal framework;
- Developing strong institutions and capacities for protected areas planning and management;
- Strengthening the skills and abilities of protected areas managers;
- Securing adequate and sustainable financial resources;
- Building greater public awareness of and support for protected areas.

4.2 Building a supportive policy and legal framework

For protected areas to be successful and sustainable in the long-term, they must exist within a supportive legal and policy framework. As nations individually and together as a global community analyze and establish priorities for expanding and strengthening protected area networks in the face of global change, the legal, social and political mechanisms for implementing such national and international decisions must also be considered.

As noted in previous chapters, an international policy framework on protected areas has developed quite rapidly over the past few decades. International agreements such as the Convention on Biological Diversity, World Heritage Convention, Ramsar Convention, and many others provide considerable general policy guidance for action at the national level, and have served to catalyze additional funding. The burden for implementing international principles and agreements, however, still falls to individual states, and is therefore ultimately dependent on the political will, capacity and actions of national and sub-national actors and institutions.

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314 Salafsky *et al*. 2001.

315 The concept of adaptive management of the environment was initially proposed by Holling (1978).

316 Oglethorpe 2002.

As the guarantor of the public interest, the State holds the ultimate authority and responsibility for establishing the policy, legal and management framework for protected areas. Despite numerous international commitments, however, protected areas policy is not high on the agenda of most countries, whether developed or developing. Rather, protected areas are often considered marginal to other areas of policy, including agriculture and economic development.[317] Furthermore, few national development plans have recognized and incorporated protected areas as potential mechanisms for alternative community and rural development strategies and conservation. Indeed, social and economic policies are frequently in direct conflict with conservation and protected areas regulations.

So what actually constitutes a "supportive policy framework"? Political and legal systems vary so greatly around the world that it is impossible to prescribe a "one size fits all" approach. Nevertheless, we suggest that there are three key dimensions that all countries must confront:

- Articulating a general national policy on the conservation and sustainable use of biodiversity;
- Enacting specific legal provisions governing the establishment and management of protected areas, including attention to "horizontal" coordination among sectors to resolve and minimize inevitable conflicts between conservation and use of natural resources and "vertical" coordination of the relative authorities and capacities of central versus sub-national units of government;
- Ensuring sufficient will and capacity to implement and enforce protected area policies and regulations in the field.

4.2.1 Policy frameworks for protected areas

The Convention on Biological Diversity (CBD) has been an important catalyst for development of national frameworks on biodiversity generally, including protected areas. CBD Article 6 creates an obligation for countries to carry out national biodiversity planning, including consideration of how biodiversity concerns can be integrated into relevant production sectors (such as agriculture and forestry) and cross-sectoral concerns. Countries have generally responded by developing National Biodiversity Strategies and Action Plans (NBSAPs). Over 140 developing country Parties to the CBD have received financial assistance to develop NBSAPs from the Global Environment Facility and other donors, and 93 countries plus the European Union have provided official NBSAP documents to the CBD Secretariat. Extensive guidance and technical support for development of NBSAPs has been developed over the past decade.[318]

Development of these NBSAPs and other types of policy frameworks does not, in itself, guarantee an environment conducive to protected areas development. The process of developing such policy frameworks, however – if adequately participatory – has

[317] Sheppard 2001.

[318] See, for example: Prescott *et al*. 2000; Miller and Lanou 1995; Hagen nd.

provided countries with an important opportunity to raise the profile of conservation issues, air the views and concerns of various stakeholders, and consider how to better "mainstream" conservation concerns into other economic and policy sectors.

Ultimately, however, bold leadership from the top is the crucial factor in building momentum for effective protected areas. At the 2003 World Parks Congress, for example, the President of Madagascar announced that his government would more than triple the country's protected area coverage from 1.7 to 6 million ha over the coming five years, a commitment that has catalyzed considerable new financial support from the international conservation community. At the same meeting, Brazil announced a plan under which fully 71% of the Amazonian state of Amapa would become part of a protected biodiversity corridor. In early 2004, the governments of Indonesia, Malaysia and the Philippines announced a joint, high-level initiative to step up conservation efforts in the Sulu-Sulawesi Sea ecoregion, an area considered to be the center of global marine biodiversity. These are but a few examples of the importance that high-level political will – and specific policy commitments – can have for a country's protected area system and those who manage it.

4.2.2 Protected area legislation

The legal frameworks that regulate protected areas on a national level vary considerably. Some countries, such as Colombia, have written protected areas provisions directly into their constitutions (see Box 4.1), while others have enacted general, sectoral or specific laws that provide a solid legal framework for protected areas. Other countries, however, lack detailed regulatory frameworks for protected areas and conservation. Experience demonstrates that when there is a constitutional mandate or strong unified national legislation regarding protected areas, the relative weight and attention given to conservation issues increases.

While many countries have made efforts in recent years to strengthen their protected area legal frameworks, it is still common to find protected areas regulated under a series of different, often contradictory, laws (forestry, fisheries, fauna, environment, mining, etc.). Furthermore, many of these laws do not consider or reflect the nation's obligations under international treaties and conventions. Lack of clarity over regulatory responsibility contributes to inter-institutional and inter-sectoral conflicts, and weakens the relative importance of protected area agencies and policies compared to those of mining, agriculture, forestry, tourism, and rural development sectors.

While the world's diversity of political and legal systems make it difficult and unwise to prescribe a particular "blueprint" for protected areas legislation, Carabias *et al*. (2003) provide a useful set of general concepts and elements that most countries will at least want to consider for inclusion in their legal framework for protected areas (see Box 4.2).

To be effective, protected areas legislation must deal very carefully with issues of horizontal and vertical coordination. As noted in Chapter 2, growing human populations and levels of economic activity are increasingly intersecting – and often conflicting – with the need to expand protected areas and link them together across wider land- and seascapes in order to slow biodiversity loss. So too, protected areas legislation cannot be developed in isolation from the legal provisions governing other forms of land and resource use surrounding protected areas. Specific coordination mechanisms need to be

Box 4.1 Colombian constitutional provisions related to protected areas

Colombia is home to a variety of different landscape and ecosystem types, housing the second largest collection of plant and animal species within a single country on earth. It boasts the greatest number of bird species in the world, and the third-largest number of mammals. Colombia is also the fourth-largest producer of water on the planet.

To protect this vast biological wealth, Colombia began in 1973 to develop one of the most comprehensive National Park Systems in the region. Building on existing natural resource legislation, the new Colombian Constitution adopted in 1991 provides a strong legal framework for environmental management and conservation. In addition to an entire chapter dedicated exclusively to environmental management, environmental issues are considered in seventy other instances throughout the Constitution.

The Constitution incorporates provisions for the protection of biodiversity, including protected areas and cultural heritage. It mandates that the State protect the diversity and integrity of the natural environment, while also establishing citizen's individual responsibilities to protect cultural and natural resources.

Among the Constitutional environmental provisions are:

Article 8: Protection by the State of cultural and natural assets of the country;

Article 63: Recognition of the importance of public property including, national parks, ethnic and communal lands, and national archaeological sites;

Article 79: Establishment of the right of every person to enjoy a healthy environment, and the obligation of the State to guarantee community participation in decisions that may affect it;

Article 95: An obligation on individual citizens to protect the country's natural and cultural resources.

In addition, the Constitution establishes guarantees concerning the protection and application of environmental rights, such as claims, petitions for access to information, actions to defend against administrative acts or omissions affecting environmental rights, and popular actions for protection of collective rights and interests.

Source: Valenzuela 2001.

established to harmonize both the making and implementation of legislation on protected areas with legislation governing land and resources uses in, for example, the agricultural, forestry, fisheries, mining, and energy sectors.

Similarly, Chapters 1 and 3 reviewed growing trends towards decentralization of governance, greater popular participation in protected areas policymaking and management, and the proliferation of a greater diversity of protected area governance types. For many countries, legislation that proceeds from the assumption that protected areas are all public lands, governed and managed by a centrally-based government protected areas agency, will simply not reflect reality and will never provide a supportive framework. Legislation needs to carefully spell out the respective powers of central government agencies versus sub-national government units, and articulate procedures through which conflicts between the two can be resolved.

Box 4.2 Suggested elements and concepts for inclusion in protected areas legislation

- Develop a strategic plan for the national protected area system;
- Identify a clear process for enacting policies, laws and regulations;
- Define management categories with clear objectives and characteristics;
- Determine procedures and legal processes to establish or modify protected areas and their management categories;
- Define clear policies regarding privately owned lands within different categories of protected areas and procedures for resolving land tenure issues and conflicts;
- Delineate the institutional framework for protected areas management and supervision, including the respective roles of national, regional and local government agencies, indigenous and other community organizations, private landowners and NGOs;
- Define penalties for violations of protected area laws and regulations, including standards of evidence and proof to be employed in prosecuting violations;
- Elaborate the general process and content requirements for preparation short- and long-term management plans for each protected area;
- Establish framework provisions and mechanisms to facilitate co-management of public protected areas by public and private organizations;
- Define clear legal instruments to facilitate improved stewardship of private nature reserves, buffer zones, biological corridors, and other private lands adjacent to and connecting publicly owned protected areas;
- Ensure that conservation measures apply to airspace, sub-surface and aquatic resources within protected areas;
- Establish legal instruments and procedures to recognize social, cultural, and spiritual values and traditions of local and indigenous communities, including mechanisms to recognize territorial rights and resolve conflicts in ways consistent with agreed conservation objectives;
- Establish, within protected areas legislation, the mechanisms necessary to ensure sufficient and predictable flows of government funding to implement all provisions of the legislation.

Source: Adapted from Carabias *et al*. 2003.

Furthermore, legislation needs to establish the legal framework and specific tenurial and other legal instruments necessary to facilitate a range of protected area governance and management arrangements, including co-management schemes, private reserves, and community conserved areas.

4.2.3 Enforcement

Despite their shortcomings, legal frameworks for protected areas have often advanced further than the institutional capacity to implement and enforce them. This is generally the case because agencies responsible for protected area management and conservation law enforcement are relatively weak organs of government, with insufficient financial and human resources, legal powers or political clout.

Institutional arrangements for conservation law enforcement vary widely. In some countries protected area rangers have full police powers; in others, specialized, decentralized organizations work with ranger corps and have the responsibility for law enforcement. In some nations only police and military personnel have direct enforcement responsibilities and authority. While it is undoubtedly preferable to limit the need for enforcement of protected area regulations through education, awareness and partnership, enforcement is nevertheless of great importance as managers cope with the many threats that protected areas face in a world of rapid global change. Indeed, a recent study by WWF confirmed a strong correlation between effective enforcement of protected areas regulations and successful achievement of conservation objectives.[319]

Effective implementation and enforcement of protected area-related laws and regulations face considerable challenges. In many countries there are few magistrates with adequate training and experience in environmental law, and most face overwhelming case loads. Many also have limited environmental awareness and little interest in conservation of biodiversity and management of protected areas. Prosecuting offices often do not have state attorneys specifically assigned to investigate or press charges for violations of environmental laws. Judges and prosecutors are likely to be more familiar with social and economic issues and can sometimes be more easily swayed by economic pressures or political intervention. And in many cases, penalties for violating protected area laws are so minimal – and so infrequently imposed – that they do not provide an effective deterrent to lawbreakers.

Two important steps in overcoming enforcement difficulties are: (1) to strengthen the ability of environmental law enforcement agencies and prosecutors to fulfill their mandates through education in environmental laws and regulations, and provide sufficient economic, human and material resources to do so; and (2) to improve coordination between protected area law enforcement agencies, judicial authorities and prosecutors.

4.3 Strengthening institutional capacity

At the institutional level, capacity development aims to increase the effectiveness of the total system as it pertains to overall organizational performance and functioning, as well as the ability of the management regime to adapt to change. "Institutional capacity building involves clarification of missions, structures, responsibilities, accountabilities and reporting lines, changes in procedures and communications, and changes in the deployment and management of human resources."[320]

4.3.1 Institutional structures

The formal institutions responsible for the administration of protected areas vary from country to country in terms of hierarchy and government sector. In a number of countries the institutional structure responsible for protected areas has been changing and, in many

[319] Dudley *et al*. 2004.

[320] Hough 2003.

cases improving, as environmental issues have become more important at both national and international levels.

Although there is no single best model, experience shows that when responsibility for protected area management falls within government institutions also responsible for commodity production and economic development – such as agriculture, forestry, fisheries or rural development – there is often limited compatibility between the conservation and development functions of such agencies.[321] Particularly in the case of developing countries, when a single agency is tasked with the objectives of both protection and production, it is often difficult for the longer-term benefits of conservation to be accorded much weight against the shorter-term, but more immediate benefits of development and exploitation. On the other hand, autonomous protected areas agencies established without a strong legal framework or sufficient technical and financial capacities may find themselves equally marginalized in the clash of competing inter-agency politics.

In other instances, authority for protected areas is spread over multiple agencies, generally resulting in a complex and devolved management structure, which acts as a barrier to effective conservation.[322] In such cases, the profile and importance of protected areas are usually low and subordinate to competing economic and political interests.

The hierarchy of protected area agencies within governments also varies widely, ranging from high-level, sub-ministerial directorates and park services, to low-level departments within agencies or ministries primarily devoted to the productive sectors. While the political level and authority of an agency is significant, equally important are its level of financial and staff support and the extent to which the agency possesses autonomy in decision-making. Perhaps unsurprisingly, experience has demonstrated that when protected areas have solid legislative grounding and are governed by agencies exclusively focused on conservation and protected area management, with sufficient financial and decision-making autonomy, they are most effective and efficient.

4.3.2 Management planning

One of the most important methods for the development of institutional capacity for protected area management is the formulation of a management plan. The purpose of such a plan is to specify the objectives for which the area is being managed, define legal and operational rules, and lay out programmes and activities that together provide a strategic path for managing the area to achieve stated objectives (see Box 4.3).

Although it may sound straightforward, there are many factors that can combine to make management planning both difficult and complex. In developing management plans, protected area managers must tackle questions such as: “What are the most significant and likely threats that an area will face in the next 50 years?”; “What actions will make the park most resilient to these changes over time?”; “What are the

[321] Findings from WCPA Capacity Theme consultative workshops with protected area managers in Asia, Latin America, and Africa (2002–2003).
[322] Appleton 2002.

Box 4.3 Benefits of protected area management planning

A good management planning process which has the support of staff and local stakeholders provides the following benefits:

Improved management of the protected area

The primary product of management planning should be more effective management of the protected area. Management planning encourages more effective management by:

- Ensuring that management decisions are based on a clear understanding of the protected area, its purpose, and the important resources and values associated with it.
- Providing managers with a long-term vision for the protected area, as well as guidance on how to direct management towards this vision. It should assist with day-to-day management decisions and complex problems by clarifying and prioritizing management objectives.
- Providing continuity of management by maintaining the direction and momentum of management towards prioritized objectives and goals.
- Helping to identify and define effectiveness of management against specified indicators and objectives.

Improved use of financial and staff resources

Management planning can help make sensible use of resources:

- Management plans identify, describe and prioritize management actions required to achieve protected area objectives, thereby helping managers to allocate staff, funding and materials based upon these specifications.
- Management plans can also highlight where additional resources are needed, and can act as a fundraising tool to help meet these needs.

Increased accountability

Management plans can provide a mechanism for increasing the accountability of:

- Protected area managers. The manager should be mandated to work within the Management Plan (including, as warranted, adaptively), which can provide targets and performance standards to attain. Managers can also use the plan to develop and assign staff tasks, and monitor and assess performance.
- Managing organizations and agencies. A plan can act as a public contract between the manager, local communities and society at large on how the protected area will be managed and protected in the future. Thus, the plan can provide a way by which the public can hold managers accountable for their decisions and delivery against stated targets.

Improved communication

The management planning process can provide a useful link between the protected area managers and other stakeholders with an interest in the area, its management and future. It does this by:

Box 4.3 Benefits of protected area management planning (cont.)

- Identifying key audiences with whom the manager needs to communicate, and clarifying the messages to be communicated.
- Providing a means of communication with the public to explain policies, actions, and proposals and to learn of values placed by others on the same area and resources.
- Promoting and publicizing the protected area to a wide range of stakeholders.

Source: Adapted from Thomas and Middleton 2003.

major gaps in knowledge and what research must be conducted to help manage better?"; and "What constituencies can help protect and legitimize the individual protected area and system?" There are a number of publications developed by the IUCN World Commission on Protected Areas which provide specific guidance to managers on how to best elaborate management plans.[323] It is important to note, however, that many sophisticated management plans have been developed and never implemented. To avoid this, planners need to ensure an inclusive, participatory process involving all important stakeholders and, perhaps most importantly, the full range of institutions that hold the real power to either frustrate or facilitate implementation. Often, these institutions will not be those which hold the formal mandate for protected areas management.

Specific options that can help managers increase the adaptability and effectiveness of protected area management include the following:

1. Develop a Management Plan for each protected area that establishes specific management strategies (including buffer and influence zones) for conservation and promotion of productive sustainable activities for local communities, compatible with objectives of conservation.
2. Elaborate specific programmes of action to achieve protected area objectives, and identify, anticipate, and elaborate options to respond to potential conflicts that may arise from implementation of various activities. For example, programmes that managers may wish to develop could include a:
    - protection programme (working with local people, controlling poaching and harvesting outside of agreed zones);
    - public use programme (recreation, tourism including concessions, interpretative services, etc., paying critical attention to fragile areas or areas of high risk and low resiliency);
    - development and maintenance programme (keeping roads and trails in good shape, supervising contractors employed to build new facilities, trash removal, energy supply, etc.);
    - law and policy programme (identifying and formulating laws and policies needed to support implementation on the ground);
    - sustainable financing strategy (see Section 4.5).

[323] Phillips 2002; Thomas and Middleton 2003.

3. Develop Annual Operational Plans for each protected area that prioritize actions and research, and define measurable goals, keeping in mind the extent of available financial resources.

4.3.3 Monitoring and research for adaptive management

Since change is a continuous process, effective protected area management requires a continuous cycle of learning and review. In order for managers to be adaptive in their management, they must track and monitor various indicators within their parks, and ultimately use the resulting information to alter their strategies and actions. In many cases, more formal scientific monitoring can be complemented by community-based methodologies, such as recording of fish landings and wildlife sitings, and monitoring of basic indicators of natural resource and environmental quality. Building the capacity for a variety of research and monitoring methods – integrating formal scientific and community-based approaches – is a critical component of effective protected areas management in the face of global change.

Climate change, for example, will likely create the need for new protected areas, and diminish the utility of existing ones, as discussed in Chapters 1 and 2. Baseline assessments and continuous monitoring will be necessary to provide protected areas managers with the information upon which to base decisions to move the boundaries of existing protected areas or establish new ones.

A multi-regional survey of protected area managers and stakeholders identified the following as key areas for research and monitoring to provide the information necessary for adaptation to climate change and other biophysical global change factors:

- Interactions between climate change, biodiversity, land degradation and ecosystem stability in both marine and terrestrial ecosystems;
- Community benefits and sustainable harvesting of natural resources;
- The potential of "green markets" for export of sustainably-produced goods and services;
- Environmental restoration;
- Development of new technologies for the diversified use of flora and fauna as well as sustainable agriculture, forestry, aquaculture and fisheries;
- Methodologies for marine and terrestrial zoning and for the establishment of biological corridors;
- Risk analysis to identify potential for species to become invasive;
- Vulnerability of different ecosystems types to invasive species.[324]

In addition to conducting research and monitoring ongoing change, managers also need to be proactive and forward-looking, developing response options based on scenarios of likely future events. Examples could be the use of modeling technology to

[324] Survey conducted at regional capacity workshops in Africa, Asia, Latin America and the Caribbean.

anticipate the rate of sea-level rise near a coastal protected area; anticipated shifts in species ranges due to modeled climate change; or even modeling of expected population increases in and around protected areas. Each of these modeled scenarios would lead to the development of proactive management responses designed to mitigate expected negative impacts, and enhance potential positive impacts. The act of modeling and scenario-building itself can further inform and highlight priorities for research concerning potential new management variables.

4.3.4 Partnerships

Protected area managers cannot do their job alone, no matter how strong their capacities. Global change factors are increasingly pressing in upon protected areas at just the time when the need to expand and connect protected areas across the landscape in order to slow biodiversity loss and preserve other values is growing. Furthermore, most countries' protected area agencies lack sufficient resources, capacities, and political clout to fulfil their mandates on their own. Managers therefore need to follow a "two-track" capacity strengthening strategy, building up the internal capacities of formal protected area agencies while at the same time reaching out to a wider range of institutions within society that can assist with – and in some cases take on – many tasks.

Protected areas managers and agencies can develop partnerships with a wide range of partners, including academic and research institutions, NGOs, indigenous and local communities, and the private business sector. Universities, for example, are valuable potential research partners, as Peruvian experience illustrates (see Box 4.4). In such instances, it is not necessary to develop specific research capacity within the protected area management institution. Rather, managers can rely upon the expertise of academic researchers. The data collected can directly inform management strategies for the park, and help managers identify and adapt to change.

Beyond research, protected area managers are increasingly recognizing the benefits of developing partnerships for collaborative management ("co-management") of protected areas. As discussed in Chapter 3, co-management arrangements may involve a diversity of stakeholders ranging from local and indigenous communities to private sector tourism operators and protected area agencies across national boundaries, in the case of transboundary protected areas.

Many of the global change factors discussed in Chapter 1, the drive to build more comprehensive protected area systems discussed in Chapter 2, and the need for a more participatory and equitable approach to protected areas discussed in Chapter 3 lie behind the increasing importance of partnerships for protected area managers. Growing populations and economic demands on resources, the need to expand protected area systems to more fully represent and protect biodiversity and ecosystem services, increasing emphasis on connectivity across the landscape, and growing political pressures for participation and decentralization all converge in a manner that makes increased partnership a practical and political necessity.

Today, the capacity to engage a diverse set of stakeholders and constituencies is an essential element of effective protected area management. The skills and capacities needed for engaging partners in co-management – and for resolving conflicts that may arise –

Box 4.4 A protected area research partnership in Peru

Manu National Park and the La Molina National Agrarian University

Manu National Park and Biosphere Reserve is the second-largest protected area in Peru and one of the largest in South America, encompassing more than 1.5 million ha of the Amazon Basin on the eastern slope of the Andes. It is thought by some to be the most biologically diverse zone on earth, comprising an extraordinary variety of habitats, including tropical lowland forest, montane forest, and grasslands. Some 1,000 bird species – nearly a quarter of all birds known in South America and 10% of all species on Earth – and more than 200 species of mammals have been identified. Botanists have claimed that Manu has a greater number of plant species than any other protected area on the earth.

According to a 1997 report by the World Conservation Monitoring Centre, the park at that time had only three professional staff, and 29 technicians and park rangers. Although Manu is well protected under Peruvian law, limited budget and staff have made it difficult for the small staff to carry out many management functions effectively.

Prior to the park's establishment in 1973, scientists from the La Molina National Agrarian University began conducting studies within its forest and grassland habitats. In 1969, students and professors from La Molina built the Cocha Cashu Biological Station, which has served as a base for botanical, ornithological and primate studies since that time. In 1981, a donation from the World Wildlife Fund was used to construct a new facility for scientific research. Since 1983, the Cocha Cashu Station has hosted 20-30 researchers each year. Primates, birds and floristic inventories have been the main research programmes, complemented by projects on mammals, reptiles, ants, and the population dynamics of a turtle species.

The research undertaken at the Station has been a critical source of information to inform and adapt management strategies in the Park. In 1986, professors from La Molina assisted park managers and representatives of the Peruvian National Park System to develop a management plan. University researchers have been able to develop and provide baseline information on many of Manu's species and habitats, and have ultimately enabled park managers to determine the most appropriate and effective policies, strategies and actions.

Source: UNEP and WCMC 1997.

however, are not necessarily skills that most protected area managers are equipped with. Many potential partners – such as indigenous and local communities – may also have limited experience and capacities concerning protected areas management. Both sides of such partnerships need to build their capacities to interact in ways that build trust, establish shared objectives, minimize and resolve conflicts, and equitably share burdens and benefits. Some of the key capacities that both protected area managers and their partners need to develop with respect to participatory processes are summarized in Box 4.5, and are further discussed in Chapter 3.

4.4 Human resources: Strengthening individual skills and capacities

At the individual level capacity development is characterized by the methods through which attitudes, behaviors and actions are changed. This generally occurs by imparting knowledge and developing new skills through training. It can also involve "learning-by-doing", and increasing performance through changes in management, motivation, morale,

Box 4.5 Capacity needs for managers and stakeholders in participatory processes for protected area management

Managers	Stakeholders
■ Understand role and purpose of participation process	■ Understand role and purpose of participation process
■ Understand motivation of stakeholders	■ Understand motivation of managers
■ Develop skills to adequately lead participation, and manage and resolve conflicts when they arise	■ Understand process of conflict resolution
■ Facilitate dialogue and establish trust among stakeholders	■ Desire and ability to engage in monitoring and participatory planning
■ Analyze use and potential outcomes of participation	■ Be comfortable lobbying for desired outcomes
■ Integrate gender equality in participatory planning process	■ Access to communication networks
■ Promote institutional synergies and policy integration	■ Access to information and ability to understand its meaning and significance
■ Cultural knowledge, language capabilities and understanding of social structure of stakeholder groups	■ Ability to understand the "culture" and technical jargon of professional protected area managers

and levels of accountability and responsibility. [325] Box 4.6 summarizes key areas for capacity development for individual protected area managers and personnel.

Traditionally, protected area managers were expected to be experts in fields of natural science such as biology and ecology, and were tasked primarily with applying their expertise to the protection of nature.[326] The challenges posed by global change, however, alter the context within which protected areas are managed, and thus modify the range of skills and capacities needed by managers. Not only must those responsible for protected areas understand the threats and impacts occurring in biological systems, but they also must understand and deal with a host of additional issues such as financial planning and management, cultural sensitivity, participatory management, and competing policy objectives, among others.

Although the individual skills most needed in each protected area, country or region may differ, Box 4.7 highlights selected types of skills that are of general use to protected area managers facing the challenges raised by multiple global change factors. In some cases, existing staff can be trained in these new skills. In other cases, protected area agencies will need to adjust their strategies and requirements for staff recruitment.

To develop the necessary capacity and human resources to manage for change, protected area managers can:

- Design methods that will help managers identify and evaluate organizational needs and skills at the protected area system as well as individual park level;

[325] Hough 2003.

[326] Sheppard 2001.

Box 4.6 Main components of human resource development for protected areas

A. Operational capacity of protected area authority:
- Resources available to support operational activities and sustainability of that support
- Staff quantity, quality and retention
- Autonomy of the protected area authority to plan and implement conservation activities
- Ability of the protected area authority to influence policy and decision-making

B. Approach of the protected area authority to staff development and training:
- Existence and use of job descriptions and terms of reference for staff
- Existence and use of performance targets, individual appraisals and standards
- Opportunities for career development, promotion and advancement within the protected area authority
- Staff perceptions of their role and value in the organization

C. Availability of training and other development opportunities:
- Identification of needs and planning of training
- Availability of relevant post-secondary education
- Availability and relevance of in-service training
- Availability of wider learning and personal development opportunities

Source: Appleton 2002.

- Apply methodologies to define skills requirements for protected area jobs;[327]
- Develop and integrate permanent training and technical assistance programmes into protected area management strategies based on identified capacity needs;
- Establish volunteer programmes for direct exchange and hands-on learning;
- Implement regional networks for training and sharing of lessons learned;[328]
- Make use of limited existing capacity by identifying individuals to train other trainers, and encourage interdisciplinary education through regional protected area management consortiums;
- Incorporate new skills such as economics, policy analysis, negotiation, business skills and biological monitoring into training for protected area personnel.

[327] See, for example, the competence standards for protected area jobs developed by the ASEAN (Association of South East Asian Nations) Regional Center for Biodiversity Conservation (ARCBC) (Appleton *et al*. 2003). Available online at: www.arcbc.org.ph.

[328] Regional nodes and networks participating in the IUCN/WCPA Protected Area Learning Network (PALNet) are relevant mechanisms for exchange of information and lessons learned. Information can be found at www.parksnet.org.

Box 4.7 Examples of new skills for protected area managers in an era of global change

- Management skills such as strategic planning, finacial management and fundraising, and effective communication;
- Adaptive skills such as application and integration of information arising from research and monitoring, as well as the ability to identify and analyze lessons learned;
- Cultural and social expertise relating to partnership development, participatory processes, dispute and conflict resolution, and networking with a complex array of stakeholders;
- Technical skills in project design, report writing and the use of existing and emerging information technologies;
- Policy expertise, such as understanding broader legal frameworks and sectoral policies within which protected area strategies and activities are implemented.

Sources: Adapted from Sheppard 2001 and Marsh 1999.

Ultimately, building more effective capacity for protected areas management needs to be a national commitment, not just an initiative of protected area agencies and managers. The 2004 Programme of Work on Protected Areas of the Convention on Biological Diversity stresses this point, and recommends specific activities that governments should undertake in order to do so, as outlined in Box 4.8.

4.5 Achieving sufficient and sustainable financing

While policies, institutions, partnerships, individual skills, and all of the other factors discussed above are very important, protected areas cannot be effectively managed without sufficient and sustainable financing. Developing the capability to ensure sustainable financing is therefore a central part of protected areas capacity building.

It is widely recognized that the financial resources available for conservation in general and protected areas in particular are grossly inadequate, particularly in developing countries. The systemic reasons why financial resources for conservation are inadequate are relatively straightforward: The value of Earth's "natural capital" is poorly understood and greatly under-valued by markets, politicians and the general public. In addition, most developing country governments have few financial resources to devote to conservation in the face of more immediate and pressing concerns such as alleviating poverty, promoting economic growth, and servicing international debt burdens.

Short-term political horizons encourage the exploitation of biological resources to meet short term economic goals. However, liquidation of these natural assets often goes unaccounted in national and company balance sheets, thus artificially reducing costs and inflating profits. The considerable economic value of ecosystem services (previously discussed) do not register in conventional markets (value does not become price), and are therefore not considered to be "real" economic assets by policymakers. At the same time, perverse incentives (e.g. ill-considered subsidies) further undermine the weight of biodiversity concerns in decision-making processes. One recent study concluded that globally, subsidies which are

Box 4.8 Strengthening the capacity to manage protected areas: Guidance to national governments from the Convention on Biological Diversity

Parties to the Convention on Biological Diversity at their 7th meeting in 2004, agreed on the following target for protected areas capacity building: "By 2010, comprehensive capacity building programmes and initiatives are implemented to develop knowledge and skills at individual, community and institutional levels, and raise professional standards."

To meet that target, the Parties recommended that governments undertake the following activities:

- By 2006 complete national protected area capacity needs assessments, and establish capacity building programmes on the basis of these assessments including the creation of curricula, resources and programmes for the sustained delivery of protected areas management training.
- Establish effective mechanisms to document existing knowledge and experiences on protected area management, including traditional knowledge….and identify knowledge and skills gaps.
- Exchange lessons learnt, information and capacity building experiences among countries and relevant organizations, through the Clearing-house Mechanism and other means.
- Strengthen the capacities of institutions to establish cross-sectoral collaboration for protected area management at the regional, national and local levels.
- Improve the capacity of protected area institutions to develop sustainable financing through fiscal incentives, environmental services, and other instruments.

Source: Decision VII/28, 7th Conference of the Parties to the Convention on Biological Diversity, February 2004.

both economically and ecologically perverse totals between US$950 billion and $1950 billion each year.[329]

Among the most basic reasons for inadequate protected area financing is thus the lack of understanding and therefore value placed on biodiversity and ecosystem services. A number of attempts have been made in recent years to apply traditional economic valuation models to Earth's "natural capital,"[330] however, in reality many protected area benefits still remain unaccounted for in the global economic system.[331]

A recent study to estimate the total annual cost of a globally representative system of protected areas suggests that US$45 billion would cover existing recurrent management costs, establishment of new protected areas, as well as payments to meet the opportunity costs of private interests for existing and new areas.[332] Although the sum appears exorbitant, the study's authors note that this estimate for a global system of protected areas

329 Balmford *et al*. 2002.

330 See, for example: Daly and Cobb 1989; Dixon and Sherman 1990; Freeman 1991; Aylward and Barbier 1992; Hanemann 1994; Jansson *et al*. 1994; Pearce and Moran 1994; Bockstael *et al*. 1995; Williams *et al*. 1996; Costanza *et al*. 1997; Daily 1997; Pimm 1997; Simpson and Christensen 1997; Phillips 1998; Costanza 2000; Heal 2000; Pritchard *et al*. 2000; Myers and Kent 2001; Daily and Ellison 2003.

331 UNEP/CBD/SBSTTA/9/INF/3.

332 Balmford *et al*. 2002.

represents less than 5% of existing agricultural and natural resource subsidies around the world, many of them perverse.[333]

Despite the existing potential for adequate conservation funding if governments, foundations and the private sector were to shift their priorities from contrary subsidies, current funding clearly falls far short of protected area needs. A 1999 study by the UNEP World Conservation Monitoring Centre (WCMC) surveyed protected area budgets for 123 conservation agencies in 108 countries during the mid-1990s, representing nearly 28% of the global terrestrial protected area system, or 3.7 million km^2.[334] As described by a report from the Secretariat of the Convention on Biological Diversity:

> The study identified US$3.2 billion in overall annual agency budgets (including all sources) with global mean protected area expenditure of US$893 per km^2, with great regional variations: "Perhaps the clearest finding of the study is the concentration of global protected area expenditures in the developed countries …" where mean expenditure was US$2,058 per km^2, versus a mean of only US$157 per km^2 in the developing countries. The developed countries accounted for 90% of protected area expenditure in the sample, but only 41% of the area protected. Meanwhile, the developing countries accounted for only 10% of expenditure but had nearly 60% of the area under protection. Overall, the study found that developing country protected area systems are only funded at approximately 30% of adequate levels.[335]

The trend of significant under-funding of protected areas in developing countries versus developed countries is of particular concern given the existing and impending impacts of global change. As has been discussed in earlier chapters, developing countries, in many cases, are both repositories for much of the Earth's biological diversity, as well the areas facing the most significant pressures from biophysical, socio-economic and institutional change.

The primary problem facing protected areas policymakers and managers is that, despite the wide range of tangible values that protected areas provide, too little of that value is transformed into concrete financial revenue that can support protected area management objectives. Enhancing financial flows to protected areas requires a broader spectrum of approaches and mechanisms than the traditional sources of funding from national government budgets and, in developing countries, from aid agencies and multilateral financial institutions. Many innovative revenue-enhancing mechanisms have been extensively documented and analyzed,[336] but are too infrequently put in place. Some of the more important innovative strategies and instruments for financing protected areas include the following:[337]

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333 A subsidy is "any measure that keeps prices for consumers below the market level or keeps prices for produces above the market level, or that reduces costs for consumers and producers by giving direct or indirect support" (de Moore and Calamai 1997). A perverse subsidy generally refers to a subsidy that has an unintended harmful effect—subsidies that are trade distorting, socially inequitable, or environmentally harmful. By cautious calculations the world is spending between US$700 and $900 billion a year on subsidies for water, agriculture, energy and road transportation. Many of these subsidies negatively effect the environment by artifically reducing the cost of harmful practices, such as producing dirty energy from oil and coal, or incentivising unsustainable practices, such as subsidized agriculture leading to increased deforestation, erosion and pesticide use. For additional information on perverse subsidies see, for example, de Moore and Calamai 1997; Myers and Kent 1998; Meyers and Kent 2001; Deacon and Mueller 2004.

334 Based on data collected between 1993 and 1995 (James *et al.* 1999).

335 James *et al.* 1999 and UNEP/CBD/SBSTTA/9/INF/3

Debt-for-nature swaps: Initiated during the Latin American debt crisis of the 1980s, debt-for-nature swaps enable developing countries to reduce their foreign debt while generating additional revenues for conservation activities. Such swaps take two main forms. The first is the commercial debt-for-nature swap in which (a) a bank or other commercial creditor agrees to sell debt owed to it by a developing country to third parties at a substantial discount from the debt's face value, because the creditor does not expect the debtor government to ever to fully repay its debts; (b) conservation organizations raise funds to buy the discounted debt from the creditor; and (c) the conservation organizations come to an agreement with the debtor government on the amount of local currency that the government will spend on new conservation activities in exchange for the conservation organizations' cancellation of the debt. The second form is a bilateral debt reduction programme, involving the cancellation of "sovereign" debt owed by one government to another, in exchange for an agreed level of new and additional conservation expenditure by the debtor government in local currency.

Conservation trust funds: A number of countries have established conservation trusts funds of various kinds over the past decade or so. These may take the form of endowment funds (in which the capital is never spent), sinking funds (which spend not only their investment income but a portion of their capital each year), and revolving funds (which are continually replenished by income from dedicated fees or taxes). Endowment funds are the most common.

A debt swap was used in the Philippines to establish an endowed "Foundation for the Philippine Environment." The Foundation is now a major funder of grassroots conservation and livelihood projects carried out by local and indigenous communities in and around protected areas throughout the country,[338] supplementing major protected areas initiatives funded by large donors with smaller-scale activities focused specifically on increasing local benefits.

User fees, taxes and other charges that are earmarked for protected areas: These can be voluntary or mandatory and may include:

- fees for protected area entry, concessions (such as restaurants), and recreational activities such as diving;
- airport and cruise-ship passenger charges;
- hotel room surcharges;
- taxes on hunting, fishing and camping equipment;
- royalties for resource extraction (e.g. petroleum) and rights of way for infrastructure such as transmission lines and pipelines;
- payment for ecosystem services (such as watershed maintenance and carbon sequestration);

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[336] See, for example, the work of the Conservation Finance Alliance – a consortium including numerous international conservation organizations, the Secretariat of the Ramsar Convention, UNDP, the World Bank, the GEF, GTZ and USAID – which has produced a comprehensive *Training Guide for Conservation Finance Mechanisms* which is available on CD-ROM and at www.conservationfinance.org.

[337] Examples in the section are drawn from Spergel 2001.

[338] For information on the Foundation for the Philippine Environment, see www.fpe.ph.

- hunting and fishing fees;
- fuel and property taxes;
- lottery revenues;
- bioprospecting fees;
- fines for illegal logging, hunting, fishing, and pollution damage.

All of these innovative instruments and mechanisms have considerable potential for increasing the pool of benefits generated by protected areas, but they all share a common drawback: they are new, and frequently complex to implement – at least the first time – with significant administrative and other start-up costs. The relative strengths and weaknesses of various existing and potential sources of protected area financing are summarized in Box 4.9.

While each of these strategies can potentially provide significant support to protected areas, it is important that individual areas and protected area systems define and pursue

Box 4.9 Strategies for financing protected areas – advantages and disadvantages

Strategy	Advantages	Disadvantages
Government funding: direct governmental budget allocations to support protected areas.	■ Gov't. funding may be more sustainable than private or international donors because the priorities of outside funders may shift, and frequently they do not provide long-term funding. ■ Increased gov't. support can demonstrate that conservation is an important national priority rather than simply the concern of private organizations.	■ Gov't. funding may be vulnerable to shifts in national spending priorities and to across-the-board budget cuts in times of economic crisis. ■ Political patronage and political agendas may guide decisions that should be based on conservation criteria.
Grants: donations from individuals, foundations, the private sector and international donor agencies.	■ There is a vast network of donors that are often interested in making a significant impact in an individual park or through a specific project.	■ Donors often shift their priorities and frequently provide only short-term support. ■ Parks can find themselves managing projects for objectives determined by donors, rather than for the objectives or best interests of the park.
Debt-for-nature swaps: agreements whereby national debt is forgiven by banks or purchased by conservation organizations in exchange for the debtor country "repaying" the cancelled debt by spending local currency on conservation programs.	■ Swaps offer a way for conservation organizations and international donor agencies to leverage their funds and finance a much greater number of conservation activities in the debtor country. ■ Swaps offer a way for developing country governments to reduce their international debt by using local currency to fund worthy projects inside the country, rather than sending scarce hard currency out of the country to repay creditors.	■ Swaps may be extremely complex to execute and may require the involvement of technical experts from multiple government agencies. ■ The financial leverage achieved by a swap may be eroded by subsequent local currency devaluation or inflation. The problem can be mitigated if the debtor government links local currency payments to the US dollar or some other external standard.

Box 4.9 Strategies for financing protected areas – advantages and disadvantages (cont.)

Strategy	Advantages	Disadvantages
Conservation trust funds: money or other property that (1) can only be used for a specified purpose or purposes (in this case specified conservation purposes), (2) must be kept separate from other sources of money, and (3) is managed and controlled by an independent board of directors.	■ Can provide sustained, long-term funding for protected areas. ■ Are a way of channeling large international grants into many small local grants, and extending the lifetime of the grant over a longer period. ■ Can be used to strengthen "civil society" by appointing NGO and private sector representatives to the board and giving them power equal to that of government representatives.	■ May have high administrative costs, especially if the fund's capital is relatively small or if the fund provides substantial technical assistance to grantees in designing and implementing projects. ■ May generate low or unpredictable investment returns, especially in the short term, if they do not have a well-conceived investment strategy.
User fees, taxes, and other charges earmarked for protected areas: fees such as entry fees to parks, recreational permit fees, surcharges on airports, cruise ships and hotel rooms, fees and royalties to extraction industries, taxes on pollution, and watershed conservation fees, among others.	■ The various taxes and fees can generate large amounts of money from previously untapped sources. ■ The "user pays" principle and the "polluter pays" principle are widely recognized as fair ways of apportioning costs for protecting the environment.	■ It may be politically difficult to charge fees for use of what was previously treated as a free public resource. ■ The income from many kinds of user fees and earmarked revenues can unexpectedly decline. Tourist numbers may suddenly drop as a result of domestic or international political or economic crises. Fees for natural resource extraction and payment for environmental services may decline if the resource dries up or if the resource price drops. ■ User fees are an effective conservation tool only if they are specifically earmarked for protected areas. Otherwise, governments may be tempted to spend the revenue from user fees and tourism taxes for other purposes.

financial strategies best suited to their particular circumstances. Among other options, they can:

- Design a financial strategy for the individual unit level, and for the entire system, and assign personnel to pursue it.
- Apply methodologies to calculate realistic costs of protected area systems that include all necessary expenditure items, including minimum salaries, infrastructure, equipment, operation and maintenance, outreach and education (see, for example, tools such as MICOSYS).[339]

[339] MICOSYS stands for "Minimum Conservation System," and was designed to (1) help identify a country's biodiversity representation and gaps in an existing protected area system, (2) model the composition of protected area systems for the durable conservation of a vast majority of a nation's species and (3) estimate the investment and operational costs of the selected system (Vreugdenhil *et al*. 2003).

- Develop mechanisms to complement fiscal funds with other financing sources.
- Establish mechanisms that allow the generation of economic resources at the site level oriented to sustain management of the protected area.

International affirmation of the importance of enhancing and sustaining protected areas financing comes from the 2004 Programme of Work on Protected Areas under the CBD. Parties to the CBD have set the following target:

> By 2008, sufficient financial, technical and other resources to meet the costs to effectively implement and manage national and regional systems of protected areas are secured, including both from national and international sources, particularly to support the needs of developing countries and countries with economies in transition and small island developing states.

To meet that target, the CBD Parties have called for increased international protected areas funding support for developing countries, and recommend that countries take, *inter alia*, the following actions:

> Conduct a national level study by 2005 of the effectiveness in using existing financial resources and of financial needs related to the national system of protected areas and identify options for meeting these needs through a mixture of national and international resources and taking into account the whole range of possible funding instruments, such as public funding, debt for nature swaps, elimination of perverse incentives and subsidies, private funding, taxes and fees for ecological services.
>
> By 2008, establish and begin to implement country level sustainable financing plans that support national systems of protected areas, including necessary regulatory, legislative, policy, institutional and other measures.

These are important steps that governments need to take seriously and implement rapidly. In doing so, however, it is crucial that assessment of financial needs – and plans for future financing – take into account the additional cost burdens that will fall on protected areas management as a result of the multifaceted processes of global change discussed in previous chapters. Some aspects of global change, however – such as the diversification of protected area governance models and the growth of carbon markets in response to climate change – may provide new options for creative protected area financing, and these should be fully explored as well. Assessment of both costs and potential sources of funding should reflect the realities of the 21st Century and beyond, not the situation of the past century.

4.6 Strengthening communication, education and public awareness

People are progressively more intertwined with protected area management. They live within or nearby; they are taxpayers and visitors; they are supporters or detractors; their businesses and livelihoods may benefit from protected area ecosystem services and natural resources – or may be harmed by resource-use restrictions; they may threaten and degrade biodiversity, or they may protect and defend it. Managing

protected areas, therefore, means managing people; and to do so effectively requires strategic communication.[340] Communicating the benefits of protected areas and their relationship to the development agenda is also an important strategy for overcoming the frequent bias against conservation priorities vis-à-vis increasing pressures from infrastructure development, agriculture, urbanization and industrialization.

While the need for communication and education programmes is largely accepted, frequently such activities do not receive priority in institutional planning, management strategies, or funding. Given the multiple pressures that they face, and the need to work ever more closely with a wide range of partners and stakeholders, protected area managers can no longer afford to treat their "public diplomacy" as an afterthought.

Communication and environmental education programmes are management tools that can foster greater public awareness of, and political support for conservation goals, as the example from Lebanon in Box 4.10 illustrates. Skillfully applied, these tools can also enhance planning and community involvement efforts. However, as one review of awareness campaigns cautions, "while a high level of awareness and knowledge on environmental issues leads to a greater level of concern among people, it does not automatically bring about an actual change in practices." Along with dissemination of information and raising awareness, it is vital that people have both relevant practical skills and direct opportunities for action. "If people don't acquire ownership over the framework in which to act, in all likelihood action will stop once the outside catalyst disappears especially if other incentives, penalties or rewards, are absent." [341]

Broadly speaking, many countries need to address basic weaknesses in the existing system for delivering education and awareness programmes to combat the general lack of awareness of the need to protect biodiversity. Communication and awareness strategies should be built into protected area management plans, while long-term education through incorporation of ecosystem and conservation information directly into formal curricula can help strengthen the understanding of general environmental concepts.[342] That having been said, if the conservation teachings of formal education are not supported and reinforced at home, there will be limited internalization of the message. Hence, it remains critical that protected area and conservation projects undertake informal communication and education strategies, and stress the links between protected areas and the consequences of lifestyle choices.

Strengthening communication and information exchange *among* protected areas managers and other stakeholders is also critically important. Managers have much to learn from each others' experiences and expertise, and the advent of the Internet age provides the technology where this can systematically happen. The Protected Areas Learning Network (PALNet), currently under development, is one potentially powerful mechanism for this kind of dialogue and exchange (see Box 4.11).

340 Hesselink *et al*. 2003.

341 Munla 2002.

342 Goldstein 2003.

Box 4.10 Local Awareness Committees for protected areas in Lebanon

Lebanon established its first two nature reserves little more than 10 years ago. In the years since, additional reserves have been established and growing professionalism in management has produced successes within the areas. The surrounding populations have remained largely sidelined, however, uninvolved and often uninformed. Deficiencies in awareness have led to lack of public support and a general skepticism about the value of the protected areas that have been established.

To tackle this problem, a grass-roots awareness campaign was initiated in October 2000. Local Awareness Committees (LACs), composed of volunteers from community organizations, municipalities and key stakeholder groups, were established at four protected areas to provide a new pool of human resources capable of reaching local audiences.

The LACs were trained and assisted by protected area managers and concerned NGOS to identify education and communication strategies and conduct local awareness events. The aim of the project was to develop the LACs into a permanent support structure for protected area management which would spread awareness and knowledge throughout its membership and communities.

Ultimately, the campaign featured more than 80 activities, and helped to promote open communication, mutual support, and trust between the communities and park management. The experience in Lebanon provides a clear example of how investment in communication partnerships and education strategies can result in substantial increases in community support for protected areas.

Source: Adapted from Munla 2002.

4.7 Putting it all together: Minimum standards for protected area management

In preparation for the Vth IUCN World Parks Congress (2003), IUCN and a number of partner organizations held a series of workshops in Africa, Asia, Latin America and the Caribbean to define the most crucial factors for effective protected area management in the 21st Century, and to identify related needs for capacity building. Despite the diversity of ecosystems, political settings and experiences discussed in the workshops, participants were able to identify a common set of core factors and capacities necessary for effective protected area management. These common factors are here proposed as minimum standards for protected area management.

4.7.1 General standards for national systems of protected areas

- Reference in the national development plan about the importance of protected areas;
- A clear legal mandate and framework for establishment and management of a national system of protected areas;
- Development of a strategic plan for the national system;
- Existence or establishment of a specialized protected area management agency.

Box 4.11 The Protected Areas Learning Network (PALNet)

Improving the sharing of information and experience among protected area managers and other relevant stakeholders and experts is essential for building the capacity to manage adaptively. The rapid development of the Internet now provides the technology to do so. The information that protected areas managers need, however, must be assembled and provided in an understandable, engaging and manageable format if it is to be useful.

In order to respond to this need, the IUCN World Commission on Protected Areas (WCPA) and the Ecosystems, Protected Areas and People (EPP) project have established the Protected Area Learning Network (PALNet) on the World Wide Web. PALNet is an interactive knowledge management tool for protected area managers and stakeholders. The PALNet website (www.parksnet.org) is an integrated component of IUCN's Knowledge Network, and it has been developed to be compatible with and supportive of other conservation networks, such as the Convention on Biological Diversity's Clearing House Mechanism (CHM), The Species Information System (SIS), the ECOLEX Gateway to Environmental Law and the World Database on Protected Areas (WDPA).

Those who become engaged with PALNet will both contribute to and benefit from lessons learned regarding adaptation of protected area policies, strategies and practices to global change. PALNet's case studies and lessons learned will be distilled from existing literature and a set of Field Learning Sites. This mechanism promotes peer-based learning interactions across regions and ecosystem types with a particular emphasis on South - South exchange. It is designed specifically to foster the use of adaptive management strategies.

The primary regional presence of the PALNet is its Nodes. Network Nodes will rely largely on existing networks or communities of practice within regions to develop a "network of networks" that builds on existing regional strengths and initiatives. Nodes represent the decentralized, web-based presence of PALNet. Their identification in various local contexts brings PALNet closer to the day-to-day work of protected area managers. Strategic location of these nodes within responsible institutions will foster the effective, long-term operation of the network and ensure that the knowledge being collected and distributed is relevant and useful.

4.7.2 Standards for individual protected areas

1. Legal certainty and management plan

- Legal certainty:
  - In accordance with national legislation;
  - Geographical extent and boundaries clearly established;
  - A general zoning scheme in place;
  - Resource use and other activities clearly and authoritatively regulated;
  - Management category is clearly stated in all relevant legislation.
- Management plan:
  - Describes outstanding biological and other features of the area;
  - Contains detailed zoning;

- Contains regulation of activities;
- Contains description of programmes, actions and goals;
- Has been analyzed and discussed with primary stakeholders;
- Approved by the relevant legal authorities;
- Officially published;
- Disseminated to all relevant stakeholders.

- Inter-institutional coordination:
  - Inter-institutional mechanisms with clear regulatory framework which includes different government sectors from national and local levels;
  - Regional development plans are in place for the influence zone of the protected area.

2. Ecological parameters

- Size is adequate to fulfill stated conservation objectives related to:
  - Landscapes;
  - Species;
  - Environmental services;
  - Ecosystem function;
  - Unique natural features and events (e.g. endemic species, migratory congregations).
- Ecosystems are maintained in good condition (with identified indicators);
- The landscapes, ecosystems, species and/or environmental services that are targets of protected are of significant value at the country or regional level.

3. Human resources

- Responsible officer (director) in charge of coordinating all activities in place;
- Necessary personnel for law enforcement;
- Personnel are sufficiently trained to undertake their assigned tasks and duties, including interface with stakeholders and conflict resolution;
- Salaries are adequate, within national standards, and scaled to responsibilities;
- Staff are sufficiently high within the government hierarchy to be able to interact effectively with other government authorities;
- A staff training programme is in place.

4. Infrastructure and equipment

- Administration offices;
- Field stations;
- Visitors' centre:
  - Easy access;
  - Low maintenance;
  - Modern museum techniques.
- Signage:
  - Prohibitions, regulations and safety information;
  - General information.
- Interpretative trails;
- Sufficient equipment for personnel to fulfill objectives (e.g. computers, land and water vehicles, safety equipment, uniforms, communication links, etc.).

5. Financial resources

- Salaries of officer in charge and staff are covered by national government;
- Basic operation expenses are covered by national government;
- Complementary activities are financed by sufficient alternative funding sources (e.g. special funds, grants, endowments, funding campaigns);
- Charges for admittance, permits, and concessions are returned to management of the area.

6. Monitoring and evaluation

- Monitoring programme:
  - Establishes goals;
  - Sets time limits to accomplish activities;
  - With scientific protocol;
  - In accordance with standardized methodologies;
  - Robust indicators;
  - Correction mechanisms (adaptive management).
- Follow-up and evaluation programme:
  - Establishes goals;
  - Sets time limits to accomplish activities.

7. Participatory processes

- Includes effective mechanisms for stakeholder and local institution participation:
  - Internal by-laws;
  - Includes all sectors;
  - Representation mechanisms.
- Includes a training programme for stakeholders to raise effectiveness of participation.

8. Public awareness

- Activities to ensure that neighboring communities are aware of the existence of the protected area;
- Campaigns and activities to increase understanding of the values and benefits of the protected area and the rationale for actions taken to protect it;
- Environmental education programmes for neighboring communities.

9. Public use

- Designated areas for recreational activities;
- Carrying capacity has been determined and impact of use is monitored;
- Specialized personnel dedicated to visitors;
- Accessible information for visitors;
- Waste management system;
- Adequate restroom facilities;
- Designated camping sites (if camping allowed);
- Concessions for specific services (e.g. restaurants, gift shop, transportation, guides – preferably local stakeholders).

10. Research

- Basic and applied research programmes to support protection and management:
  - ecosystems and species;
  - socio-economic dimensions.
- Agreements with national and foreign academic institutions to carry out necessary research;
- Adequate regulation for sample collection and handling of natural resources to ensure no adverse impacts from research activities in the protected area.

4.8 Summary

Protected area managers need to develop stronger capacities – and, in some cases, new skills – to build and manage comprehensive protected area systems that respond to the full range of global change factors. "Capacity" is the ability to perform functions, solve problems, and to set and achieve objectives. Most fundamentally, protected areas managers need to develop the capacity for "adaptive management."

Protected areas can only thrive in a supportive policy, legal and institutional framework, and national governments ultimately hold the authority and responsibility for establishing that framework. Three important dimensions of such a framework include articulating a general national policy on biodiversity, enacting legal provisions for protected area management and governance (including questions of horizontal and vertical institutional coordination), and ensuring sufficient enforcement capacity. Protected areas institutions themselves need to be strengthened as well. Experience has demonstrated that when protected areas have solid legislative grounding and are governed by agencies exclusively focused on conservation and protected area management, with sufficient financial and decision-making autonomy, they are most effective and efficient.

Site management plans are another important element, and should specify the objectives for which the area is being managed, define legal and operational rules, and lay out programmes and activities that together provide a strategic path for managing the area to achieve stated objectives. Plan development, however, needs to be an inclusive, participatory process if implementation is to gain popular and political support. Monitoring and research – both formal and community-based – need to be built into management plans, to provide the basis for an adaptive management approach over time.

The development of partnerships is a critical strategy for improving institutional capacity. Partners may include academic and research institutions, NGOs, indigenous and local communities, and the private business sector. The skills and capacities needed for engaging partners in collaborative management, however, are not necessarily skills that either protected area managers or their potential partners currently possess.

At the individual level, capacity development involves imparting knowledge and developing new skills through training, but may also include "learning-by-doing", and increasing performance through changes in management, motivation, morale, and levels of accountability and responsibility. The challenges posed by global change modify the range of skills and capacities needed by managers. New scientific, managerial, social and cultural skills must be developed.

While policies, institutions, partnerships, individual skills, and all of the other factors discussed above are very important, protected areas cannot be effectively managed without sufficient and sustainable financing. Managers need to approach financing in the same systematic and innovative fashion that they must approach conservation goals, developing strategic sustainable financing plans and taking advantage of the many innovative financing mechanisms that have been developed and tested in recent years.

Capacity to educate and communicate with the public also needs to be strengthened. Given the multiple pressures that they face, and the need to work ever more closely with

a wide range of partners and stakeholders, protected area managers can no longer afford to treat their "public diplomacy" as an afterthought. Strengthening communication and information exchange *among* protected areas managers and other stakeholders is also critically important. Managers have much to learn from each others' experiences and expertise, and the advent of the Internet age provides the technology through which this can systematically happen.

5. Evaluating the effectiveness of protected area management: The challenge of change[343]

5.1 How do we manage effectively?

5.1.1 The challenge of change

Earlier chapters have shown us a world where we can expect dramatic changes – in the biophysical world, the community, the economy and the way we govern ourselves. As these changes sweep the globe, can protected areas be a successful strategy for conservation? Is it possible that these precious areas can be managed effectively – that their values can be protected though they will be subject to climate changes, fragmentation, pressures from increasing populations, greater demands for resources, changing social attitudes, and violent conflicts raging around and even within them?

If protected area managers and communities are to meet these challenges, locally and globally, it is clear that effective management must be able to cope with surprises. Above all we have to learn about resilience, and about management that anticipates, responds, and adapts to changes at all scales. Our response times have to be rapid, and a new flexibility has to appear in public management agencies, which have often relied on thorough, but slow and cumbersome processes.

However, conservation of park values for posterity requires that we are also strong in "holding the line" and protecting what is most important. Flexibility should not mean following new fashions and accommodating all social demands or political pressures.

We cannot afford to make the same mistakes over and over – or to ignore successes and good initiatives and let them languish uncelebrated and unrepeated. Managers need to build on the best ideas and practices of the past and combine them with inspiration, innovation and initiative for the future.

In addition to the human, institutional, financial and legal capacities discussed in Chapter 4, evaluation of management effectiveness is a vital component of responsive, proactive protected area management that can cope with global change. Through evaluation, every success and failure can be used as an opportunity for learning, and continual improvement can be combined with anticipation of future threats and opportunities.

This chapter presents a summary of the experience, reflections and discussions among some of the practitioners in management effectiveness evaluation, particularly those working with the IUCN World Commission on Protected Areas (WCPA) theme on this topic. The purposes and positive outcomes of management effectiveness evaluation are

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[343] **Authors:** Fiona Leverington, Queensland Parks and Wildlife Service, Australia; Dr Marc Hockings, School of Natural and Rural Systems Management, University of Queensland, Australia.

discussed, followed by a brief overview of lessons learned about planning, conducting and using evaluations.[344] This chapter is not a guide to doing an evaluation – for more specific advice and for methods that can be used or adapted, see the references at the end of the chapter.[345]

5.1.2 What is "management effectiveness evaluation" and why is it important?

Effective protected area management in the 21st Century – management in the face of global change -– can be seen to have some consistent features, though protected areas and their environmental, social and political contexts vary greatly. Effective management:

- Has a "learning culture", conducts regular and open evaluations and learns from its successes and its mistakes;
- Looks to the future, anticipates changes and has the ability to respond to them while resisting inappropriate pressures;
- Undertakes effective planning and has an understanding of the systems being managed;
- Fosters a cadre of capable, motivated leaders, staff and partners;
- Strives to maintain good relationships with local communities and involve indigenous communities (where such communities exist);
- Has a supportive management culture and a solid level of support and financing from government and/or non-government organizations;
- Practices conservation and extension "beyond boundaries" so that the park is managed as part of a broader landscape, society and regional economy, not as an isolated fragment.

Management effectiveness is the degree to which a protected area is protecting its values and achieving its goals and objectives.

Evaluation is the judgement or assessment of achievement against some pre-determined criteria (usually a set of standards or objectives).[346]

Evaluation of management effectiveness is at the core of resilient, adaptive and anticipatory protected area management. It enables us to reflect on past experiences

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[344] Most of the case studies referred to in text and many of the recommended guidelines were contributed during a workshop held in Australia in February 2003 and reflect the experience of a diverse group of practitioners over the last decade, around the world.

[345] The guidelines presented in this chapter refer extensively to two framework documents: the WCPA Framework (Hockings *et al*. 2000) and the Adaptive Management approach (Salafsky *et al*. 2001). They also reference a range of case studies and other work cited in the bibliography. See, for example: the World Bank/WWF Forest Alliance Tracking Tool (Stolton *et al*. 2003a); the WWF RAPPAM Methodology (Ervin 2001, 2003); the Marine Protected Areas Evaluation Guidebook (Pomeroy *et al.* 2003); the "Enhancing our Heritage" Toolkit (Hockings *et al*. 2001); the ProArca CAPAS methodology (Courrau 1999); the WWF/CATIE methodology (Cifuentes *et al*. 2000); The Nature Conservancy's "Five-S" methodology (TNC 2000, 2002); and adaptive management-based evaluation (Margolius and Salafsky 1998, 2001).

[346] Hockings *et al.* 2000.

and to develop excellent antennae to tell us what is happening now and what potential threats and opportunities are on the horizon.

In the face of rapid global change – socio-economic, biophysical and institutional – we need to be able to show the extent to which protected areas are an effective conservation strategy. Society is making huge investments of money, land, and human effort in protected area acquisition and management and into specific intervention projects. Both the community and the managers need to know:

- Are protected areas effectively conserving the values for which they were established?
- Is management of these areas effective and how can it be improved?
- Are specific projects, interventions and management activities effectively achieving their objectives, and how can they be improved?

Evaluation of management effectiveness can play an important role in providing transparency and accountability, and in identifying mistakes and "dead-end" approaches. However, it is an essentially positive process, and is best viewed as a critical part of an improving management cycle.

How can evaluation help us to be more prepared for surprises and to develop better anticipatory management? An increasing number of scientists now believe that the *application* of knowledge from multiple sources into management should be the most critical focus, and that "the priority for ecosystem management is evolving improvements through reflection on experience that follows decision and action."[347] A system of evaluating management effectiveness can help us to integrate whatever information sources are available, including traditional and community knowledge, scientific findings, and the perceptions and experience of managers and stakeholders. Evaluation focuses on relevant management-oriented knowledge, and on group learning about how this knowledge should be practically applied to meet future challenges.

5.1.3 Evolution of management effectiveness evaluation

As other fields such as health and international development have progressively recognized the importance of evaluation in effective management and project cycles, so conservation has also put a higher emphasis on evaluation over the past fifteen to twenty years. New methodologies and approaches have developed in a number of fields, with many common issues and some productive exchange of ideas across the sectors.[348] Protected area management involves biophysical, cultural, socio-economic and managerial factors as well as numerous stakeholders, so monitoring and evaluation must draw on tools from a wide range of disciplines. Approaches such as participatory rural appraisal and project cycle management have offered many useful ideas.

The need to develop tools and guidelines to evaluate the ecological and managerial quality of existing protected areas was recognized in the "Bali Action Plan" adopted

347 Brunner and Clarke 1997.

348 Foundations of Success *et al*. 2003.

at the end of the Third World Parks Congress in 1982. Following the Bali Congress the issue of management effectiveness of protected areas began to appear in international literature and particularly within the work and deliberations of WCPA.

The IVth World Parks Congress in 1992 identified effective management as one of the four major protected area issues of global concern and called for IUCN to further develop a system for monitoring management effectiveness of protected areas. In 1996 a Task Force was formed within the WCPA and in 2000 it published a framework and guidelines for assessing the management of protected areas. The Task Force has now been replaced by a thematic programme within WCPA, which is continuing work on the issue. At the same time as the Task Force was preparing these guidelines, a number of other groups and individuals around the world were addressing the same issue. A suite of methodologies now exists and is being applied around the world.[349]

5.1.4 Evaluation and global change

Some of the global change factors identified in this book have significant implications for management effectiveness evaluation. Increased emphasis on evaluation is in part due to changes in society, especially the increased demand for accountability, transparency and demonstrated "value for money."

Some of the responses of management effectiveness evaluation to global change should include:

Community and governance trends

- Assessments will become more transparent and participatory in response to community expectations;
- As park management becomes decentralized, management effectiveness evaluation can play an important role in maintaining standards. It may also be able to assist in times of political crises or even military conflict, as a strong system of management effectiveness evaluation could be a focus for international pressure or presence to maintain a park's integrity;
- Better communications mean that a global network of practitioners can effectively share ideas and experiences, and make cross-site comparisons;
- Management effectiveness evaluation reflects an increased focus on applied knowledge and attempts to incorporate both scientific and traditional knowledge as well as the perceptions and experience of park managers;
- There is a greater respect for ownership of culturally important information;
- Evaluation needs to look beyond park boundaries and traditional outcomes – for example, relevance to and appreciation by the local community may become an important indicator for long-term survival.

[349] Hockings 2000.

Biophysical changes

- Evaluation of ecosystem services and their economic significance will become increasingly important in recognition of this role of protected areas;
- Monitoring should be carefully designed to indicate which changes might be driven by global biophysical changes such as global warming. A network of evaluated sites is desirable for these purposes;
- Monitoring and evaluation should be designed to give early warning of destructive changes such as pest invasions;
- Protected areas should be managed as sites to test hypotheses and to better understand the implications of change;
- Management effectiveness evaluation should include the assessment of success of complementary conservation initiatives such as corridors linking protected areas;
- We may need to develop "triage" assessments for protected areas in serious danger: Which areas can realistically be conserved, and which ones are beyond hope?

5.2 What can management effectiveness evaluation achieve?

Evaluation is initiated and supported for a range of purposes. These purposes should be stated explicitly, as they shape the expectations of stakeholders and guide the evaluation process.

Broadly, management effectiveness evaluation can:

- lead to better management in a changing environment;
- assist in effective resource allocation;
- promote accountability and transparency;
- help involve the community, build constituency and promote protected area values.

One evaluation methodology can often be used for several purposes. For example, the RAPPAM methodology (see Box 5.1) has been used by the Worldwide Fund for Nature (WWF) in a number of protected area systems for different purposes. In addition to the stated purposes, evaluations sometimes have unexpected outcomes, such as better communication and working relationships between stakeholders. This section outlines some of the purposes and outcomes of assessments, with examples taken from a wide range of case studies.

Box 5.1 Rapid Assessment and Prioritization of Protected Area Management (RAPPAM)

The RAPPAM project has undertaken a range of assessments, and each has had a different rationale.

The goal of the Russian assessment was to develop a picture of the extent of problems within the entire national protected area system, including threats and pressures, but also institutional problems stemming from recent economic and political changes.

The goal of the China assessment was to assess the management effectiveness of protected areas within the Upper Yangtze Ecoregion as part of a systematic conservation planning process. This broader process sought to prioritize support to critically threatened protected areas.

The goal of the Bhutan assessment was to reflect back over the first decade of park management, identify areas for improvement, and establish baseline data for future assessments.

The goal for South Africa was to prioritize and reallocate budget expenditures for the recently consolidated parks department. KwaZulu Natal Wildlife was also involved in a systematic conservation planning exercise for the province, and planned to use the data in that broader assessment process.

Source: Ervin 2003.

5.2.1 Better management in a changing environment

Most case studies reviewed in this chapter cite improvement of protected area management as the most important overarching aim of the evaluation process. Evaluation can improve management effectiveness in a number of ways:

- enabling adaptive management;
- "action learning" for better management;
- encouraging a learning organization and culture;
- signalling global and local changes and threats;
- informing management planning;
- ensuring impacts on communities are recognized by management;
- providing positive reinforcement when protected area management is effective;
- showing gaps in protected areas and systems, and identifying major constraints in management;
- showcasing management techniques applicable to broader landscape management.

Enabling adaptive management

Through adaptive management people systematically experiment with different interventions, evaluate them, learn and adapt. In an adaptive management strategy, "learning is not a haphazard by-product of mistakes in policy or management."[350]

In contrast to the usual system of rewards and advancement, which tends to

discourage admission of error, adaptive management allows managers and decision-makers to view unanticipated outcomes as opportunities to learn, and accept learning as an integrated and valued part of the management process. Learning-while-doing accelerates progress towards improved policies and management.[351]

The adaptive management approach has much to offer protected area management, especially when similar programmes are evaluated across protected areas or wider areas. This "learning portfolio" approach means that the learning can be on a broader scale and shared more widely as illustrated in Box 5.2.[352]

"Action learning" for better management

"Action learning" is the deliberate and conscious reflection on processes and problems, to ensure that lessons are learned from experience. Park managers can use and encourage an action learning approach to:

Box 5.2 Learning about the effectiveness of specific conservation tools across protected areas: lessons from sustainable agriculture in Central America and Mexico

Two conservation NGOs (Línea Biosfera in Mexico and Defensores de la Naturaleza in Guatemala) managing protected areas in Guatemala and Mexico conducted evaluations as part of a process of adaptive management and as an experiment in sharing cross-site lessons. Both partner organizations approached the Biodiversity Support Program (BSP) with the question: "How do we determine if sustainable agriculture is working as a conservation tool the way it is supposed to be?"

The purpose of the evaluation was to:

- Measure the effectiveness of sustainable agriculture interventions at site and cross-site levels;
- Build the capacity of partner organizations to do adaptive management;
- Document the conditions under which sustainable agriculture is successful in reducing the threats to biodiversity (and by doing this, learning about this specific tool);
- Learn about the best way to develop networks of site-level projects to maximize results and learning.

At one site, one partner learned that subsistence crops were not the main threat to the protected area (the focus of the sustainable agriculture project) and shifted their efforts from projects focused on subsistence crops to one focused on reducing the threats associated with cash crops.

At the other site, the partner organization learned that its sustainable agriculture project was working, and therefore continued it with only minor modifications.

Both partners integrated adaptive management principles into their routine management systems.

Source: Margolius and Stem 2003.

350 Parks Canada Agency 2000.

351 Parks Canada Agency 2000.

352 Margolius and Salafsky 1998, 2000.

- consider whether management strategies and interventions are working well and how they might be improved;
- increase understanding of management processes;
- build a better knowledge base for future projects;
- share knowledge, insights and information sources.

In this process, good scientific information – preferably the results of robust monitoring – is extremely valuable. However, where sufficient information is not available, evaluation needs to be undertaken anyway, using the best possible combination of information and informed opinions.

Encouraging a learning organization and culture

The process of evaluation encourages managers to take time out and reflect on what they are doing and how effective they are being – essential activities in a responsive management agency. In a well-run evaluation, people feel secure enough to be critical of themselves and of processes, and to openly consider failures as well as successes. Over time, evaluation can encourage a whole organization to adopt a culture of reflection, allowing institutional as well as individual learning to occur (see Box 5.3).

Informing management planning

Evaluation and planning are very closely linked processes. Management plans identify management goals, objectives and strategies, which form the basis of many evaluations. Ideally, management plans also include details of how their implementation should be monitored and evaluated. Where plan implementation is evaluated regularly, managers can judge and improve both the quality of the plan and their capacity to achieve its outcomes.

Box 5.3 Institutional impacts of management effectiveness evaluation at the Tasmanian Wilderness World Heritage Area, Australia

Application of an evaluative approach to management is bringing about a change in the way managers are viewing their role and responsibilities at this protected area. There is a growing focus on being able to document and demonstrate the results of management, and declining reliance on "trust us, we're the experts."

Program managers have become more inclined to articulate and focus on the outcomes they are seeking, and to assess the quality of their strategies and actions in the light of these targets. Preparation of reports on the findings of evaluation is enabling those involved to see their work, alongside others', from a different and broader perspective, and to take pride in the contribution they are making to management progress.

The opportunity for managers to provide critical comments (both positive and negative) on management performance places value on their knowledge and expertise, and allows them to contribute directly to improving ongoing management performance.

Source: Jones 2000.

Most evaluations present conclusions and recommendations for improvement, which may be implemented directly or incorporated into future management plans. Evaluation results also assist in decision-making and provide good justification for decisions and recommendations. As the community requires a higher level of accountability and involvement in management planning, the ability to show good cause for decisions has become much more important. Regular evaluation should therefore be built into project planning cycles to ensure they are relevant, flexible and appropriate and to avoid costly mistakes.

Signaling global and local changes and threats

Anticipatory management must recognize both existing and potential threats to protected areas. "Just as ecosystems have their own inherent response times, so do societal, economic and institutional systems. How long an inappropriate policy is successful depends on how slowly the ecosystem evolves to a point when the increasing fragility is perceived as a surprise and potential crisis."[353]

Some evaluation methods have a primary focus on threat assessment, and many others include threat assessment as an important aspect. For example, the "Five-S" methodology developed by The Nature Conservancy (discussed in Chapter 2) looks at systems (including focal conservation targets), stresses and their sources, strategies to address the stresses, and measures (indicators) of success.

Evaluation of the state of protected areas can provide critical information about the state of the wider environment. Protected areas are generally far less subject to human disturbance than other parts of the landscape, and can be good indicators of widespread and significant changes, including global climate change. When wide-ranging species disappear or decline in protected areas, it is a sign that landscape health over an entire region might be seriously compromised. For example, significant declines in some fauna in Kakadu National Park are suspected to demonstrate the loss of bushland birds and savannah mammals across northern Australia's savannahs.[354]

Changes on this scale and other threats from outside the protected area – such as the incursion of pollution, declining water quality, or changes in species due to climate change –require broad responses, such as policy changes and large-scale actions by government, industry and community. Without regular evaluation, these changes may not be identified or taken seriously until irreversible damage has been caused. In addition, monitoring and evaluation can also identify more local changes and threats – such as new pest problems, illegal logging, or unsustainable levels of park visitors.

Ensuring impacts on community are recognized by management

Evaluation projects that include local communities gain information about positive and negative effects of the park and park management on local people. Participatory evaluation techniques can unearth viewpoints and experiences that are very different from agency-based evaluations.[355]

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353 Holling 1986.

354 Woinarski *et al*. 2001.

355 Margolius and Salafsky 1998.

Providing positive reinforcement when protected area management is effective

Sometimes a significant outcome of evaluation is to demonstrate effective practices and to provide justification for their continued support. External and independent assessment can be particularly successful in this regard.

Showing gaps in protected areas and systems, and identifying major constraints in management

Broad-scale evaluations review a protected area or a system as a whole and reveal:

- gaps in protected area systems;
- gaps in resources, staff, training, expertise;
- problems with policies of the organization or other agencies;
- problems with internal communication.

A major system-wide evaluation study was undertaken in India during the 1980s and has recently been repeated. The first study had very significant outcomes (see Box 5.4). For a single protected area, an evaluation at Bwindi Impenetrable National Park, a World Heritage Area in Uganda, has also had very positive outcomes for management (see Box 5.5).

Showcasing management techniques for broader landscape management

Benefits of evaluation can extend beyond protected area boundaries. Evaluation results can be demonstrated to local communities and other interest groups through field days and extension techniques, and by community involvement in the monitoring and evaluation process (see Box 5.6). For example, the effectiveness of revegetation programmes to restore park habitat and establish wildlife corridors can be studied in conjunction

Box 5.4 Protected area management effectiveness evaluation in India

An evaluation was recently conducted by the Indian Institute of Public Administration and the Centre of Equity Studies (commissioned by the Indian Ministry of Environment and Forests to survey the status of protected areas in India, including legal and administrative status, socio-economic pressures, management planning and implementation, staffing, research, monitoring, and tourism.

A previous evaluation done in the 1980s led to significant increases in investments in the protected areas network, to amendments in the laws governing wildlife and protected areas, and to the setting up of various recommended institutional mechanisms. It also led to the acceptance, by the Government, of recommendations relating to the initiation of "eco-development" activities around protected areas.

A more recent study (2003) is assisting the Government of India to evaluate the efficacy of systemic, institutional and other remedial measures taken since the last evaluation. It also highlights other issues needing attention and recommends legal and policy changes. The study is helping to prioritize protected areas for special attention and investment and will help the government to take stock of its performance.

Source: Singh 2003.

Box 5.5 Evaluation of Bwindi Impenetrable National Park, Uganda

A management effectiveness evaluation in this park, an important habitat for the endangered mountain gorilla, resulted in significant changes, including:

- an increase in staffing levels as well as individual staff changes;
- further training of staff particularly in computer use and data storage and analysis;
- a plan for acquisition of more equipment, specifically vehicles and radio communication;
- a plan for infrastructure development;
- a plan for acquisition of more land through purchase from a neighbouring community, to contain the gorillas that have often strayed onto this land causing considerable damage to crops;
- a plan to work together with communities in ecotourism efforts in this land area.

The evaluation also resulted in a stronger emphasis on research and monitoring, with particular focus on gorilla health and on the impacts of tourism.

Source: Mapesa 2003.

with landholders and other organizations. Good practices – which often increase productivity as well as biodiversity – can then be applied on other lands beyond the park boundaries.

5.2.2 Effective resource allocation

A second broad purpose for management effectiveness evaluation is to support decision-making in the allocation of resources. A common theme for protected area agencies in the 21st Century is the inadequacy of resources to manage all protected areas to the standards we would like. Many agencies are therefore searching for objective, fair and effective methods to prioritize resource allocation to those areas and activities most critical to conservation and to where they will have the greatest effect.

Box 5.6 Benefits beyond boundaries in Queensland, Australia

Lochern National Park in central Queensland – a former rangelands grazing property – was declared as national park in 1994. Cattle and sheep were removed and an "experimental" management program implemented. Changes in the ecosystems were regularly monitored. After ten years, a field day was held at the park to demonstrate to the local community how the park is managed and to encourage discussion on the use of fire for vegetation management. Neighboring landowners, students, local government officers and a natural resource scientist were among the 28 participants.

The rangers conducted a guided tour comparing burnt and unburnt sites in Mitchell grass and mulga systems. This was of particular interest to the property owners, since invasion of Mitchell grass by gidgee (*Acacia cambagei*) – a major problem in the area – was greatly reduced in the burnt sites. Fire is a natural part of the ecosystem – and therefore desirable for conservation purposes – but had not been used as a tool by graziers.

Source: Queensland National Parks and Wildlife Service 2000.

Informing priority-setting processes

Evaluations are undertaken by donor organizations to help set priorities for future investments. Evaluation enables these organizations to rank protected areas according to such criteria as ecological and cultural importance, level of threat, level of management, and likely success of future interventions. One of the objectives of the RAPPAM methodology[356] is to allow donors and managers to rate protected areas according to level of threat and conservation importance, and to assess the extent to which they are well managed and effectively conserved.

Adjusting resource allocation on a logical and informed basis

A number of conservation agencies and organizations are attempting to develop rational, consistent models for allocating resources, to overcome the past tendency to fund the "squeakiest wheel." Evaluation plays a key role in these models, which generally establish a minimum acceptable standard for a range of criteria, then assess the current status of protected areas against these standards. The conservation importance of protected areas, their suitability for particular uses (e.g. tourism) and their current threats and opportunities are usually taken into account in these decision-making models. Box 5.7 provides an example from Australia.

Evaluation findings also inform resource allocation decisions by demonstrating which programmes are effective in achieving objectives (and so deserving of continued or enhanced funding) and which programmes are either not relevant or not performing well (signalling redirection of funding away from the programme – or perhaps the need for additional resources to make it more effective).

Box 5.7 Systematic resource allocation analysis for the parks of Victoria, Australia

With finite resources, it is impossible to keep all of Victoria's state and national parks in optimum condition. So how does Parks Victoria decide where to apply resources and effort to gain the best benefit possible?

Results of evaluations (visitor analyses, market research and asset analyses) are processed through an assessment model known as the Level of Service (LOS) Framework. This framework details the desired level of service for different categories of parks, quantifies the existing level and the gap between desired and existing, and then is used to develop optimum approaches for every park in the context of its relative priority in Victoria. The Framework provides a robust methodology for comparing and ranking priorities. It also removes much of the subjectivity and emotion from decisions surrounding funding of various park sites. Since introducing the LOS Framework and promoting its function, Parks Victoria staff, particularly line managers and rangers responsible for individual park sites, have increased the quantity and quality of the services offered at supported sites, in an effort to raise the condition, profile and demand for the site.

Source: O'Connor nd.

[356] Ervin 2003.

5.2.3 Accountability and transparency

A third broad purpose of management effectiveness evaluation is to provide information for public reporting. The community expects accountability from public agencies and non-government organizations, including evidence that protected areas are being adequately managed. Evaluation can assist in a number of ways.

Providing reliable and timely information for donors, government and the community about the use of their resources and the effectiveness of protected area management

Most bodies spending public money have to justify that it is spent according to high standards of accountability. With increasing competition for resources, they also need to demonstrate "value for money" by showing clear benefits and outcomes.

Some organizations and international agreements require reports from participating agencies, so they can judge whether parties are meeting their agreed management obligations. For example, the World Heritage Convention requires regular reports from State parties and a current project is developing more informative and useful evaluations to inform these reports (see Box 5.8).

Box 5.8 The "Enhancing Our Heritage" project

The *Enhancing our Heritage: monitoring and managing for success in Natural World Heritage sites* (EoH) project is a four-year project working in 10 World Heritage sites in southern Asia, Latin America and southern and eastern Africa.

The EoH project aims to demonstrate a more consistent and reliable mechanism for meeting World Heritage Convention reporting requirements by using management effectiveness evaluations. Based on the results, IUCN will provide recommendations to the World Heritage Committee on a consistent approach to monitoring and reporting on the state of conservation and management effectiveness of all natural World Heritage sites and on improving the effectiveness of management of World Heritage sites. The project should also result in improved management of the 10 pilot World Heritage sites, by providing:

- an established assessment, monitoring and reporting programme for evaluating management effectiveness and the state of conservation of World Heritage values;
- training for site managers and others in the application of assessment and monitoring techniques;
- established or improved communication and cooperation between site managers, local communities and NGOs, regional training institutions and other key experts and stakeholders to ensure continuation of assessment and monitoring beyond the life of the project;
- improved management in areas of identified deficiency resulting from training programmes and small-scale support provided through the project;
- integration of assessment and monitoring practices into management;
- the basis for preparing funding proposals for large-scale projects required to address deficiencies.

Source: Stolton *et al*. 2003.

As discussed in Chapter 3, protected area managers must in many cases collaborate with local people living in and around parks. Management effectiveness evaluation can play a role in building mutual trust in such situations.

Providing the basis for co-management and other conservation agreements

As discussed in Chapter 3, management of protected area systems is increasingly being devolved from central agencies to traditional owners, local government, community groups or private enterprise. Often this devolvement is based on a covenant, contract, agreement or trusteeship where the central agency retains some or all of the legal responsibility for overseeing the standard of management. Evaluation provides baseline and follow-up information about the state of protected areas as well as management processes. With this information, agencies and the community can fairly judge whether protected areas are being effectively managed by the contractors, joint management partners or trustees. Some management agreements may in fact require regular independent evaluations to ensure that specified standards are met.

Informing decisions on certification

Initiatives and proposals in some areas are attempting to officially "certify" protected areas according to whether they meet set standards. In certain cases, management effectiveness evaluations are being used to award or withhold certifications of protected areas. There is a great deal of debate about the values and drawbacks of certifying protected areas, but in particular circumstances, as described in Box 5.9, evaluation for this purpose can be useful.

Tracking progress of projects

Evaluation helps to track the progress of specific intervention projects, including the achievement of goals, emergence of new issues or problems, and effectiveness of particular

Box 5.9 Evaluation of Oulanka National Park, Finland for PANpark

The evaluation was carried out to obtain the PAN Parks (Protected Area Network) certification for Oulanka National Park. The evaluation was the first-ever verification of a PAN Parks candidate and thus an important learning process. The PAN Parks Initiative aims to:

- create a European network of wilderness protected areas;
- improve nature conservation by sustainable tourism development;
- provide a reliable trademark which guarantees nature protection and is recognized by all Europeans.

The objectives of the Oulanka National Park certification included promoting partnership between the park and local tourism enterprises; guaranteeing ecological sustainability of tourism activities; and creating a foundation for joint marketing efforts. The protected areas agency also saw the process as a useful way to learn about international certification processes and to compare experiences from different processes in order to improve management effectiveness.

Source: Väisänen 2003.

actions. Regular evaluations during a project cycle enable adjustment of programmes with timely feedback, so that maximum learning can occur and the best path can be taken throughout the life of the project. The World Bank/WWF Forest Alliance uses a rapid assessment of management effectiveness to track the success and progress of their projects (see Box 5.10).

5.2.4 Community involvement, constituency building and protected area values

A fourth broad purpose of management effectiveness evaluation is concerned with increasing public awareness about and support for protected area systems and sites. As mentioned above, a chronic resource shortage is a common feature of protected area systems, and stronger public support is needed to convince governments to provide more funding. Evaluation results, especially from independent external sources, can provide the persuasive evidence needed to spur public support and action. And as mentioned earlier, the management effectiveness evaluation process can also serve as a catalyst for improving mutual trust and cooperation between protected area managers and their partners and stakeholders. Boxes 5.11 and 5.12 highlight examples, from very different social and political environments, of evaluation processes in which good public communication campaigns have catalyzed significant community advocacy for protected areas.

5.3 Guidelines for management effectiveness evaluation: What have we learned?

5.3.1 Good communication, team-building and stakeholder involvement are essential

Evaluation always involves a group of people, including at a minimum the evaluators and management agency or project staff, and usually a range of other stakeholders. Good communication is essential from the beginning of the evaluation and at all stages throughout.

Box 5.10 World Bank/EEF Forest Alliance Tracking Tool

The World Bank/WWF Alliance for Forest Conservation and Sustainable Use ("the Alliance") has set an ambitious target concerning protected areas management effectiveness: 50 million ha of existing but highly threatened forest protected areas to be secured under effective management by the year 2005.

To evaluate progress towards this target, the Alliance has developed a simple site-level Tracking Tool – based on the WCPA Management Effectiveness Evaluation Framework – to facilitate reporting on management effectiveness of protected areas where the Alliance is sponsoring or managing projects. The Tracking Tool has the very specific purpose of monitoring the progress of specific projects, and does not, therefore, replace more thorough methods of assessment for the broader purposes of adaptive management.

Source: MacKinnon 2003.

Box 5.11 Management effectiveness evaluation of protected areas in Brazil

Due to concern about the deterioration of natural resources and biodiversity in Brazil, WWF, together with the Brazilian Environment Institute (IBAMA), set out to evaluate 86 protected areas, using a methodology that was simple and inexpensive to apply, would gather precise information, and would generate results quickly. The project also aimed to call attention to so-called "paper parks", and to press the government to vote on, and pass a bill to create a National System of Protected Areas (Sistema Nacional de Áreas Protegidas – SNUC). The bill had been in the House of Representatives since 1992, but had never been voted on.

The results of the evaluation survey were used by WWF with great effect in their campaign in support of protected areas in Brazil. WWF launched an email petition in favor of parks, asking people to press Congress to vote on the SNUC Bill. On World Environment Day, 1999, WWF organized an event in front of the National Congress. Hundreds of children stood on the Congress lawn forming a map of Brazil. Others stood inside the map, each representing a protected area, holding a sign with the park's name on it, and wearing a colored T-shirt and cap to represent the degree of risk that the protected area faced. The children also read out the petition that was sent by email, and handed over 5,000 signatures to a group of Congressmen. Ten days after this event, the SNUC Bill was voted on and approved in the House of Representatives.

Sources: Lemos de Sa *et al*. 2000; Izurieta 2000.

Teamwork amongst the evaluators and the participants is also important. In most cases, the evaluation process should be regarded by all concerned as a team effort to obtain positive change, rather than as a potentially punitive process where participants are unwilling subjects of an unwanted "inspection." Box 5.13 discusses the positive team-building aspects of evaluation.

5.3.2 Evaluation is part of an effective management cycle

Effective evaluation needs a high level of support and commitment from protected area management agencies as well as from other parties involved. This is essential both for the smooth conduct of the evaluation process and for making sure the evaluation brings about desired changes in management.

The optimal situation is for evaluation to be integrated into management processes so that it becomes an accepted, integral part of doing business. Parks Canada (see Box 5.14) has taken evaluation of park integrity very seriously, and its legislation requires that the Minister convene a national "round table" to review key programmes and policies.

How can better integration of evaluation with management be achieved?

Agencies can:

- foster a learning environment and use an adaptive management approach wherever possible;
- build evaluation, and the monitoring which underlies it, into business planning, policies and management plans, preferably backed by legislative mandate (see Box 5.15).

Box 5.12 Developing a "State of the Parks" program to assess natural and cultural resource conditions in the U.S. National Park System

There is widespread concern that natural and cultural resources across the 387 units of the U.S. National Park System are threatened, but we often do not know what we are losing or how fast we are losing them. One reason for this situation is that a comprehensive assessment and tracking of resource conditions according to an objective set of standards does not exist. Additionally, the public generally believes that park resources are preserved simply because of national park designation. Hence, there is a critical need for information and analysis to identify the most urgent resource needs in the parks, so that the Park Service and the nation can respond.

The State of the Parks program is based on the premise that communication of park resource conditions, based on a credible methodology packaged in an understandable manner and strategically delivered to key audiences, can significantly advance park resource protection over time. The role of the National Park Conservation Association (NPCA) as a non-government citizens' advocacy group is central to the potential of the program. It is vital that the data be collected by an independent non-biased third party, and then leveraged to vigorously advocate for changes in specific park management policies and overall budget priorities. Such information will greatly aid in advocacy efforts. NPCA has the history, expertise and policy background to develop this product along with the advocacy experience to create change.

In addition, park assessment can help others. There is increasing interest in national park issues. This can be seen in the emergence of strong "friends" groups and the interest in media. This creates an opportunity to coalesce this increasing interest into an organized, strategic force for park protection.

Source: Peterson 2003.

Evaluators can:

- understand and address the factors promoting or blocking institutional adoption and integration of evaluation systems. These factors include capacity issues such as resources and staff training, and stakeholder willingness to undertake regular evaluations;
- ensure that results of evaluation are interpreted in an appropriate way for all levels of the organization;
- widely disseminate results to stakeholders, to maintain support for the evaluation process from the broadest possible group.

5.3.3 Use an accepted framework for evaluation: The WCPA framework

Numerous evaluation exercises over recent years have demonstrated the advantages of sharing approaches and methods so that experience and ideas can be harnessed and new evaluations can proceed more smoothly. While there must be flexibility to respond to local conditions, some common ground has been established. To better harmonize different evaluation approaches and to provide a solid theoretical and practical basis for management effectiveness evaluation, it is desirable to clearly base evaluation on a

Box 5.13 Team-building in the Enhancing our Heritage project

The underlying premise of the Enhancing our Heritage project is that World Heritage sites undertake the assessment of their own management effectiveness. For self-assessment to be rigorous it is essential that site managers form a team of stakeholder representatives to work with them to develop the monitoring and assessment process. The project therefore requires development of "site implementation groups" to undertake evaluations. These groups then work with a wider group of stakeholders to develop and ratify the initial assessment.

In Venezuela's Canaima National Park, for example, the project has been perceived as an opportunity to combine the separate efforts of civil society, government, local governments and indigenous groups. The local team has demonstrated capacity and commitment to implement the project and quickly identified themselves as a team, ensuring all stakeholders involved in the project are actively engaged in project implementation.

Source: Stolton *et al*. 2003.

consistent framework, such as that developed by the WCPA.[357]

The WCPA framework is based on the idea that protected area management follows a process with six distinct stages, or elements, as shown in Figure 5.1:

- it begins with reviewing context and establishing a vision for site management (within the context of existing status and pressures);
- progresses through planning;
- allocation of resources (inputs);
- as a result of management actions (process);

Box 5.14 Ecological integrity evaluation in the Canadian park system

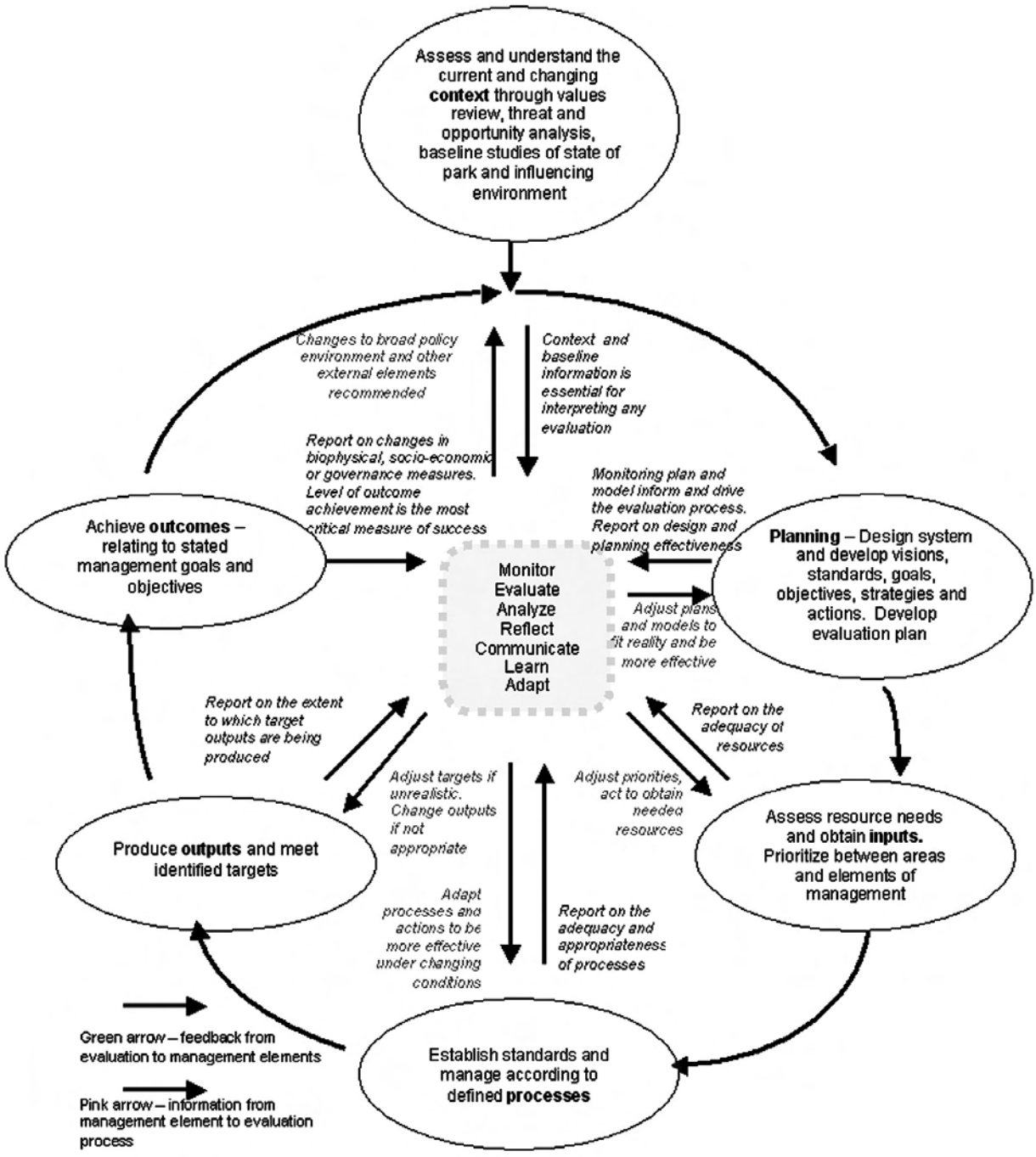
In 1998, the Minister for Parks Canada asked a panel of experts to assess the strengths and weaknesses of Parks Canada's approach to the management of ecological integrity, and to recommend improvements. The panel assessed nine "focus parks" and considered others. The report has had substantial influence on the directions of the agency and on park management across the country.

The Panel on Ecological Integrity recommended that Parks Canada adopt adaptive management as their framework for management at all levels, from individual sites to the whole system. Their report recommended …"that Parks Canada integrate monitoring within the management accountability framework …" and " … establish an on-going park-based monitoring report of the state of each individual park's ecological integrity … These reports should be done every five years, prior to management plan review. In addition these reports should undergo a third-party review/audit and be made publicly available as part of an annual public reporting process. In using this report, the revised park management plan should demonstrate how the proposed direction and specific management actions respond to the state of ecological integrity within the park."

Source: Parks Canada Agency 2000.

[357] Hockings *et al*. 2000.

Figure 5.1 An adaptive management framework for park management



Source: Adapted from Hockings *et al*. 2000.

Box 5.15 The rationale for building evaluation into management planning

It helps monitoring and evaluation to happen

The integration of monitoring and evaluation into core management systems for protected areas – such as the management plan – makes it more likely that monitoring and evaluation will be undertaken as part of the suite of "normal" management activities.

It strengthens evaluations by providing for the collection of baseline data

The most valuable and informative evaluations occur when data about performance indicators have been collected before (or during the early phases of) active management so that "before" and "after" data can be compared and so allow for changes to be detected. The inclusion in management plans of prescriptions for the early establishment of monitoring programs for selected performance indicators paves the way for stronger and more meaningful evaluations of management performance.

Source: Jones 2000.

- eventually produces goods and services (outputs);
- that result in impacts or outcomes.

These six stages have a central core, which is a cycle of evaluation, reflection and learning. This inner cycle is further depicted and discussed later in this chapter. Table 5.1 shows that each element of the management cycle can be evaluated and presents criteria and focus for each of these elements.

Table 5.1 WCPA framework for management effectiveness evaluation

Evaluation elements	Context	Planning	Input	Process	Output	Outcome
Explanation	*Where are we now* Assessment of importance, threats and policy environment	*Where do we want to be?* Assessment of protected area design and planning	*What do we need?* Assessment of resources needed	*How do we go about it?* Assessment of the way management is conducted	*What were the results?* Assessment of implementation of management programmes and actions; delivery of products and services	*What did we achieve?* Assessment of outcomes and the extent to which they achieved objectives
Criteria assessed	Significance Threats Vulnerability National context	Protected area legislation and policy System design Reserve design Management planning	Funding of agency Funding of site Partners	Suitability of management processes	Results of management actions Services and products	Impacts: effects of management in relation to objectives
Focus of evaluation	Status	Appropriateness	Resources	Efficiency Appropriateness	Effectiveness	Effectiveness Appropriateness

Elements of the WCPA framework

The stages or elements of the management cycle are discussed briefly below, with mention of how each stage can be evaluated and how evaluation results can guide management changes. The evaluation cycle can directly feed back information about an element being evaluated (for example, an evaluation of inputs recommends changes to inputs) or can feed back information to a number of linked elements (for example, an outcome evaluation usually produces recommendations in relation to planning and design, inputs, processes and outputs).

Context – where are we now?

The context of a protected area includes its values, its current status and the particular threats and opportunities that are affecting it. It sits outside the management cycle because it is not directly a part of management activities, but context has a very significant bearing on management effectiveness and includes physical, economic, institutional, political and social features. In context evaluation, clear identification of protected area significance and values is particularly important, as the extent to which these are conserved or threatened over time becomes a major focus of most evaluations. Context evaluations also focus on analyzing present and potential threats.

Evaluation of other elements, especially the interpretation of results, needs to consider context factors – both internal and external – which are capable of determining success or failure of particular interventions and also have major influences on management of protected areas generally.

Feedback from the evaluation cycle often recommends changes to the protected area or project context, such as changes to broad government policy or economic incentives. These matters are generally beyond the control of managers, but evaluation reporting can bring them to the attention of other influential people.

Planning and design – where do we want to be?

This phase of management drives the evaluation process. It identifies the management goals, objectives and strategies that will be evaluated, and can include planning for evaluation as well as management. Evaluation of this element focuses on appropriateness of planning and design at whatever level is being assessed:

System level:

- the appropriateness of national protected area legislation and policies;
- plans for protected area systems (e.g. ecological representativeness and connectivity).

Site level:

- design of individual protected areas in relation to the integrity and status of the resource (e.g. shape, size, location – whether the protected area is too small to protect biodiversity over the long term);
- detailed management objectives and plans.

Project level:

- the logic and clarity of project plans;
- validity of assumptions made in project planning.

The results of management effectiveness evaluations (of all elements of management) should be fed back into this element, with managers adjusting plans, systems and designs to make them more appropriate to current and future needs.

Inputs – what do we need?

This element of management determines the needs for resources – money, staff, training, resources and infrastructure. Evaluation of inputs addresses the adequacy of resources in relation to the management objectives. Input evaluation seeks to answer the questions:

- Are sufficient resources being devoted to managing the protected area system/site or to the project implementation?
- How are resources being applied across the various areas of management?
- Is the project working with the right partners and is their capacity adequate?

The evaluation cycle feeds information back into the "input" element after analyzing whether the outputs and outcomes of management would be improved by changes in the inputs.

Process – how do we go about it?

Protected area management is implemented through processes and systems that need to be appropriate for the management objectives for a system or a site. The assessment of management processes focuses on the standard of management within a protected area system or site. Relevant questions include:

- Are the best systems and processes for management being used, given the context and constraints under which managers are operating?
- Are establshed policies and procedures being followed?
- What areas of management need attention to improve the capacity of managers to undertake their work (more resources, staff training, etc.)?

Assessment of processes involves a variety of indicators, including issues of day-to-day maintenance, the adequacy of approaches to local communities, and various types of natural and cultural resource management

Feedback from the evaluation cycle includes information about whether the defined standards and processes are being used, and information (from evaluating other elements of the management cycle) about whether these processes at the current level are appropriate and adequate.

Outputs – what did we do and what products or services were produced?

Outputs are the products and services delivered by management. They need to be distinguished from the outcomes of management, as successful completion of output targets (e.g. completion of a management plan; fencing of a protected area) will not always achieve the intended conservation outcomes. Output evaluations consider what management has done, and examine the extent to which targets, work programmes or management plans have been implemented. The focus of output monitoring is not so much on whether these actions have achieved their desired objectives (this is the province of outcome evaluation) but on whether the activities have been carried out as scheduled and what progress is being made in implementing long-term management plans.

Information from output evaluation can drive changes to the inputs and processes so that the production of outputs becomes more efficient and effective. Results from other parts of the evaluation cycle might suggest that some outputs are not appropriate to the achievement of management objectives.

Outcomes – what did we achieve?

Outcomes are the extent to which management objectives for a protected area, project or system have been achieved. Outcome evaluation is most meaningful where concrete objectives for management have been specified in national legislation, policies, site-specific management plans or project plans. For evaluation of a protected area, outcome evaluation usually means assessing the extent to which values have been protected, threats abated, relationships with communities enhanced and other management objectives achieved. Outcome evaluation could also measure the state of – or change in – aspects of context, input, process, or output – as long as this state or change is specified as an objective of the protected area or project.

In the final analysis, outcome evaluation is the true test of management effectiveness. It is most accurate where there has been long-term monitoring of the condition of the biological and cultural resources, socio-economic aspects of use, and the impacts of management on local communities. However, these monitoring results are often not available or are inadequate. Outcome evaluation must therefore make the most of what information is available (where necessary, interpreting qualitative and anecdotal information), and should drive the establishment of a future monitoring programme which is targeted to find out the most critical information.

Use of the WCPA framework

The WCPA management effectiveness framework has been applied to develop a number of evaluation projects throughout the world, and it has been found to provide a solid basis. It is flexible and does not impose a methodology, but rather helps to understand how different methodologies can complement each other and work together to provide a richer picture of management effectiveness.[358]

Evaluation that assesses each of the elements of Figure 5.1 and the links between them should provide a relatively comprehensive picture of management effectiveness.

However, many evaluation processes will choose to evaluate only certain elements, and the results in such cases need to be interpreted with care, knowing that information is incomplete. For example, in some national or international overviews or in cases where funds and time are very limited, an assessment might concentrate only on the elements that are easier to evaluate (inputs and processes). In other cases, only a representative sample of a large protected area system will be evaluated using a complete set of indicators, to optimize efforts and resources.

5.3.4 Evaluation works best with a clear plan

Conducting an evaluation within the framework outlined above follows a number of common steps, whether it is directed at a project, site, protected area or system. Figure 5.2 depicts the inner circle of figure 5.1 and presents four major phases in an evaluation process.

It should be emphasised that these four phases and the steps within them are iterative and that learning and management changes can occur at any time during the process.

The remainder of this section discusses the lessons learned about the process of planning and implementing evaluations. These lessons are organized according to the four phases shown in Figure 5.2. Generally the preparation of an evaluation plan is the first step in an evaluation process, and consideration of all the points in Figure 5.2 is recommended in such a plan.

5.3.5 Clear purpose, scope and objectives are needed

It is important at the beginning of an evaluation project to know exactly what it is expected to achieve, and to understand the levels of funding and support that can be expected. All parties need to agree on these expectations.

Deciding the purpose, scale and scope of the evaluation

The different purposes of management effectiveness evaluation (management improvement, resource allocation, accountability and advocacy) influence how the evaluation process is designed and implemented. Often an evaluation process can be designed to fulfill several purposes. Design for management improvement often yields information useful for accountability, advocacy and resource allocation, but the reverse is not always true.

The scope and scale of the evaluation also need to be established at the outset. The scope of evaluation can be very broad – the evaluation of all aspects of management – or specific – for example, looking at how effective a particular education programme or weed control initiative has been. The scope should also specify whether this is a one-off evaluation, a time-bound evaluation (e.g. the life of a short-term project) or the establishment of a continuing programme.

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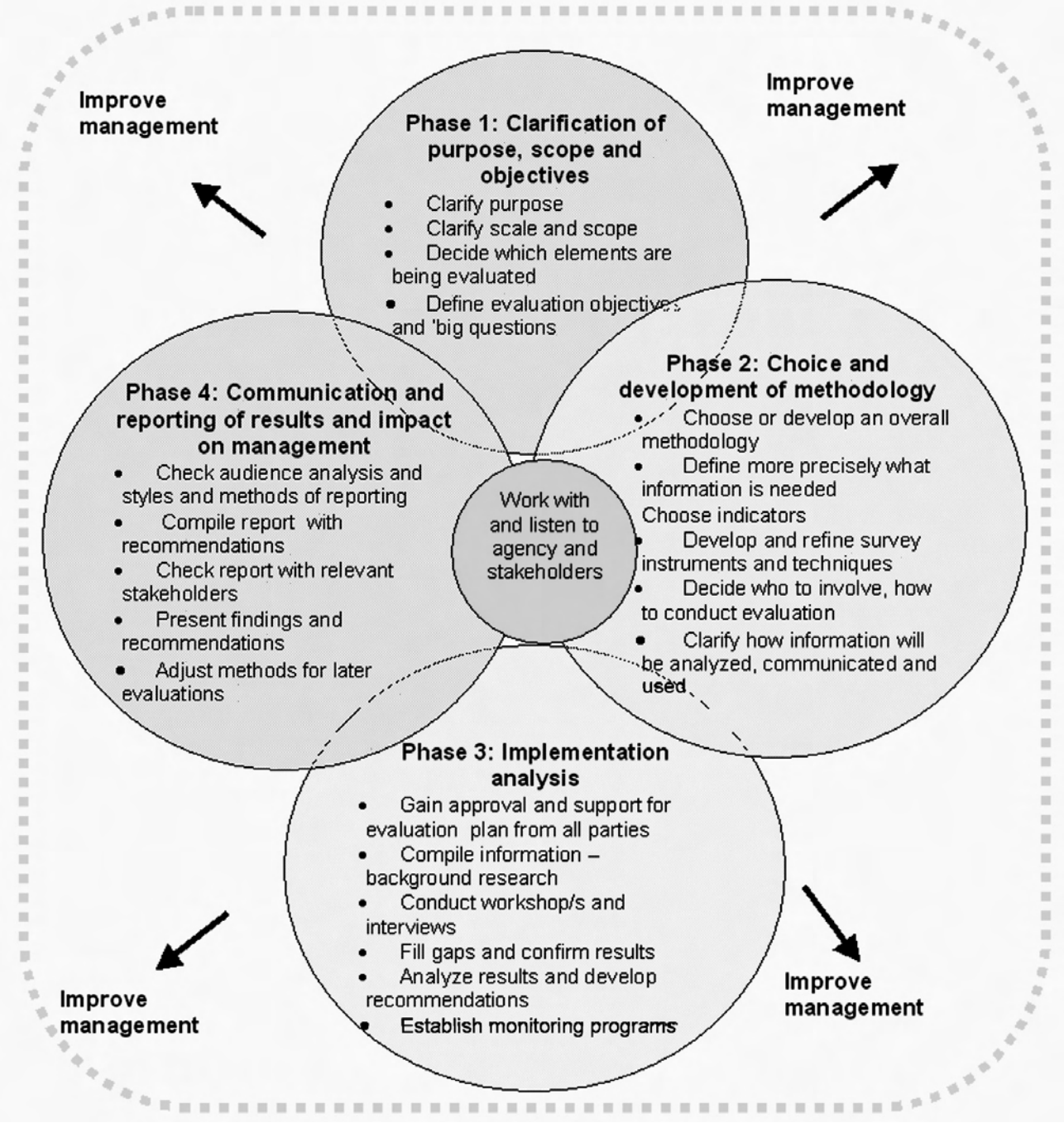
[358] For examples of different applications of the framework, see Hockings *et al*. 2001; Ervin 2001; Ervin 2003; Pomeroy *et al.* 2004; McKinnon 2003.

Figure 5.2 The evaluation cycle



The scale can also vary from system-wide (or even embracing a number of national systems) to a particular protected area site or part of a site.

The case studies already discussed from Brazil, India and Finland are examples of system-wide evaluations with a broad scope, as is an evaluation of the protected areas of Catalonia in Spain discussed in Box 5.16. Evaluations of broad scale and scope are likely to be relatively superficial but can provide vital information for meaningful improvements in management at high levels, such as system-wide resource prioritization, advocacy and policy directions.

Box 5.16 Broad scope and scale: Assessment of protected area management effectiveness in Catalonia, Spain

It was felt that the lack of public, reliable information on the state of protected areas was an important obstacle for improving the awareness of both managers and the general public. In 1999, the Institució Catalana d'Història Natural proposed a project to evaluate the effectiveness of the entire system of natural protected areas of Catalonia, and was able to persuade the responsible public agencies and private organizations to cooperate, providing the necessary information and some funding.

The evaluation, based on the WCPA framework, aimed to:

- assess the condition of the entire system of 148 protected areas of Catalonia; and
- based on the results of assessment, propose actions for improvement where needed.

The project also aimed to test, refine and be a reference for an evaluation methodology that could be more broadly applicable throughout Spain, and, possibly, in other Mediterranean countries.

Source: Mallarach 2003.

Localized, more detailed evaluations are useful for improving management at a practical on-ground level (see Box 5.17). For example, evaluating the effectiveness of a particular approach to resource management may result in a change in frequency of fires, resulting in measurably better biodiversity outcomes. Where possible, however, the scope of evaluation should be broad enough to capture the relationships and inter-linkages between various factors affecting management.

Factors to consider when defining the purpose, scale and scope of an evaluation include:

- organizational capacity and resources available;
- primary audience for the results;
- primary driver of the process;
- time available for the evaluation;
- whether the evaluation is "one-off" or to be repeated at regular intervals over time.

It is therefore critical at this stage that commitment and capacity are carefully assessed, and the scale and scope adjusted if necessary.

Box 5.17 Narrow scope and park-wide scale: Evaluation of the Dingo Education Campaign, Fraser Island, Australia

There have been serious concerns about human safety and dingoes in the Fraser Island World Heritage Area, especially after a child was fatally mauled in 2000. An external evaluation was commissioned to assess the effectiveness of education strategies relating to dingoes on the island. The evaluation was able to investigate the topic in detail through a literature review, stakeholder interviews and consideration of all target audiences. Recommendations were also detailed and specific, guiding practical actions on the ground.

Though the study was narrow in scope and scale, the general international issue of wildlife-visitor interaction was investigated and other facets of park management were asssessed in order to make meaningful recommendations.

Source: Environmetrics 2003.

Defining criteria, objectives and broad questions for evaluation

With the purpose, scale and scope clear, the management elements and the criteria for the evaluation (see Table 5.1) can be selected and the evaluation objectives and broad questions relating to these framed logically. Some evaluations attempt to assess all the elements shown in Table 5.1, while others concentrate on only one or two.

Agreement among all partners on criteria, evaluation objectives and broad questions is important before a more detailed methodology is selected or developed. It is an essential step before detailed questions and indicators are selected, as it helps to ensure a focused approach to evaluation – everything that is measured should relate to one or more of these criteria or objectives.

To frame the evaluation objectives and questions, and to choose elements for evaluation, it is critical that the management goals and objectives for the protected area or project being evaluated have been clearly articulated. This is especially important for outcome-oriented assessments, which measure how well these goals and objectives have been achieved.

Developing a specific conceptual model

The field reality faced by most conservation managers is very complex, with many layers of causes and effects, and many interacting environmental factors, both biophysical and human. This complexity makes assessment of the park context and programme evaluation, especially the interpretation of results, extremely difficult.

For some evaluations, such as those undertaken for adaptive management purposes and assessments of specific interventions or projects, a conceptual model of how the project is supposed to work is a vital tool for both planning and evaluation.[359] A concept model clearly shows a chain of assumed causal events, where factors interact with each other to influence a conservation objective. It therefore guides what should be measured for effective and efficient evaluation, and assists in interpreting results. The adaptive management approach[360] and

[359] See Salafsky *et al*. 2001 for further detail and explanation.

[360] Salafsky *et al*. 2001.

the Five-S threat analysis[361] use conceptual models to facilitate both project design and evaluation.

Clarifying links and assumptions

Most evaluations of management effectiveness assess a number of elements, and these are linked to one another. For example, the number of staff (input) and the way their work programme is organized (process) will affect the level of their output and thus the achievement of their objectives (outcome).

We need to understand the links between the elements or criteria being evaluated so we can interpret the results of evaluation. It is important to clearly specify the assumptions being made when any of these elements are linked. Two related types of assumptions can be recognized.[362] The first type is the expectation that certain conditions will exist at a specific time (for example, that a market will remain stable, that climate and sea temperature will stay the same, or that staff numbers will increase). The second type of assumption is the unproven belief that certain actions will result in certain consequences. When assumptions are "miscast as fact", there are great risks for projects as they may fail totally or become quite irrelevant when conditions change.[363]

Figure 5.3 shows an example of the major assumptions in a simplified model for a protected area project. (Note that this diagram is similar to the concept models referred to in the adaptive management framework.)

5.3.6 The methodology needs to suit the purpose

What methodology should be used?

We should learn from others and use or adapt existing methodologies if possible. A global community of conservation practitioners is using modern communication technologies to share methodologies and experiences. A great deal of thought has been put into existing methodologies, and the use or adaptation of these can save considerable resources as well as allow comparability of results between projects or sites. For example, a guidebook for evaluating marine protected areas has been developed, based on the WCPA framework (see Box 5.18).

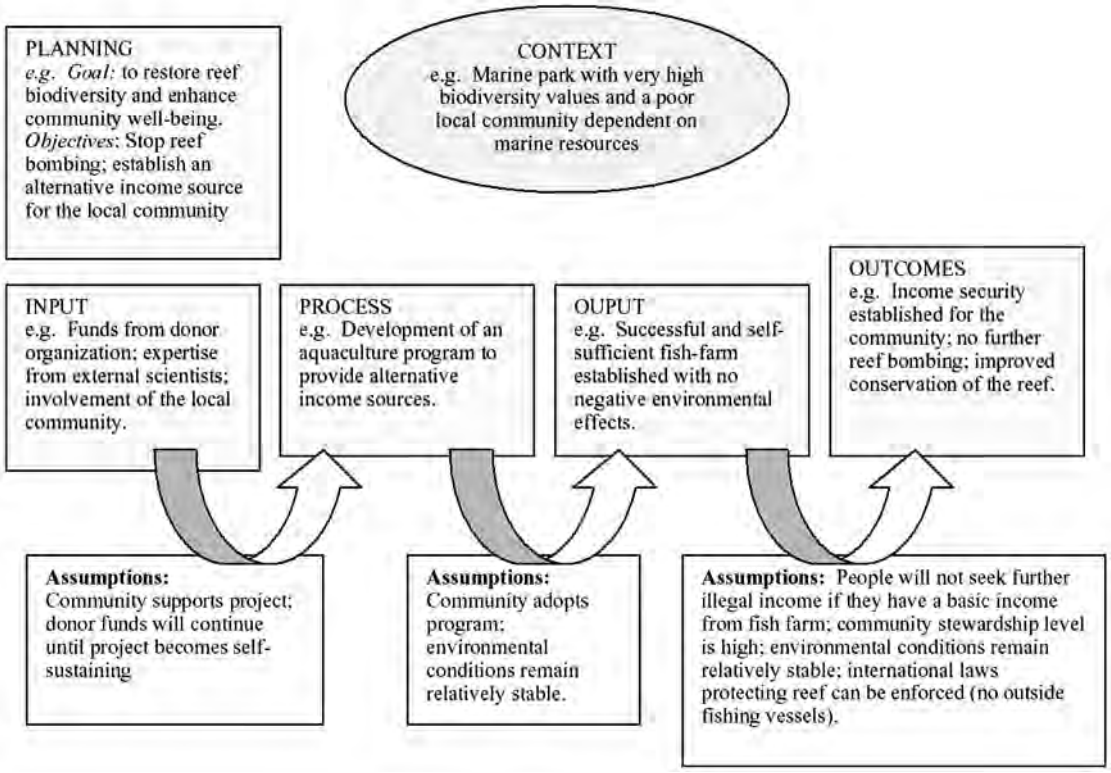
Adopting or adapting a methodology does not mean all of the recommended indicators, survey methods or reporting templates need to be used. These can and should be tailored to fit specific local needs.

Suggested guidelines for choosing an evaluation methodology include the following:

Methodologies should be compatible or harmonized as much as possible. Use of standard, comparable methodologies, to the extent this is compatible with local needs, is

361 TNC 2000; TNC 2002.
362 Brown and Wyckoff-Baird 1992.
363 Brown and Wyckoff-Baird 1992.

Figure 5.3 Assumptions linking the elements of the management cycle



desirable, to allow for mutual understanding and better exchange of information among sites and systems. As discussed above, the WCPA framework and the adaptive management approach provide useful evaluation tools that also promote harmonization and comparability.

Design of a methodology needs to consider how the initial phase will relate to later phases of evaluation. An overall plan specifying the frequency of later evaluations should therefore be developed at the outset.

Tools need to be appropriate and responsive to needs. Practitioners have listed the following characteristics of good evaluation methods and tools, although all may not be essential for every evaluation method.

Methods should be:

- Cost-effective – if they are too expensive they will not be adopted;
- Replicable – to allow comparability across sites and times;
- Robust and statistically valid – they must be able to withstand scrutiny;
- Simple – very complex tools can alienate field staff and stakeholders;
- Field-tested – pilot studies before major projects are essential;
- Documented in manuals or other formats so they can be reviewed;
- Credible, honest and non-corrupt – the results need to be shown to be genuine;

Box 5.18 IUCN WCPA-Marine/WWF MPA Management Effectiveness Initiative

WCPA and WWF are collaborating on an initiative to address evaluating management effectiveness in Marine Protected Areas (MPAs). The initiative builds on the IUCN Management Effectiveness Framework by applying an evaluation process to MPAs and focuses on indicators that are specific to MPAs, the marine environment and coastal communities. The main tool developed is the guidebook "*How is Your MPA Doing? A Guidebook of Natural and Social Indicators for Evaluating MPA Management Effectiveness* (Pomeroy *et al*. 2003). The guidebook aims to enhance the capacity for adaptive management in MPAs by providing a method to measure whether the management of a MPA meets its goals and objectives.

Source: Watson 2003.

- Able to yield unambiguous results – or to have the greatest explanatory power possible;
- Congruent between management and community expectations;
- Scaleable – so that scores can be compared;
- Rapid – the evaluation process should draw on and review longer-term monitoring where possible, but should not be overly time-consuming.

Information should be "triangulated" where possible. A common method of ensuring more accurate results is to choose several different indicators for the same question, different sources of information, and different methods or tools. This is known as triangulation of data, and is particularly important in any kind of qualitative research where a classic scientific method cannot be used.

Flexibility should be retained – an iterative approach is helpful. While a plan for evaluation is important, so is the ability to adjust and develop during the evaluation process. At the beginning of the assessment, it may not be clear what information is available and what is important. The process must also be flexible enough to accommodate major changes in the park or project environment over time, especially if the programme is long-term.

Methodologies should be improved over time. Some people believe it is best to start with a fairly simple system and develop more sophisticated methods as participants learn about what works best and become more skilled in evaluation processes.

What should be measured?

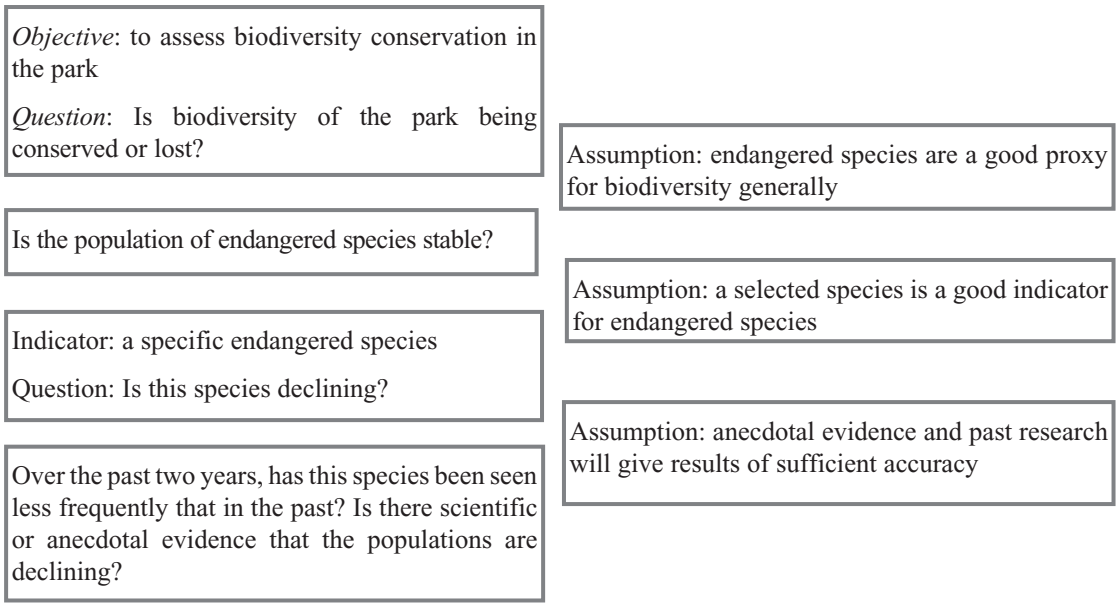
An evaluation process is distinct from the process of monitoring, and evaluators often have to work with whatever information is readily available, including the results of existing past or current monitoring. Evaluation may drive and dictate future monitoring programmes, so future evaluations can report on a better quality of information.

Framing questions

Evaluations usually start with broad questions such as "is biodiversity of the reef being conserved?" or "how has the park affected local communities?" Such broad questions are impossible to measure or report on accurately and objectively, so more detailed questions need to be framed. Most methodologies use a layered approach when defining what should be measured, gradually subdividing the broad-level questions until a level of very specific questions is reached. Different methodologies use different terminologies for these levels and this can be confusing, but the unifying factors are that:

- Different layers of questions look at conditions in a particular dimension. Layers of questions should proceed logically and link from very general level (e.g. biodiversity) to specific and measurable level (e.g. the population of one animal species recorded at one time in one place);
- It is important to be explicit about the assumptions linking different levels of questions and indicators.

An example of four layers of questions with linking assumptions is shown below.



Choosing indicators

Selection of indicators – the units of information that are actually measured and reported on – is of great concern for all evaluations. It is critical that indicators are relevant and useful in answering the higher level questions. Evaluation will not get – or deserve – continuing support if large amounts of unnecessary information are collected in the process. Relevance needs to be well thought out at the planning stage and well communicated to participants.

For similar reasons, Indicators need to be as cost-effective as possible. Considerable time and effort will go into measuring the indicators, whether through a field monitoring programme or a simpler information-gathering exercise. Where monitoring is already being conducted, indicators already being measured should be utilized, to the extent that they are appropriate.

As we learn from evaluation experiences, we can identify if indicators are useful, if they are impossible to measure or give us irrelevant information, or if they are redundant (i.e. they always tell us exactly the same thing as another indicator). The importance of triangulating information should be kept in mind – usually more than one indicator is chosen for each higher-level question. Preferably indicators will be linked to the question by different assumptions, reducing the likelihood of error. Box 5.19 summarizes the desirable characteristics of indicators.

Indicators should have some explanatory power, or be able to link with other indicators to explain causes and effects. For example, an evaluation programme which chooses frog populations as an indicator of biodiversity status might also choose to measure aspects of water quality and streamside vegetation cover as ecological health indicators, so changes in these might be linked to any changes in frog populations.

Useful indicators are scaleable and sensitive to changes. They might also have the potential to be manipulated in an experimental setting or an adaptive management programme. The ideal indicator would change in a predictable and regular manner so that changes in the attribute being evaluated (or the higher-level question) are accurately reflected. However, such ideal indicators are rarely found in the real world.

The limitations of indicators need to be understood. There is a danger that evaluations can over-simplify reality by interpreting indicators to mean more than they really do – for example, by using the abundance of one species to indicate the health of an ecosystem. Good project planning and the recognition of assumptions should make this kind of mistake less likely.

Box 5.19 Desirable characteristics of indicators

A good indicator meets the following criteria:

- **Measurable**: able to be recorded and analyzed in qualitative or quantitative terms;
- **Precise**: defined in the same way by all people;
- **Consisten**t: not changing over time so that it always measures the same thing;
- **Sensitive**: Changing proportionately in response to actual changes in the condition or item being measured.

Indicators for biological health should be:

- **Biologically relevant** (reflect target health);
- **Socially relevant** (recognized by stakeholders);
- **Sensitive to anthropogenic stress** (reflect threats);
- **Anticipatory** (early warning);
- **Measurable**;
- **Cost-effective** (the maximum information per unit of effort).

Sources: Margolius and Salafsky 1998; TNC 2002.

A well-documented evaluation clearly presents the hierarchy of levels of investigation with clear justification and assumptions linking each level. The justification for the indicator, and an explanation of how the indicator should be measured or scored, could also be documented (see Box 5.20).

Box 5.20 Example of selection of one indicator for one aspect of management, showing layers of questions

1. Social aspect

Is the protected area communicating with interest groups associated with it and are they participating in planning, management, and decision-making?

a. **Communications factor**

Is there planned, organized communication between the protected area and its corresponding interest groups?

a.1 ***Criterion of willingness to communicate by the protected area***

Is the communication plan prepared and implemented and what is its impact?

INDICATOR: *Communications plan of the protected area, executed and evaluated.*

Justification of the indicator: The basic idea for this indicator is that the protected area should have a communications plan to efficiently disseminate truthful information about its management, species and ecosystems. At the same time, it is important that the impact caused by this program be accurately measured. It is of vital importance that appropriate methods of communication with the protected area's interest groups be established.

Measurement of the indicator: The indicator is measured by comparing the initial optimum scenario against the condition of this component of the protected area at the moment of measurement. This condition refers to the existence or absence of a communication plan and its operation.

The measurement of the indicator is based on the following scale:

5 = A communications plan exists and is in operation, it is evaluated and is oriented to have a significant impact in the target population;

4 = The plan has been executed and its impact on the target population has been evaluated;

3 = Sufficient technical know-how, equipment and materials exist to execute the communications program;

2 = Communication needs have been identified, or isolated actions have been taken;

1 = A communication plan does not exist, nor have isolated actions been taken.

Source: Adapted from Courrau 1999.

Who should be involved?

There are no simple rules as to who should conduct and be involved in management effectiveness evaluations. Involvement of stakeholders, including park staff, local communities, and experts, is desirable – and essential at certain stages – but either agency staff or external organizations can be the primary drivers or coordinators of evaluation initiatives. The formation of a team with a common purpose is essential.

There are advantages of involving evaluators from universities or other scientific backgrounds as the range of expertise for some assessments may be beyond the capacity of protected area agencies, and these people can provide a fresh viewpoint. Some protected area evaluations are able to draw on the expertise of scientific advisory committees or equivalent bodies. Table 5.2 presents some of the advantages and constraints of conducting evaluations primarily by external and internal operators, and of including community involvement.

Table 5.2 Advantages and constraints of groups involved in evaluations

	Internal (i.e. agency staff-led) evaluation	External evaluation	Community involvement
Truthfulness in discussions and questionnaires	Staff are more likely to be honest and open in an internal process. However, even internal evaluations will be threatening to some staff and all results require some mediation to ensure accuracy. There could also be bias in their opinions.	Some staff may wish to hide unpalatable truths – in some cultures will not wish to "lose face" or cause other staff to lose face. Agencies may be punitive if staff reveal unpalatable facts or are critical of policies and procedures.	Agency staff may be reluctant to reveal weaknesses or be self-critical in front of community members. Community members may be most open with external evaluators without park staff present.
Open reporting	Reports may be repressed or edited by senior staff or relevant politicians. May not be able to openly criticize e.g. statements of inadequate funding.	External evaluators are generally regarded as unbiased and highly credible. Reports can be totally open and critical where necessary	Community involvement means that reports are more likely to be open and complete.
Access to agency information	Will generally be free and complete access to any information needed	May be inversely related to the openness and public profile of reporting. Freedom of information in some jurisdictions may be helpful, but information can still be very difficult to obtain and interpret, especially when not in written form.	Access to certain information will be restricted (e.g. information relating to location and status of rare animals, special cultural sites)
Availability of resource information	Park staff should have all information available – but in practice are often unaware of important findings of research etc. High level of local knowledge	External evaluators (e.g. scientists) may have access to a different set of resource information than that known to park staff.	Community members may have a wealth of resource information including traditional knowledge.
Learning processes	Critical outcome of evaluation is organizational learning and encouragement of reflection	External evaluators (e.g. consultants) may take valuable knowledge away so it is not institutionalised	Involvement of community in this process can be extremely valuable for their increased capacity in environmental management
Advocacy and community relations	Less likely to contribute unless used with community relations or publicity campaign.	Can be used to advocate better funding	Likely to contribute to positive working relationships – unless criticism by community members of park staff creates rifts.
Cost of evaluation	Relatively inexpensive	Expensive, but may be externally funded	Adds considerably to time and cost of process

How should information be obtained?

Evaluation processes use a range of techniques in a combination that suits the needs and context. The most common process for gathering information consists of: approval and socialization; background research; workshops; and follow-up research. Both primary and secondary sources of information can be used, and as discussed earlier, "triangulation" of methods is helpful. For example, if information offered in a workshop is backed up by reports and an evaluator's observation, it adds further credibility to the source.

Approval and "socialization" of the evaluation process

Gaining approval, trust and cooperation of stakeholders, especially the managers of the protected areas to be evaluated, is critical and must be ensured throughout the evaluation

Depending on how the evaluation was devised and who is driving it, gaining support of the agency directorate may be a major task. An initiative to evaluate management of the protected area system of Catalonia, Spain, for example, faced the following difficulties:

> We learnt … the difficulty of getting the public agencies interested and involved in an evaluation project for protected areas. It took us almost two years to convince the Department of the Environment of Catalonia to accept that the results should be made public, while the Diputació de Barcelona (the second most important agency in protected areas planning and management in Catalonia) finally decided not to provide funding for this project.[364]

Finding a "champion" within the agency or group being evaluated is valuable (see Box 5.21). Convincing the operational field staff can also be a significant challenge, and efforts must be made to repay their trust and the time they put into the process. Suspicions are easier to overcome when evaluation systems take a non-threatening stance. If an evaluation is perceived to be likely to "punish" participants or to reduce their resources, they are unlikely to be helpful to the process.

Credibility for the evaluation is greatly enhanced if the participants are shown that previous work has been used or at least recorded. Protected area staff and communities have become very resistant to participating in research and evaluation exercises for which they see no outcomes. It is vital for evaluators to make genuine efforts to obtain previous material and to return something – even meeting transcripts – to participants as soon as possible.

Background research

This phase may be a comprehensive research project, but in most evaluation processes it is a time-restricted desk-top exercise to compile *relevant* information already available, especially a basic understanding of the context and the results of earlier evaluation, monitoring and research efforts. This phase is important to:

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364 Mallarach 2003.

- enable the evaluators to go into the field armed with a reasonable understanding of the situation, so that their learning can be rapid and their questions relevant;
- avoid annoying field staff and stakeholders by requiring them to repeat former processes of information-gathering;
- make the best use of field time and field staff/stakeholder time;
- gain credibility with on-site managers; and
- in many cases, provide managers with usefully-compiled information.

Field familiarization is often undertaken, especially if someone from outside the local area is conducting the evaluation. This is an opportunity for intensive observations, which can be used to confirm or question other information sources.

Workshops with key staff and other stakeholders

Workshops are effective and efficient for obtaining verbal information from a number of sources simultaneously. Advantages include the ability of the workshop group to moderate results, the benefit of information being shared, and the opportunity for people to hear other points of view. Skilled facilitators may be needed for larger workshops or those likely to become heated or controversial.

Care needs to be taken to ensure all stakeholders have an opportunity to express their viewpoints. Some evaluators choose to conduct separate workshops if there are cultural or physical difficulties in hearing all people at the same place and time, though splitting groups (for example, into separate staff and community workshops) loses some of the advantages of the workshop method. Evaluators planning workshops and other field discussions should consider carefully matters of language, cultural norms and locations, as some participants can be inadvertently excluded by settings in which they are not comfortable. Mapesa (2003) points out that "the lower cadres of staff particularly the rangers and some community members need to be given the confidence to speak up in the language they can best express themselves …"

Box 5.21 The Importance of Leadership for Evaluation Processes

It helps to have a designated, enthusiastic leader of the assessment process. For example (a senior officer) approached WWF International early on, expressing his interest in implementing the RAPPAM Methodology. His enthusiasm and commitment ensured not only that the assessment was run smoothly and efficiently, but also that he contributed to the design of the methodology itself, collaborated with others in the region interested in assessing management effectiveness, and was instrumental in ensuring that the provincial government supported the findings of the assessment.

Source: Ervin 2003.

Follow-up research, field work and/or collection of secondary data

Workshops and background research answer many of the evaluation questions, but they also identify information gaps, and leads which need to be followed, before the

evaluation is complete. A further stage of information gathering by evaluators, field staff or other stakeholders is often needed.

Establishing monitoring programmes for future use

Frequently, evaluations reveal significant gaps in available information, which might be important in judging management effectiveness. A protected area may have been established, for example, to conserve a particular endangered species, but information about the species' population and threats to it may be inadequate. Establishment of a future monitoring programme to remedy this gap might therefore be an important outcome of the evaluation process.

How should the results be analyzed?

It is most useful to look at causal links between context, input, processes, outputs and outcomes. It is the combination of all these and teasing out their causal relationships that is most useful.

Answering simple questions

The first level of analysis, often very useful to all involved, is simple compilation of collected data, either for one site or across sites. This analysis usually includes the creation of simple report tables and graphs.

SWOT analysis

Some evaluators find a "SWOT" analysis – usually in a workshop with agency staff and/or other stakeholders – a useful and simple tool for analyzing information further. This method provides a quick summary of management effectiveness in a format that is particularly appropriate for communication with busy upper-level managers and politicians (see Box 5.22).

Scoring and indexes

Many protected area evaluation systems use simple scores, which summarize a lot of data into one number. Scores can be easy for managers and the public to work with and understand, and provide a simple way for an audience to quickly determine comparative conditions. Examples of these scores can be seen in most of the evaluations discussed in this chapter, including the WCPA framework, RAPPAM method, World Bank Tracking Tool and The Nature Conservancy's Five-S system. These scores can be very useful in providing comparisons and snapshots, but the advantages of simplicity can also have some drawbacks. Some explanation of results should usually accompany "score-card" reports so the audience does not draw the wrong conclusions from the figures.

It may be possible for more advanced statistical analyses to be conducted, looking at trends in data and attempting to draw out broader patterns. However, qualitative data that is turned into quantitative data should be treated with care and its limitations fully

Box 5.22 Analysis of Strengths, Weaknesses, Opportunities and Threats (SWOT): Sian Ka'an Biosphere Reserve, Mexico

Strengths

- Basic and functional legal framework, positive land tenure agreements
- Financial resources that guarantee basic operations
- Motivation and commitment to the development of personnel functions
- Follow-up in actions and work team consolidated
- Social presence and acceptance
- Basic training and capacity building in the protected area
- Acknowledgement of achievements, national and international designations
- Basic scientific information
- Incorporation of communities from the influence zone of the protected area into management strategies

Weaknesses

- Deficiencies in design and operation of management plans
- Lack of technical and scientific information that supports decision-making processes
- Lack of an organizational structure
- Deficiencies in profile, induction and training of personnel
- Lack of incentive and promotion plans
- Deficiency in occupational health (security, hygiene)

Direction

- Old management plan and inadequate zoning
- Lack of legal support
- Three areas under the same administration and resources
- Financial resources limited to basic operations
- Gaps in legislation
- Lack of presence of mid- and high-level authorities in the areas
- Deficiencies in intra- and inter-institutional coordination

Control

- Lack of mechanisms of control for actions and processes
- Absence of mechanisms to control resources and products

Box 5.22 Analysis of Strengths, Weaknesses, Opportunities and Threats (SWOT): Sian Ka'an Biosphere Reserve, Mexico (cont.)

Opportunities

- Acknowledged for its values and environmental benefits
- Access to external financing
- Tourist demand to generate resources
- Participation in development programs
- Regional acknowledgement

Threats

- Impacts generated by uncontrolled tourism growth
- Reduced budgets
- Illegal extraction of flora and fauna
- Exotic species
- Forest fires
- Diverse sources of pollution: tourism development, human settlements, marine pollution
- Infrastructure for development.

Source: Leal 2003.

recognized. In particular, manipulating results through summing and averaging, assigning weights to different indicators, and through the use of scales and indexes, can give misleading results. Evaluators should always seek professional advice before attempting this kind of manipulation.

Assessing against standards or targets

Information can be further analyzed by comparing the field reality with the defined standards or targets for management. These results are often scored (as discussed above) and presented quantitatively as a percentage of the ideal or as a "poor" to "excellent" rating.

For assessment of input, processes and outputs, this analysis is reasonably straightforward using the chosen indicators and standards. Measuring the extent to which outcomes have been achieved is a more complex task, requiring the assessment of indicators and answering questions at a number of levels. Often the answers to higher-level questions, such as the extent to which biodiversity conserved has been achieved, can only be approximated and inferred from the indicators. It is important that reports make any such approximations and assumptions very clear and give details of how the analysis was conducted, as well as the background to the conclusions reached.

Comparisons over time

For all except special-purpose, single-event evaluations, it is desirable to repeat similar measures at intervals. A number of protected area systems are now developing "State of the Parks" evaluations, which they intend to repeat regularly to see trends over time. At the park level, implementation of management plans should be tracked, while for specific intervention projects, evaluations should occur throughout the project cycle.

Evaluation is itself a learning experience, and better indicators, changed circumstances, or more useful technology will shape evaluation projects over time. Participatory evaluations, by their nature, need to be flexible and respond to people's needs and perceptions. However, if comparability over time is a purpose of the evaluation, minimum changes should be made to methods and measures from one evaluation to the next, unless there are very good reasons for doing so, or unless adjustments can be made in ways that still provide comparable information.

Comparisons between sites

Similarly, comparisons between sites for accountability or resource allocation purposes must rely on standard measures. "Scorecards" are a common mechanism to compare effectiveness on very different sites – for example, two protected areas can be rated from one to five on their efforts to conserve endangered species, even though the species themselves are completely different. However, such comparisons must always be treated with a degree of caution, with a consideration of context.

The "Learning Portfolio" approach applies adaptive management principles across a range of sites.[365] This process involves the selection of a number of projects using the same conservation strategy in different locations. These projects work together to test hypotheses that will provide insight about the conditions under which the strategy works or does not work, and why.

This general approach – comparing over space rather than time – can also be used to efficiently evaluate the long-term effectiveness of particular management programmes or the potential impacts of a threat. For example, we could evaluate the effectiveness of revegetation techniques by looking at similar areas that were revegetated two, five and ten years ago rather than following one site over time. Comparisons also are very helpful in setting priorities among sites and projects competing for attention.

Looking for explanations

Once we have assessed whether management outcomes have been achieved, it is desirable to establish to what extent these results are due to our management interventions and to what extent they are due to other factors – maybe those beyond managers' control. However, it is more important to know the reason for success or failure of a programme than to simply know whether the outcome was caused by the programme activities. If we cannot understand the reasons for management success or failure, then attempts to improve performance or to emulate successful programmes may be ineffective.

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[365] Salafsky and Margolius 1999.

> Evaluation and monitoring go hand in hand. Monitoring provides the raw data to answer questions. But in and of itself, it is a useless and expensive exercise. Evaluation is putting those data to use and thus giving them value. Evaluation is where the learning occurs, questions answered, recommendations made, and improvements suggested. Yet without monitoring, evaluation would have no foundation, have no raw material to work with, and be limited to the realm of speculation … A monitoring program should not be designed without clearly knowing how the data and information will be evaluated and put to use. We cannot afford to collect and store data that are not used. Monitoring for monitoring's sake is monitoring that should never be done.[366]

Many factors interact in the complex systems that are protected areas. For example, improvement in the ecological state of a grassland over the first five years of management in a new protected area could be due to reduction in grazing, better fire management, or a series of good seasons.

Well-designed evaluation processes yield results with greater explanatory power, giving us some ideas as to why outcomes have been achieved or not achieved. Clear questions, explicit assumptions and meaningful indicators all help to increase our ability to understand and interpret the results. More comprehensive evaluation programmes – i.e. those that address more of the elements of management – also explain causes better. Information about context, inputs, processes and outputs help interpret to what extent outcomes are due to particular interventions.

Interpretation of results is much easier if evaluators can refer to a simple model such as that in Figure 5.3, which shows how the elements are linked, what assumptions are made and what factors could influence management outcomes. Where an evaluation has been based on such a model, and assessments have been made of context, planning, inputs, processes, outputs and outcomes, we can draw on all this information to come up with informative and useful explanations and future recommendations. Even at the analysis phase a model can be developed to better understand results.

Referring to the example shown in Figure 5.3, possible summarized results could be:

Scenario 1: The outcomes were all achieved. The planning and execution of the project were excellent and that the chain of events and the assumptions were all "on track."

Scenario 2: The output (a successful fish farm) was achieved. However, one of the critical assumptions (the level of enforcement of outside fishing) was incorrect, so the outcome was not achieved and the reefs were still plundered seriously. The recommendation from the evaluation is to continue the fish farm project but to also increase law enforcement capacity.

Scenario 3: The fish farm was not established on target and objectives were not achieved. Processes of working with the community were inadequate and need to be improved.

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366 Allen 1997.

Scenario 4: As for scenario 3, but the cause of this problem was that the funding was discontinued for 6 months at a critical time, resulting in loss of key staff and of community trust. However, strict new law enforcement has stopped the reef destruction and some recovery is evident in spite of the project failure.

Scenario 5: All elements of the project appear to be successful but a severe drought and high temperatures have caused coral bleaching, so the reef biodiversity has further declined.

These scenarios are not all successful, but the project evaluation has explained the results and will practically guide future improvements.

Recommendations for action

As analysis is being undertaken, the critical question "how well is this protected area being managed?" is usually paired with two other questions: "how can this be improved?" and "what other information do we need to make these judgments better?" Recommendations for improved management and for monitoring usually result from the analysis phase. Advice from evaluation exercises needs to be clear and specific enough to improve conservation practices and it needs to be realistic, addressing priority topics and feasible solutions.

5.3.7 Ensuring that evaluations have an impact

How can practitioners ensure that the evaluation does achieve its purposes and result in more effective and anticipatory protected area management? All the guidelines suggested in this chapter work towards making an evaluation proceed successfully. However, one or more "champions", either within a management agency or outside it, need to follow through both during and after the evaluation process to facilitate and encourage the needed changes. It should never be assumed that an evaluation will automatically result in improved management – unfortunately many excellent reports have very little impact at all.

Making an impact during the process

Adaptive management and action learning approaches work on the philosophy that the evaluation process itself is a vital learning experience which enhances and transforms management. Evaluation often has impacts on management well before a formal report is prepared.

The process of *designing* the evaluation often formalizes and documents park values and objectives and the determination of expected management standards. Though these statements and standards have ideally been formulated as part of a prior management planning process, in reality many protected area sites and systems have inadequate planning, and the evaluation process can assist in these core planning elements.

Conducting the evaluation also has immediate benefits (see Box 5.23). Getting people together to talk about management and to focus on management effectiveness

provides a valuable – sometimes unique – opportunity for increased understanding, improved learning and the exchange of different viewpoints.

Short-term benefits of evaluation should be demonstrated clearly wherever possible. The acceptance of longer-term evaluation and monitoring can be undermined when no results or outcomes are seen for a long time. Some form of feedback – even unprocessed information – should be returned to agency field personnel and other stakeholders as soon as possible after evaluation exercises to reinforce the learning and exchanges that have taken place.

Communicating the results

Evaluation planning should include an early consideration of communication and of the audiences for the evaluation's findings and recommendations. In some cases, the audience might be the organization that requested the evaluation, but often a much wider audience is interested in the results. It may be possible to greatly multiply the positive effects of the evaluation by effective communication. Possible methods of communication include reports in hard copy and on the Internet, attractive publications and brochures to increase public interest, presentations to managers, decision-makers, interest groups and other stakeholders, field days and special events, media coverage and displays.

Several reports or presentations with different levels of detail for different audiences might be appropriate communications outputs from a single evaluation. Careful thought needs to be given to which results should be kept confidential. Scores or comments that relate directly to individuals, for example, might be grouped or otherwise reported to avoid potential repercussions on participants.

Broad audiences might be most interested in the main conclusions, while more detailed information with a higher level of technical explanation may be made available to particular audiences. It can be difficult to decide or negotiate what information should made public if it is critical of current management practices or if it clearly signals the need for more funding. In Brazil problems arose when agency staff felt they were being openly criticized (see Box 5.24).

The way that findings are reported must suit the intended audiences. Methods of presentation, language and terminology used in collecting and reporting evaluations should be commonly understandable, though more technical language will be appropriate

Box 5.23 Evaluation through rapid assessment in Queensland, Australia

An unexpected and immediate outcome of assessing our management is the sharing of knowledge in group meetings. Park managers find out about really valuable information or resources that they have never heard of, and about some great innovations other managers are making.

There have also been very robust discussions about some aspects of management, about current and potential threats, and about impacts of certain activities, which I think will result in some park managers changing their practices or being more vigilant for problems. The important thing is that these results would not have come about without the meetings of staff from different areas, and the resulting opportunity for peer review and reflection time.

Source: Leverington 2003.

for selected audiences. Use of electronic publishing and the Internet has enabled much wider audiences to be supplied with greater information. It can be particularly appropriate for regular reporting and for large amounts of information where people are likely to want to see only a fraction at one time. Some stakeholders, however, may have limited access to the Internet, and some hard copy reports are therefore usually required for a complete communication strategy.

Timeliness of reporting is also critical. It is futile to spend months conducting detailed analyses and producing attractive reports if the evaluation is then out of date by the time it is disseminated. "Note that if early results show that current management is failing to achieve the objectives, it is essential that decision makers get the facts [in a timely fashion] … and know what needs to be done to improve management. If the results of evaluations don't get back to and influence those who can change ongoing management, the benefits of the evaluation can be lost."[367]

Making sure change happens

Box 5.24 Anticipating and Managing Perceptions of Effectiveness Evaluation Results in Brazil

… the media's interest in the campaign (between March and October 1999, there were 50 news releases on newspapers and magazines about the WWF report, and several TV and radio interviews) caused some difficulties between WWF Brazil and IBAMA, mainly because the parties did not agree in advance on the objectives of the study and the use of its results…Some IBAMA staff responded defensively, seeing the report as a reflection on their management rather than on the difficult circumstances faced by protected area managers in Brazil. As far as WWF was concerned, "the study was meant to be a 'snap shot' of the present situation, a base-line for future monitoring, and an instrument for government planning, not a judgement of past or present performance."

Subsequently, WWF and IBAMA staff have reviewed the difficulties that arose over the publication and use of the results of the study, and have clarified the project's objectives and their institutional roles. This has resulted in a formal, five-year cooperative agreement.

Making recommendations

Evaluations should spell out need for planned change or should encourage reinforcement of what is going well at site, organizational or institutional levels. To that end, it is important that:

- Recommendations include short-term actions, which are clear, concrete, achievable within time and resource constraints and prioritized; as well as long-term and other recommendations that enable managers to take advantage of potential increased resources and opportunities;
- Advice from evaluation is specific and clear enough to improve conservation practices;

[367] Jones 2000.

- Findings address priority concerns, are relevant to evaluation audiences, and are presented in a way that is meaningful to them; and
- Evaluation findings, wherever possible, are positive, identifying challenges rather than blame.

Using recommendations

The findings and recommendations of evaluation need to feed back into management systems to influence future plans, resource allocations and management actions. Evaluations that are integrated into the managing agency's culture and processes are more successful and effective in improving management performance in the long term.

Two key factors that determine whether evaluation findings will make a difference are:

- strong commitment to the evaluation by managers and owners of the protected areas;
- adequate mechanisms, capacity and resources to address the findings and recommendations.

5.4 Summary

We cannot afford to make the same mistakes over and over – or to ignore successes and good initiatives and let them languish uncelebrated and unrepeated. Managers need to build on the best ideas and practices of the past and combine them with inspiration, innovation and initiative for the future. Evaluation of management effectiveness is therefore a vital component of responsive, proactive protected area management that can cope with global change. Through evaluation, every success and failure can be used as opportunity for learning, and continual improvement can be combined with anticipation of future threats and opportunities. To serve these purposes, though, evaluation needs to be systematically built into the overall process for protected areas management planning.

Management effectiveness evaluation works best within a tested and accepted framework, adapted for specific local needs and conditions. The IUCN Management Effectiveness Evaluation framework is useful for this purpose, and has been widely adapted and utilized for evaluation of numerous protected areas. Evaluation also works best with a strategic plan that sets out a clear purpose and scope, states assumptions, articulates the linkages between the various questions being asked, and clarifies cause-and-effect linkages. Indicators and data sources should be as cost-effective as possible, while still yielding needed information, and avoiding over-simplification. Where possible, several different indicators and sources of information should be used to answer each question. The use of existing methodologies consistently, over time and among different sites, allows for greater comparability, although evaluation methods should also evolve and improve over time, based on experience. A long-term evaluation plan with a good monitoring programme is usually preferable.

Evaluations require good communication, team-building and stakeholder involvement. Gaining the trust and cooperation of stakeholders, especially the managers of the

protected areas to be evaluated, is critical. Evaluation systems should be established with a non-threatening stance to overcome suspicion. Care needs to be taken to ensure all stakeholders have an opportunity to express their viewpoints.

Evaluation findings must be effectively communicated and used proactively. Evaluation planning should therefore include an early consideration of communication strategy, suited to intended audiences. Advice from evaluations needs to be clear and specific enough to improve conservation practices and it needs to be positive and realistic, addressing priority topics and feasible solutions. Commitment to the evaluation by managers and adequate institutional capacity and political will to implement evaluation recommendations are key determinants of whether an evaluation will make a significant difference for management of the protected area.

References

Chapter 1

Abramovitz, J.N. 1996. *Imperiled Waters, Impoverished Future: The Decline of Freshwater Ecosystems*. Washington, DC: Worldwatch Institute.

Abramovitz, J.N. and A.T. Mattoon. 1999. *Paper Cuts: Recovering the Paper Landscape*. Washington, DC: Worldwatch Institute.

Arnold, J.E.M. *et al.* 2003. *Fuelwood revisited: What has changed in the last decade?* Bogor, Indonesia: Center for International Forestry Research.

Barber, B.R. 1995. *Jihad vs. McWorld. How Globalism and Tribalism are Reshaping the World*. New York: Times Books.

Baskin, Y. 1998. "Winners and losers in a changing world." *BioScience*, 48: 788–792.

Baskin, Y. 2002. A Plague of Rats and Rubbervines: The Growing Threat of Species Invasions. Washington, DC: Shearwater Books/Island Press.

Bender, D.J., T.A. Contreras and L. Fahrig. 1998. "Habitat loss and population decline: a meta-analysis of the patch size effect." *Ecology*. March.

Berger, T. 1994. "The independent review of the Sardar Sarovar projects 1991–1992." *Water Resources Development* 10.

Bhalla, S. 2002. *Imagine There's No Country: Poverty, Inequality, and Growth in the Era of Globalization*. Washington, DC: Institute of International Economics.

BirdLife International *et al*. 2004. *Joint NGO Statement and Joint NGO Commitment on Protected Areas*. 7th Conference of the Parties to the Convention on Biological Diversity, Kuala Lumpur, February 9–20, 2004.

Bond, M. 2000. "The Backlash against NGOs." *Prospect Magazine*. April.

Borrini-Feyerabend, G. *et al*. 2000. *Co-management of Natural Resources. Organising, Negotiating and Learning-by-Doing*. Heidelberg, Germany: GTZ and IUCN, Kasparek Verlag.

Brown, L.R. 2004. "Troubling New Flows of Environmental Refugees." *Eco-Economy Update*, 28 January 2004, Earth Policy Institute. www.earth-policy.org/Updates/Update33.htm

Brown, L.R. 2001. *Eco-Economy*. New York: W.W. Norton.

Brown, L.R. *et al.* 1998. *Beyond Malthus: Sixteen Dimensions of the Population Problem*. Washington, DC: Worldwatch Institute.

Bryant, D. Nielsen and L. Tangley. 1997. *The Last Frontier Forests: Ecosystems and Economies on the Edge*. Washington, DC: World Resources Institute.

Bryant, D. *et al*. 1998. *Reefs at Risk. A Map-Based Indicator of Threats to the World's Coral Reefs*. Washington, DC: World Resources Institute.

Chan, K.W. 2001. "Recent Migration in China: Patterns, Trends, and Policies." *Asian Perspectives*, 25(4): 127–155.

Cincotta, R. and R. Engelman. 2000. *Nature's Place: Human Population and the Future of Biological Diversity*. Washington, DC: Population Action International.

Clarke, R. 1991. *Water: The International Crisis*. London: Earthscan.

Collinge, S.K. 2000. "Effects of grassland fragmentation on insect species loss, recolonization, and movement patterns." *Ecology* 81(8): 2211–2226.

Conservation International. 2004. Unpublished data.

Dale, V.H. (Ed). 2000. "Climate Change, Forests and Disturbances." *Sci. Total Env*,. 262 (3).

DePhilip, M. 2003. "The Giving Rivers: Protected areas and environmental flows in North America." Contribution by Michele DePhilip of the Nature Conservancy to the Workshop on "Building Broader Support for Protected Areas", Vth IUCN World Parks Congress, Durban, South Africa. September.

Diamond, L. 1994. "Rethinking civil society: Toward democratic consolidation." *Journal of Democracy*, 5(3): 4–17.

Doering, D.S. *et al*. 2002. *Tomorrow's markets: Global trends and their implications for business*. Washington, DC: World Resources Institute, United Nations Environment Programme and World Business Council for Sustainable Development.

Dunne, T. and N.J. Wheeler (Eds.) *Human Rights in Global Politics*. Cambridge, UK: Cambridge University Press.

FAO (U.N. Food and Agriculture Organization). 2001. *Rice Market Monitor.* March.

Forman, R.T. and L.E. Alexander. 1998. "Roads and their major ecological effects." *Annual Review of Ecological Systems*, 29: 207–31.

Fowler, A. 2000. *Civil Society, NGDOs and Social Development: Changing the Rules of the Game*. Geneva: United Nations Research Institute for Social Development.

Frazier, S. 1999. *Ramsar Sites Overview: A Synopsis of the Worlds' Wetlands of International Importance*. Wageningen, the Netherlands: Wetlands International.

Gascon, C, B. Williams and G.A.B. da Fonseca. 2000. "Receding Forest Edges and Vanishing Reserves." *Science*,. 288: 1356–1358.

Gleick, P.H. 1993. *Water in Crisis*. New York: Oxford University Press.

Global Reach. 2004. *Global Internet Statistics*. http://glreach.com/globstats. Accessed 14 July 2004.

Gray, D.D. 1997. "Dam Builders Eye Mekong: Poverty, Energy, Thirst May Tame Mighty River." *Washington Times*. 26 May 1997. A14.

Guest, P. 1999. "Mobility Transitions within a Global System: Migration in the ESCAP Region." *Asia-Pacific Population Journal,* Vol. 14 No. 4.

Harrison, P. and F. Pearce. 2001. *AAAS Atlas of Population and Environment*. Berkeley, CA: University of California Press.

Heywood, V.H. (ed). 1995. *Global Biodiversity Assessment*. Cambridge, UK: Cambridge University Press. Published for the United Nations Environment Programme.

Homer-Dixon, T. 1999. *Environment, Scarcity, and Violence*. Princeton, NJ: Princeton University Press.

Houghton, J. 1994. *Global Warming*. Oxford, UK: Lion Publishing.

International Telecommunications Union. 2002. *World Telecommunication Development Report 2002*. Geneva.

IPCC. 2001a. *Climate Change 2001: Impacts, Adaptation, and Vulnerability*. Cambridge, UK: Cambridge University Press.

IPCC. 2001b. *Climate Change 2001: Mitigation*. Cambridge, UK: Cambridge University Press.

IPCC. 2001c. *Climate Change 2001c: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press.

IUCN. 2000. *IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species*. Species Survival Commission Invasive Species Specialist Group. www.iucn.org/themes/ssc/pubs/policy/invasivesEng.htm

Jablonski, D. 1995. "Extinction in the fossil record." In J.H. Lawton and R.M. May (Eds.). *Extinction Rates*. Oxford, UK: Oxford University Press.

Jackson R.B. *et al*. 2001. "Water in a Changing World." *Ecological Applications*, Vol. 11 number 4. August.

Khare, A. and D.B. Bray. 2004. *Study of Critical New Forest Conservation Issues in the Global South*. Final Report Submitted to the Ford Foundation, New York. June.

Lange, D. 1998. *Europe's medicinal and aromatic plants: their use, trade, and conservation*. Cambridge, UK: TRAFFIC Europe/International.

Leatherman, S.P. *et al*. 1995. *Vanishing Lands: Sea level, Society and the Chesapeake Bay*. College Park, MD, US: Laboratory of Coastal Research, University of Maryland.

Leonard, H.J. 1989. *Environment and the Poor: Development Strategies for a Common Agenda*. New Brunswick, NJ: Transaction Books.

Levinger, B. and J. Mulroy. 2003. *Making a Little Go a Long Way: How the World Bank's Small Grants Program Promotes Civic Engagement*. Washington, DC: The World Bank, Prepared by the Educational Development Center and Pact, Inc.

Levovich, M. and G. White. 1990. "Use and transformation of terrestrial water systems." In Turner, B.L (ed). *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere Over the Past 300 Years*. Cambridge, UK: Cambridge University Press. 235–252.

McChesney,. R.W. 1999. "The New Global Media." *The Nation*. November 29.

McNeely, J. 2000. "Invasive Species: A Costly Catastrophe for Native Biodiversity." In Preston G., A.G. Brown, and E. van Wyk (Eds.) *Best Management Practices for Preventing and Controlling Invasive Alien Species*. Symposium Proceedings, Cape Town, South Africa: Working for Water Programme.

McNeely, J.A. (Ed.) 2001. *The Great Reshuffling: Human Dimensions of Invasive Alien Species*. Gland, Switzerland and Cambridge, UK: IUCN.

McNeely, J.A. *et al*. (Eds.) 2001. *A Global Strategy on Invasive Alien Species*. Gland, Switzerland and Cambridge, UK: IUCN in collaboration with the Global Invasive Species Programme.

McNeely, J.A. and S.J. Scherr. 2003. *Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity*. Washington, DC: Island Press.

McNulty, S.G. and J.D. Aber. 2001. "U.S. National Climate Change Assessment on Forest Ecosystems: An Introduction." *Bioscience,* 51: 720–722.

Milanovic, B. 1995. *True World Income Distribution, 1988 and 1993: First Calculation Based on Household Surveys Alone*. Washington, DC: World Bank.

Milanovic, B. and S. Yitzhaki. 2001. *Decomposing World Income Distribution: Does the World have a Middle Class?* Washington, DC: World Bank.

Mills, J.A. 1997. *Rhinoceros Horn and Tiger Bone in China: An Investigation of Trade since the 1993 Ban*. Cambridge, UK: TRAFFIC.

Minnemeyer, S. 2002. *An Analysis of Access to Central Africa's Rainforests*. Washington, DC: World Resources Institute.

Moses, M. C. Prentice, and S. Frazier. 1999. *A Global Overview of Wetland Loss and Degradation*. Wageningen, the Netherlands: Wetlands International.

Moyle, P.B. and R.A. Leidy. 1992. "Loss of biodiversity in aquatic ecosystems: evidence from fish faunas." In Fiedler, P.L. and S.K. Jain (Eds.) *Conservation biology: the theory and*

practice of nature conservation, preservation and management. New York: Chapman and Hall.

Murcia, C. 1995. "Edge effects in fragmented forests: Implications for conservation." *Trends in Ecology and Evolution*. 10: 58–62.

NAST (National Assessment Synthesis Team). 2001. "Conclusions and research pathways." In *Climate Change Impacts on the United States. The Potential Consequences of Climate Variability and Change: Foundation*. Cambridge, UK: Cambridge University Press.

NAST (National Assessment Synthesis Team). 2000. *Climate Change Impacts on the United States. The Potential Consequences of Climate Variability and Change: Overview*. Cambridge, UK: Cambridge University Press.

Nickel, J. 2003. "Human Rights." In E.N. Zalta (Ed.) *The Stanford Encyclopedia of Philosophy (Summer 2003 Edition)*. http://plato.stanford.edu/archives/sum2003/entries/rights-human/

NRC (National Research Council). 2000. *Ecological Indicators for the Nation*. Washington, DC: National Academies Press.

OECD (Organisation for Economic Cooperation and Development). 1998. *Financial Flows to Developing Countries in 1998: Rise in Aid; Sharp Fall in Private Flows*. Paris.

Parson, E.A. *et al*. 2003. "Understanding Climatic Impacts, Vulnerabilities, and Adaptation in the United States: Building a Capacity for Assessment." *Climatic Change*, 57: 9–42.

Peluso, N. and M. Watts. 2001. *Violent Environments*. Ithaca, NY: Cornell University Press.

Perrings, C. 2000. "The Economics of Biological Invasions." In Preston, G., A.G. Brown, and E. van Wyk (Eds.) *Best Management Practices for Preventing and Controlling Invasive Alien Species*. Symposium Proceedings, Cape Town, South Africa: Working for Water Programme.

Pimm, S.L. *et al*. 1995. "The future of biodiversity." *Science,* 269: 347–350.

Pimm, S.L. 2001. *The world according to Pimm: A scientist audits the Earth*. NewYork: McGraw-Hill.

Pimm, S.L. and P. Raven. 2000. "Extinction by numbers." *Nature* 403: 843–845.

Pinter, F. 2001. "Funding Global Civil Society Organisations." In Anheier, H., M. Glasius, & M. Kaldor (Eds.) 2001. *Global Civil Society*. Oxford, UK: Oxford University Press.

Poff, N.L. *et al*. 1997. "The natural flow regime: a paradigm for river conservation and restoration." *BioScience*, 47: 769–784.

Population Resource Center. 2004. *Executive Summary: International Migration*. www.prcdc.org/summaries/intlmigration/intlmigration.html. Accessed 13 July 2004.

Postel, S. 1996. *Dividing the Waters: Food Security, Ecosystem Health, and the New Politics of Scarcity.* Washington, DC: Worldwatch Institute.

Postel, S. 1999. *Pillar of Sand: Can the Irrigation Miracle Last?* New York: W.W. Norton.

PricewaterhouseCoopers. 2003. "Global Entertainment and Media Industry Will Reach $1.4 Trillion in 2007 Despite Weak Economy, Defense Spending Increases." Press Release, 11 June 2003. Www.pwcglobal.com/extweb/ncpressrelease.nsf/DocID/D34E8B94A65AEF0C85256D42006B3F2D. Accessed 15 July 2004.

Rees, W. 1996. "Ecological footprints of the future." *People and the Planet,* 5(2): 6–9.

Revenga, C. *et al*. 2000. *Pilot analysis of global ecosystems: Freshwater Systems*. Washington, DC: World Resources Institute.

Ribot, J.C. 2002. *Democratic Decentralization of Natural Resources. Institutionalizing Popular Participation*. Washington, DC: World Resources Institute.

Riley, A.L. 1998. *Restoring streams in cities: A guide for planners, policymakers, and citizens*. Washington, DC: Island Press.

Rodrigues, A.S.L. *et al*. 2003. *Global Gap Analysis: Towards a Representative Network of Protected Areas*. Washington, DC: Center for Applied Biodiversity Science, Conservation International. Advances in Applied Biodiversity Science No. 5.

Rosegrant, M.W. *et al*. 2001. *Global Food Projections to 2020. Emerging Trends and Alternative Futures*. Washington, DC: International Food Policy Research Institute.

Rosegrant, M.W., X. Cai, and S.A. Cline. 2002. *World Water and Food to 2025: Dealing with Scarcity.* Washington, DC: International Food Policy Research Institute.

Rosen, J.E. and S.R. Conly. 1998. *Africa's Population Challenge: Accelerating Progress in Reproductive Health*. Washington, DC: Population Action International.

Sanderson, E.W. *et al*. 2002. "The Human Footprint and the Last of the Wild." *BioScience,* 52(10).

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. "Biological Consequences of Ecosystem Fragmentation: A Review." *Conservation Biology*, Vol. 5 No. 1. March.

Scherr, S.J. 2000. "A downward spiral? Research evidence on the relationship between poverty and natural resource degradation." *Food Policy,* 25: 479–498.

Scherr, S.J., A. White, and D. Kaimowitz. 2003. *A New Agenda for Forest Conservation and Poverty Alleviation: Making Markets Work for Low-Income Producers*. Washington, DC: Forest Trends and the Center for International Forestry Research.

Seckler, D. 1996. *The new era of water resources management*. Colombo, Sri Lanka: International Irrigation Management Institute. Research Report No. 1.

Shiklomanov, I.A. 1999. *World Water Resources: Modern Assessment and Outlook for the 21st Century*. St Petersburg, Russia: Federal Service of Russia for Hydrometeorology and Environment Monitoring, State Hydrological Institute.

Shine, C., N. Williams, and L. Gündling. 2000. *A Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species*. Gland, Switzerland and Cambridge, UK: IUCN Environmental Law Centre Environmental Policy and Law Paper No. 40.

Stedman-Edwards, P. 1997. *Socioeconomic Root Causes of Biodiversity Loss: An analytic approach paper*. Washington, DC: World Wide Fund for Nature.

UNPD (United Nations Population Division). 2000. *World urbanization prospects: The 1999 revision*. New York.

UNEP (United Nations Environment Programme). 2002. *Global Environmental Outlook 2003*. London: Earthscan.

UNEP (United Nations Environment Programme). 1999. *Global Environmental Outlook 2000*. London: Earthscan.

United Nations. 2003. *World Population Prospects: The 2002 Revision. Highlights*. New York. February.

U.S. Census Bureau. 2004. *Global Population at a Glance: 2002 and Beyond*. Washington, DC. March.

Vitousek, P.M. *et al*. 1986. "Human Appropriation of the Products of Photosynthesis." *BioScience*, Vol. 36 No. 6.

Vitousek, P.M. *et al*. 1997. "Human Domination of Earth's Ecosystems." *Science,* Vol. 277. 25 July.

Wetlands International. 1996. *A global overview of wetland loss and degradation*. Preliminary paper presented at "technical session B" of the 6th Meeting of the Contracting Parties to the Ramsar Convention, Brisbane, Australia. March. Available at: www.ramsar.org/about_wetland_loss.htm

White, R., S. Murray and M. Rohweder. 2000. *Pilot analysis of global ecosystems: Grassland ecosystems*. Washington, DC: World Resources Institute.

Wilcove, D. S., C.H. McLellan, and A.P. Dobson. 1986. "Habitat fragmentation in the temperate zone." In M.E. Soule (Ed.) 1986. *Conservation Biology: The Science of Scarcity and Diversity. 237–256. Sunderland, MA, US: Sinauer Associates.*

Wilkie, D. *et al*. 2000. "Roads, Development, and Conservation in the Congo Basin." *Conservation Biology*, Vol. 14 no. 6.

Wood, A., P. Stedman-Edwards, and J. Mang (Eds.) 2000. *The Root Causes of Biodiversity Loss*. London: Earthscan.

Wood, S., K. Sebastian, and S.J. Scherr. 2000. *Pilot Assessment of Global Ecosystems: Agroecosystems*. Washington, DC: International Food Policy Research Institute and World Resources Institute.

World Bank. 2001. *World Development Indicators* 2001. Washington, DC: World Bank.

World Bank. 2002. *Information and Communication Technologies: A World Bank Group Strategy*. Washington, DC.

World Bank. 2004. *World Development Indicators*. Washington, DC.

World Commission on Dams. 2000. *Dams and Development: A New Framework for Decision-Making*. London: Earthscan.

WRI (World Resources Institute). 1996. *World Resources: The Urban Environment*. Washington, DC.

WRI (World Resources Institute). 2000. *World Resources 2000–2001: People and Ecosystems*. Washington, DC.

WRI (World Resources Institute). 2003. *World Resources 2002–2004: Decisions for the Earth: Balance, Voice, and Power*. Washington, DC.

WRI (World Resources Institute), IUCN (The World Conservation Union) and UNEP (United Nations Environment Programme). 1992. *Global Biodiversity Strategy*. Washington, DC.

WTO (World Trade Organization). 2004. *Selected long-term trends*. www.wto.org/english/res_e/statis_e/chp_2_e.pdf. Accessed 14 July 2004.

Chapter 2

Abell, R. 2002. "Conservation Biology for the Biodiversity Crisis: a Freshwater Follow-up." *Conservation Biology,* Vol. 15 No. 5. October.

Agardy, T. *et al.* 2003. "Dangerous targets? Unresolved issues and ideological clashes around marine protected areas." *Aquatic Conservation: Marine and Freshwater Ecosystems*, Vol. 13 No. 4. July/August.

Aliens No. 17. 2003. *Special Issue on Invasive Alien Species and Protected Areas*. IUCN Species Survival Commission Invasive Species Specialist Group.

Arensberg, W.W. 2003. *Critical Ecosystem Partnership Fund Mid-Term Review*. Washington, DC. Prepared for the Critical Ecosystem Partnership Fund. June.

Bennett, A.F. 2003. *Linkages in the Landscape. The Role of Corridors and Connectivity in Wildlife Conservation*. Gland Switzerland: IUCN.

BirdLife International. 2001. *Guidelines for Important Bird Area Site Action Planning. Africa*. NGO-Government Partnerships for Sustainable Biodiversity Action Project.

Boyd, C. 2004. "Protected Landscapes, Corridors, Connectivity and Ecological Networks." In Secretariat of the Convention on Biological Diversity 2004.

Bridgewater, P. 2002. "Biosphere Reserves – a network for conservation and sustainability." *PARKS,* Vol 13 No. 3: 15–20.

Brooks, T.M., G.A.M. de Fonseca and A.S.L. Rodrigues. 2004. "Protected Areas and Species." *Conservation Biology,* Vol. 18 No. 3: 616–618.

Bryant, D., D. Nielsen, and L. Tangley. 1997. *The Last Frontier Forests: Ecosystems and Economies on the Edge*. Washington, DC: World Resources Institute.

Buddemeier, R.W., J.A. Kleypas and R.B. Aronson. 2004. *Coral Reefs and Global Climate Change. Potential Contributions of Climate Change to Stresses on Coral Reef Ecosystems*. Pew Center on Global Climate Change. February.

Burke, L., E. Selig, and M. Spalding. 2002. *Reefs at Risk in Southeast Asia*. Washington, DC: World Resources Institute.

Carey, C., N. Dudley, and S. Stolton. 2000. *Squandering Paradise? The importance and vulnerability of the world's protected areas*. Gland, Switzerland: WWF.

Coates, D. 2004. "Protected Areas and Inland Aquatic Ecosystems." In Secretariat of the Convention on Biological Diversity. 2004. 58–62.

Conservation International. 2004. Unpublished data.

Dasmann, R.F. 1974. *Biotic Provinces of the World: Further Development of a System for Defining and Classifying Natural Regions for Purposes of Conservation*. Morges, Switzerland: IUCN. Occasional Paper No. 9.

Davey, A.G. 1998. *National System Planning for Protected Areas*. Gland, Switzerland and Cambridge, UK: IUCN.

Dudley, N. 2003. *No Place to Hide: Effects of Climate Change on Protected Areas*. Berlin: WWF Climate Change Programme.

Dudley, N. and S. Stolton. 2003. *Running Pure. The importance of forest protected areas to drinking water.* Washington, DC: World Bank/WWF Alliance for Forest Conservation and Sustainable Use.

Eken, G., L. Bennun, and C. Boyd. 2004. "Protected areas design and systems planning: Key requirements for successful planning, site selection and establishment of protected areas." In Secretariat of the Convention on Biological Diversity. 2004. 37–51.

Fonseca, G.A.B. 2003. "Conservation Science and NGOs." *Conservation Biology,* Vol 17 No. 2. April.

Foxcroft, L.C. 2003. "Invasive Alien Species and Biodiversity Conservation – The Anomaly. Kruger National Park (South Africa)." In *Aliens* No. 17, 2003.

GEF (Global Environment Facility). 2004. *Performance-Based Allocation Framework for GEF Resources*. GEF Council, 19–21 May, 2004, Washington, DC. GEF/C.23/7. April 20.

Green, R.E. *et al*. (Eds.) 2003. *Global Climate Change and Biodiversity*. Bedfordshire, UK: Royal Society for the Protection of Birds.

Groves, C.R. *et al*. 2000. *Designing a Geography of Hope: A Practitioner's Handbook for Ecoregional Conservation Planning*. Arlington, VA: The Nature Conservancy.

Groves, C.R. *et al*. 2002. "Planning for Biodiversity Conservation: Putting Conservation Science into Practice." *BioScience,* Vol. 52 No. 6. June.

Hannah, L. and T. Lovejoy. (Eds.) 2003. *Climate Change and Biodiversity: Synergistic Impacts*. Washington, DC: Center for Applied Biodiversity Science, Conservation International. Advances in Applied Biodiversity Science No. 4.

Hannah, L. and R.V. Salm. 2003. "Protected areas and climate change." In Hannay and Lovejoy 2003. 91–100.

Hansen, L.J., J.L. Biringer, and J.R. Hoffman. 2003. *Buying Time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems*. Berlin: WWF Climate Change Programme.

Heinen, J. and J. Mehta. 2000. "Emerging issues in legal and procedural aspects of buffer zone management with case studies from Nepal." *Journal of Environment and Development*, 9(1): 45–67.

Hughes, R. and F. Flintan. 2001. *Integrating Conservation and Development Experience. A Review and Bibliography of the ICDP Literature*. London: International Institute for Environment and Development.

IPCC (Intergovernmental Panel on Climate Change). 2002. *Climate Change and Biodiversity*. IPCC Technical Paper V.

IUCN. 1994. *Guidelines for Protected Area Management Categories*. Gland, Switzerland and Cambridge, UK: IUCN.

IUCN. 1995. *IUCN/SSC Guidelines for Re-introductions*. Species Survival Commission Re-introduction Specialist Group. www.iucn.org/themes/ssc/pubs/policy/reinte.htm

IUCN. 1999. *Threats to Forest Protected Areas. Summary of a survey of 10 countries*. Gland, Switzerland and Cambridge, UK: IUCN.

IUCN. 2000. *IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species*. Species Survival Commission Invasive Species Specialist Group. www.iucn.org/themes/ssc/pubs/policy/invasivesEng.htm

Jennings, M.D. 2000. "Gap analysis: Concepts, methods, and recent results. *Landscape Ecology* 15: 5–20.

Jepson, P. and R.J. Whittaker. 2002. "Ecoregions in Context: A Critique with Special Reference to Indonesia." *Conservation Biology,* Vol. 16 No. 1. February.

Justus, J. and S. Sarkar. 2002. "The principle of complementarity in the design of reserve networks to conserve biodiversity: a preliminary history." *J. Biosci.* (*Suppl. 2*)27: 421–435. Indian Academy of Sciences.

Kareiva, P. and M. Marvier. 2003a. "Conserving Biodiversity Coldspots. Recent calls to direct conservation funding to the world's biodiversity hotspots may be bad investment advice." *American Scientist,* Vol. 91. July–August.

Kareiva, P. and M. Marvier. 2003b. Letter to the Editor. *American Scientist,* Vol. 91. July–August.

Khare, A. and D.B. Bray. 2004. *Study of Critical New Forest Conservation Issues in the Global South*. Final Report Submitted to the Ford Foundation, New York. June.

Kelleher, G. 1999. *Guidelines for Marine Protected Areas*. Gland, Switzerland and Cambridge, UK: IUCN. World Commission on Protected Areas Best Practice Protected Area Guidelines Series No. 3.

Malcolm, J.R. *et al*. 2002. *Habitats at Risk. Global Warming and Species Loss in Globally Significant Terrestrial Ecosystems*. Gland, Switzerland: WWF.

Margules, C. and R.L. Pressey. 2000. "Systematic Conservation Planning." *Nature,* 405: 243–253.

Margules, C., R.L. Pressey and P.H. Williams. 2002. "Representing biodiversity: data and procedures for identifying priority areas for conservation." *J. Biosci*. (*Suppl. 2*) 27. 309–326. Indian Academy of Sciences.

Martino, D. 2001. "Buffer Zones around Protected Areas: A Brief Literature Review." *Electronic Green Journal,* Issue 15. December. http://egj.lib.uidaho.edu/egj15/martino1.html

McNeely, J.A. (Ed.) 2001. *The Great Reshuffling. Human Dimensions of Invasive Alien Species*. Gland, Switzerland and Cambridge, UK: IUCN.

McNeely, J.A. *et al*. (Eds.) 2001. *A Global Strategy on Invasive Alien Species*. Gland, Switzerland and Cambridge, UK: IUCN in collaboration with the Global Invasive Species Programme.

McNeely, J.A., J. Harrison, and P. Dingwall (Eds.) 1994. *Protecting Nature. Regional Reviews of Protected Areas*. Gland, Switzerland and Cambridge, UK: IUCN.

Midgley *et al*. 2002. "Assessing the vulnerability of species richness to anthropogenic climate change in a biodiversity hotspot." *Global Ecology and Biogeography,* 11(6): 485–495.

Miller, K.R. 1996. *Balancing the Scales: Guidelines for Increasing Biodiversity's Chances through Bioregional Management*. Washington, DC: World Resources Institute.

Miller, K.R. 1999. "Bioregional Planning and Biodiversity Conservation." In S. Stolton and N. Dudley 1999. 41–49.

Mittermeier, R.A. *et al*. 1998. "Biodiversity Hotspots and Major Tropical Wilderness Areas: Approaches to Setting Conservation Priorities." *Conservation Biology,* Vol. 12 No. 3. June.

Mittermeier, R.A. *et al*. 2003a. "Wilderness and biodiversity conservation." *Proceedings of the National Academy of Sciences*. Vol. 100 No. 18. 10309–10313.

Mittermeier, R.A. *et al*. 2003b. Letter to the Editor. *American Scientist,* Vol. 91 384.

Mogelgaard, K. 2003. *Helping People, Saving Biodiversity. An Overview of Integrated Approaches to Conservation and Development*. Washington, DC: Population Action International.

Mulongoy, K.J. and S. Chape. 2004. *Protected Areas and Biodiversity. An Overview of Key Issues*. Kuala Lumpur: UNEP-WCMC and Secretariat of the Convention on Biological Diversity.

Myers, N. 1988. "Threatened biotas: 'Hotspots' in tropical forests." *The Environmentalist*, 8: 1–20.

Myers, N. 1990. "The biodiversity challenge: Expanded hot-spots analysis." *The Environmentalist*, 10: 243–256.

Myers, N. *et al*. 2000. "Biodiversity hotspots for conservation priorities." *Nature* Vol. 403. 24 February.

Noss, R. 2001. "Beyond Kyoto: Forest Management in a Time of Rapid Climate Change." *Conservation Biology*, Vol. 15 No. 3. June.

Olson, D.M. and E. Dinerstein. 2002. "The Global 200: Priority Ecoregions for Global Conservation." *Annals of the Missouri Botanical Garden,* 89: 199–224.

Phillips, A. 2002. *Management Guidelines for IUCN Category V Protected Areas: Protected Landscapes/Seascapes*. Gland, Switzerland and Cambridge, UK: IUCN.

Poff, N.L. *et al*. 1997. "The natural flow regime: a paradigm for river conservation and restoration." *BioScience* 47: 769–784.

Redford, K. *et al*. 2003. "Mapping the Conservation Landscape." *Conservation Biology,* Vol. 17 No. 1. February.

Redford, K. and B.D. Richter. 1999. "Conservation of Biodiversity in a World of Use." *Conservation Biology,* Vol. 13 No. 6. December.

Reid, W.V. 1998. "Biodiversity Hotspots." *TREE*, Vol. 13 No. 7. July.

Revenga, C. and Y. Kura. 2003. *Status and Trends of Biodiversity of Inland Water Ecosystems*. Montreal: Secretariat of the Convention on Biological Diversity. Technical Series No. 11.

Ricciardi, A.R., R.J. Neves and J.B. Rasmussen. 1999. "Extinction rates of North American freshwater fauna." *Conservation Biology,* 13: 1–3.

Richter, B.D., *et al*. 1997. "How much water does a river need?" *Freshwater Biology*, 37: 231–249.

Roberts, C. *et al*. 2002. "Marine Biodiversity Hotspots and Conservation Priorities for Tropical Reefs." *Science*, Vol. 295. 15 February.

Rodrigues, A.S.L. *et al*. 2003. *Global Gap Analysis: Towards a Representative Network of Protected Areas*. Washington, DC: Center for Applied Biodiversity Science, Conservation International. Advances in Applied Biodiversity Science No. 5.

Root, T.L. *et al*. 2003. "Fingerprints of global warming on wild animals and plants." *Nature,* 421: 57–60.

Salm, R.V., J.R. Clark, and E. Siirila. 2000. *Marine and Coastal Protected Areas. A Guide for Planners and Managers*. Gland, Switzerland and Cambridge, UK: IUCN.

Sarkar, S. 1999. "Wilderness preservation and biodiversity conservation – keeping divergent goals distinct." *Bioscience*, Vol. 49 No. 5.

Saunders, D.L., J.J. Meeuwig and C.J. Vincent. 2002. "Freshwater Protected Areas: Strategies for Conservation. *Conservation Biology,* Vol. 16 No. 1. February.

Sechrest, W. *et al*. 2002. "Hotspots and the conservation of evolutionary history." *Proceedings of the National Academy of Sciences*, Vol. 99 No. 4: 2067–2071.

Secretariat of the Convention on Biological Diversity. 2004. *Biodiversity issues for consideration in the planning, establishment and management of protected area sites and systems*. Montreal, Canada.

Shine, C., N. Williams and L. Gündling. 2000. *A Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species*. Gland, Switzerland and Cambridge, UK. IUCN Environmental Law Centre Environmental Policy and Law Paper No 40.

Smith, R.D. and E. Maltby. 2003. *Using the Ecosystem Approach to Implement the Convention on Biological Diversity*. Gland, Switzerland and Cambridge, UK: IUCN.

Soulé, M. and M.A. Sanjayan. 1998. "Conservation Targets: Do They Help?" *Science* 279: 2060–2061.

Spalding, M. 2002. "The World Heritage List – the best of all worlds?" *PARKS*, Vol. 12 No. 3: 50–57.

Stattersfield, A.J. *et al*. 1998. *Endemic Bird Areas of the World*. Cambridge, UK: BirdLife International. BirdLife Conservation Series No. 7.

Thomas, C.D. *et al*. 2004. "Extinction risk from climate change." *Nature*, 427: 145–148.

TNC (The Nature Conservancy). 2000. *The Five-S Framework for Site Conservation: A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success*. Arlington, VA, US.

TNC (The Nature Conservancy). nd. "Site Conservation Planning: How to Approach Governments in Countries where Conservation Planning Legislation Already Exists." (Unpublished manuscript).

Udvardy, M.D.F. 1975. *A Classification of the Biogeographical Provinces of the World*. Morges, Switzerland: IUCN. Occasional Paper No. 18.

Van Schaik, C.P., J. Terborgh and B. Dugelby. 1997. "The Silent Crisis: The State of Rain Forest Nature Preserves." In R. Kramer, C. van Schaik and J. Johnson (Eds.) 1997. *Last Stand. Protected Areas and the Defense of Tropical Biodiversity*. New York (USA) and Oxford (UK): Oxford University Press.

Vreugdenhil *et al*. 2003. *Comprehensive Protected Areas System Composition and Monitoring*. Shepherdstown, West Virginia, USA: World Institute for Conservation and Environment.

Wells, M. and K. Brandon. 1992. *People and Parks. Linking Protected Area Management with Local Communities*. Washington, DC: The World Bank.

Wells, M., and K. Brandon. 1993. "The principles and practice of buffer zones and local participation in biodiversity conservation." *Ambio*, 22(2–3): 157–162.

Wells, M. *et al*. 1999. *Investing in Biodiversity. A Review of Indonesia's Integrated*

Conservation and Development Projects. Washington, DC: The World Bank.

West, J. and R.V. Salm. 2003. "Resistance and Resilience to Coral Bleaching: Implications for Coral Reef Conservation and Management." *Conservation Biology,* Vol. 17 No. 4. August.

Whitten, T., D.Holmes and K. MacKinnon. 2001. Conservation Biology: A Displacement Behavior for Academia? *Conservation Biology*, Vol 15 No. 1. February.

Wikramanayake, E. *et al*. 2002. "Ecoregions in Ascendance: Reply to Jepson and Whittaker." *Conservation Biology*, Vol. 16 No. 1. February.

Wilkinson, C. (Ed.) 2002. *Status of Coral Reefs of the World: 2002*. Townsville, Australia: Australian Institute of Marine Sciences.

Wittenberg, R. and M.J.W. Cock (Eds.) 2001. *Invasive Alien Species: A Toolkit of Best Prevention and Management Practices*. Wallingford, Oxon, UK: CAB International.

Worah, S. 2002. "The challenge of community-based protected areas management." *PARKS*, Vol. 12 No. 2.

WRI (World Resources Institute), IUCN (The World Conservation Union) and UNEP (United Nations Environment Programme). 1992. *Global Biodiversity Strategy*. Washington, DC.

Chapter 3

Adams, J.S. and T.O. McShane. 1992. *The Myth of Wild Africa: Conservation without Illusion*. New York, USA and London, UK: W.W. Norton and Co.

Ashley, C. and J. Elliott. 2003. "'Just Wildlife?' or a Source of Local Development?" *Natural Resource Perspectives*, No. 85. ODI. April.

Balmford, A., *et al*. 2002. "Economic Reasons for Conserving Wild Nature." *Science*, Vol. 297. August 9.

Barber, C.V. 2004. "Can we quantify the value of protected areas? From tangibles to intangibles." In Secretariat of the Convention on Biological Diversity 2004.

Barber, C.V., and J. Schweithelm. 2000. *Trial By Fire. Forest Fires and Forestry Policy in Indonesia's Era of Crisis and Reform*. Washington, DC: World Resources Institute.

Bassi, M. 2003. "Enhancing equity in the relationship between protected areas and local communities in the context of global change: Horn of Africa and Kenya." IUCN/TILCEPA. www.iucn.org/themes/ceesp/Wkg_grp/TILCEPA/community.htm#A

Beltran, J. (Ed.) 2000. *Indigenous and Traditional Peoples and Protected Areas. Principles, Guidelines and Case Studies*. Gland, Switzerland and Cambridge, UK: IUCN and WWF.

Borrini-Feyerabend, G. 1996. *Collaborative Management of Protected Areas: Tailoring the Approach to the Context*. Gland, Switzerland and Cambridge, UK: IUCN Social Policy Group.

Borrini-Feyerabend, G. 2001. "Co-management partnerships: a challenging approach for integrated conservation and development programmes." In Agersnap, H. and M. Funder (Eds.) 2001. *Conservation and Development: New Insights and Lessons Learnt*. Copenhagen: The Environment and Development Network.

Borrini-Feyerabend, G. 2003. *Community conserved areas (CCAs) and co-managed protected areas (CMPAs) – towards equitable and effective conservation in the context of global change*. Report of the IUCN joint CEESP.WCPA Theme on Indigenous and Local Community, Equity and Protected Areas (TILCEPA) for the Ecosystems, Protected Areas and People (EPP) Project. Gland, Switzerland. April. (Draft.)

Borrini-Feyerabend, G. 2004. "Governance of Protected Areas, Participation and Equity." In Secretariat of the Convention on Biological Diversity 2004.

Borrini-Feyerabend, G. *et al*. 2000. *Co-management of Natural Resources. Organising, Negotiating and Learning-by-Doing*. Heidelberg, Germany: GTZ and IUCN, Kasparek Verlag.

Borrini-Feyerabend, G. *et al*. 2004 (forthcoming). *Sharing Power: Learning by Doing in Co-management of Natural Resources throughout the World*. London and Cambridge, UK and Gland, Switzerland: International Institute for Environment and Development (IIED) and IUCN/CEESP.

Borrini-Feyerabend, G, and T. Sandwith. 2003. "Editorial: From 'guns and fences' to paternalism to partnerships: The slow disentangling of Africa's protected areas." *PARKS*, Vol. 13 No.1. Gland, Switzerland and Cambridge, UK: IUCN.

Cernea, M.M. and K. Schnidt-Soltau. 2003. "The end of forcible displacements? Conservation must not impoverish people." *Policy Matters,* Vol. 12. September 2003. Gland, Switzerland and Cambridge, UK: IUCN.

Cesar, H. 1996. *Economic Analysis of Indonesian Coral Reefs*. Washington, DC: The World Bank.

Chennells, R. 2002. "The Komani San Land Claim." Paper presented at the "Indigenous Rights in the Commonwealth Project Africa Regional Expert Meeting." Cape Town, South Africa, 16–18 October, 2002.

Colchester, M. 1995. *Salvaging Nature. Indigenous Peoples, Protected Areas and Biodiversity Conservation*. Geneva: United Nations Research Institute for Social Development.

Colchester. nd. *Beyond "participation": indigenous peoples, biological diversity conservation and protected areas management*. www.fao.org/docrep/w1033e08.htm Accessed April 14, 2003.

Davey, A.G. 1998. *National System Planning for Protected Areas*. Gland, Switzerland and Cambridge, UK: IUCN.

Davis, P. 2000. *Carbon Forestry Projects in Developing Countries: Legal Issues and Tools.* Washington, DC: Forest Trends.

DFID (Department for International Development). 2002. *Wildlife and Poverty Study*. London.

Dupar, M. and N. Badenoch. 2002. *Environment, Livelihoods and Local Institutions. Decentralization in Mainland Southeast Asia*. Washington, DC, USA: World Resources Institute.

Forest Peoples Project. 2003. *Indigenous Peoples and Protected Areas in Africa: From Principles to Practice*. Project Briefing, March 2003. http://forestpeoples.gn.apc.org. Accessed 21 April, 2003.

Gell, F.R. and C.M. Roberts. 2002. *The Fishery Effects of Marine Reserves and Fishery Closures*. Washington, DC: WWF.

Gregersen, H. *et al*. 2004. *Forest Governance in Federal Systems: An Overview of Experiences and Implications for Decentralization*. Washington, DC: Forest Trends.

Heylings, P. and M. Bravo. 2001. "Survival of the fittest? Challenges facing the co-management model for the Galapagos Marine Reserve." *CM News*, 5: 10–13. Gland, Switzerland and Cambridge, UK: IUCN/CEESP/CMWG.

IUCN. 1998. *Economic Values of Protected Areas: Guidelines for Protected Area Managers*. World Commission on Protected Areas. Best Practice Protected Area Guidelines Series No. 2.

IUCN. 2003. *Durban Action Plan*. Vth IUCN World Parks Congress. Durban, South Africa, 8–17 September 2003.

Jaireth, H., and D. Smyth (Eds). 2003. *Innovative Governance. Indigenous Peoples, Local Communities and Protected Areas*. New Delhi: Ane Books.

Johnson, N. A. White, and D. Perrot-Maitre. 2002. *Developing Markets for Water Services from Forests: Issues and Lessons for Innovators*. Washington, DC: Forest Trends, World Resources Institute and The Katoomba Group.

Kemf, E. (Ed.) 1993. *The Law of the Mother. Protecting Indigenous Peoples in Protected Areas*. San Francisco CA, USA: Sierra Club Books.

Kothari, A. 2004. "Protected areas and people: participatory conservation." Secretariat of the Convention on Biological Diversity. 2004. *Biodiversity Issues for Consideration in the Planning, Establishment and Management of Protected Area Sites and Networks*. Montreal, Canada: CBD Technical Series No. 15.

Koziell, I. and J. Saunders. 2001. *Living Off Biodiversity. Exploring Livelihoods and Biodiversity Issues in Natural Resources Management*. London: International Institute for Environment and Development.

Laird, S. *et al*. 2003. *Biodiversity Access and Benefit-Sharing Policies for Protected Areas*. Tokyo: United Nations University Institute of Advanced Studies.

Lutz, E. and J. Caldecott (Eds.) 1997. *Decentralization and Biodiversity Conservation: A World Bank Symposium.* Washington, DC: The World Bank.

Lynch, O.J. and K. Talbott. 1995. *Balancing Acts: Community-Based Forest Management and National Law in Asia and the Pacific*. Washington, DC: World Resources Institute.

McKay, F. 2002. *Addressing Past Wrongs. Indigenous Peoples and Protected Areas: The Right to Restitution of Lands and Resources*. Moreton-in-Marsh, UK: Forest Peoples Programme. FPP Occasional Paper. October.

McNeely, J.A. 1995. *Expanding Partnerships in Conservation*. Washington, DC and Covelo CA, USA: Island Press.

McNeely, J.A. 1999. "Protected Area Institutions." In Stolton and Dudley 1999. 195–204.

Momberg, F., K. Atok, and M. Sirait. 1996. *Drawing on Local Knowledge: A Community Mapping Training Manual*. Jakarta, Indonesia: Ford Foundation, WWF-Indonesia Programme and Yayasan Karya Pancur Kasih.

Oviedo, G., L. Maffi, and P.B. Larsen. 2000. *Indigenous and Traditional Peoples of the World and Ecoregion Conservation*. Gland, Switzerland: WWF and Terralingua.

Pagiola, S., J. Bishop, and N. Landell-Mills (Eds). 2002. *Selling Forest Environmental Services. Market-based Mechanisms for Conservation and Development*. London: Earthscan.

Panayotou, T. and D. Glover. 1995. "Economic and Financial Incentives for Biodiversity Conservation and Development." In J.A. McNeely, (Ed.) 1995. *Biodiversity Conservation in the Asia and Pacific Region*. Manila, Philippines: Asian Development Bank and IUCN.

Parks, J.E. and N. Salafsky (Eds.) 2001. *Fish for the Future? A Collaborative Test of Locally-Managed Marine Areas as Biodiversity Conservation and Fisheries Management Tools in the Indo-Pacific Region*. Washington, DC, USA: The World Resources Institute.

Pimbert, M. 2003. "Reclaiming diversity and sustainability in community-based conservation." *Policy Matters*, Vol. 12, September 2003. Gland, Switzerland and Cambridge, UK: IUCN.

Phillips, A. 2003. "Turning Ideas on their Head. The New Paradigm for Protected Areas." In H. Jaireth, and D. Smyth. 2003. *Innovative Governance. Indigenous Peoples, Local Communities and Protected Areas*. New Delhi: Ane Books.

Phillips, A. 2002. *Management Guidelines for IUCN Category V Protected Areas: Protected Landscapes/Seascapes*. Gland, Switzerland and Cambridge, UK: IUCN.

Pomeroy, R.S., B.M. Katon, and I. Harkes. 1998. "Fisheries Co-Management: Key Conditions and Principles Drawn from Asian Experiences." Presented at "Crossing Boundaries," the seventh annual conference of the International Association for the Study of Common Property, Vancouver, British Columbia, Canada, June 10–14, 1998.

Poole, P. 1995. *Indigenous Peoples, Mapping and Biodiversity Conservation: An Analysis of Current Activities and Opportunities for Applying Geomatics Technologies*. Washington, DC: Biodiversity Support Program. People and Forests Program Discussion Paper.

Posey, D.A. 1996. *Traditional Resource Rights. International Instruments for Protection and Compensation for Indigenous Peoples and Local Communities*. Gland, Switzerland and Cambridge, UK: IUCN.

Pyhala, A. 2002. "Institutions, Participation and Protected Area Management in Western Amazonia." Paper presented at the 9th Biennial Conference of the International Association for the Study of Common Property, Victoria Falls, Zimbabwe, 17–21 June, 2002.

Redford, K. *et al*. 2003. "Mapping the Conservation Landscape." *Conservation Biology,* Vol. 17 No. 1. February. pp. 116–131.

Redford, K. *et al*. 1998. "Holding Ground." K. Brandon, K.H. Redford, and S.E. Sanderson. 1998. *Parks in Peril. People, Politics and Protected Areas*. Washington, DC: Island Press.

Ribot, J.C. 2002. *Democratic Decentralization of Natural Resources. Institutionalizing Popular Participation*. Washington, DC, USA: World Resources Institute.

Rice, R. 2002. *Conservation Concessions – Concept Description*. Washington, DC, USA: Conservation International Center for Applied Biodiversity Science.

Roe, D. and J. Elliott. 2003. "Pro-poor conservation: The elusive win-win for conservation *and* poverty reduction?" Paper presented at the Vth IUCN World Parks Congress, Durban, South Africa. September 8–17.

Sanderson, S. and S. Bird. 1998. "The New Politics of Protected Areas." K. Brandon, K.H. Redford and S.E. Sanderson. 1998. *Parks in Peril. People, Politics and Protected Areas*. Washington, DC: Island Press.

Scholte, P. 2000. "Towards Consensual Park Management Planning in Africa." *Oryx*, Vol. 34 No. 2: 87–89.

Secretariat of the Convention on Biological Diversity. 2004. *Biodiversity Issues for Consideration in the Planning, Establishment and Management of Protected Area Sites and Networks*. Montreal, Canada: CBD Technical Series No. 15.

Simarmata, R. 2002. "Autonomy and the Character of Local Government Laws and Regulations – New Pressures on the Environment and Indigenous Communities: A Preliminary Diagnosis." Paper presented at the 9th Conference of the International Association for the Study of Common Property, Victoria Falls, Zimbabwe, June 17–21, 2002.

Spergel, B. 1997. "Compensation and substitution programmes." In Borrini-Feyerabend, G. (Ed.) 1997. Beyond Fences: Seeking Social Sustainability in Conservation. Gland, Switzerland and Cambridge, UK: IUCN. Www.iucn.org/themes/spg/Files/beyond_fences/beyond_fences.html

Stolton, S. and N. Dudley (Eds.) 1999. *Partnerships for Protection: New Strategies for Planning and Management for Protected Areas*. London, UK: Earthscan.

Thomas, L. and J. Middleton. 2003. *Guidelines for Management Planning of Protected Areas*. Gland, Switzerland and Cambridge, UK: IUCN. World Commission on Protected Areas Best Practice Protected Area Guidelines Series No. 10.

Totten, M. 2001. *Getting it Right: Emerging Markets for Storing Carbon in Forests*. Washington, DC: Forest Trends and World Resources Institute.

WALHI (Indonesian Forum for Environment), JATAM (Mining Advocacy Network) and AMAN (Archipelago Indigenous Peoples' Alliance). 2004. *Conservation is Not for Concession.* Position paper for the 7th Meeting of the Conference of the Parties to the Convention on Biological Diversity, Kuala Lumpur, February 6–20. 2004.

Wells, M. *et al*. 1999. *Investing in Biodiversity. A Review of Indonesia's Integrated conservaiton and Development Projects*. Washington, DC, USA: The World Bank.

Western, D. and R.M. Wright (Eds.) 1994. *Natural Connections. Perspectives in Community-based Conservation*. Washington, DC and Covelo, CA, USA: Island Press.

White, A. *et al*. 1994. *Collaborative and Community-Based Management of Coral Reefs. Lessons from Experience*. West Hartford, Connecticut, USA: Kumarian Press.

Worah, S. 2002. "The challenge of community-based protected areas management." *PARKS* Vol. 12 No. 2. Gland, Switzerland and Cambridge, UK: IUCN.

World Bank. 2003. *Governance of Natural Resources in the Philippines: Lessons from the Past, Directions for the Future*. Washington, DC: Rural Development and Natural Resources Sector Unit, East Asia and Pacific Region.

World Resources Institute/Forest Watch Indonesia. 2002. *The State of the Forest: Indonesia*. Washington, DC and Bogor, Indonesia.

Wyckoff-Baird, B. *et al*. 2000. *Shifting the Power: Decentralization and Biodiversity Conservation*. Washington, DC: World Resources Institute.

Chapter 4

Appleton, M. 2002. "Islands of Good Practice: Progress and Problems for Human Resource Development for Protected Area Management in ASEAN Member Countries." *ASEAN Biodiversity*, July–September. 60–63.

Appleton, M., G. Texon, and M. Uriarte. 2003. *Competence Standards for Protected Area Jobs in Southeast Asia*. Los Banos, Philippines: ASEAN Regional Center for Biodiversity Conservation.

Aylward, B. and E. Barbier. 1992. "Valuing environmental functions in developing countries." *Biodiversity and Conservation*, Vol. 134.

Balmford, A. *et al*. 2002. "Economic Reasons for Conserving Wild Nature." *Science*, Vol. 297. August 9.

Bockstael, N. *et al*. 1995. "Ecological economic modeling and valuation of ecosystems." *Ecological Economics*, 14: 143–159.

Carabias, J., J.de la Maza and R. Cadena. 2003. "Capacity Needs to Manage Protected Areas: A Global Overview." In Carabias and Rao 2003. 17–33.

Carabias, J. and K. Rao (Eds.) 2003. *Capacity Needs to Manage Protected Areas. Asia*. Mexico City: The Nature Conservancy, IUCN World Commision on Protected Areas and WorldHeritage, UNESCO.

Costanza, R. 2000. Social goals and the valuation of ecosystem services. *Ecosystems*, 3: 4–10.

Costanza *et al*. 1997. "The value of the world's ecosystem services and natural capital." *Nature*, 387: 253–260.

Daily, G. (Ed.) 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Washington, DC: Island Press.

Daily, G. and K. Ellison. 2003. *The New Economy of Nature: The quest to make conservation profitable*. Washington, DC: Island Press/Shearwater Books.

Daly, H. and J. Cobb. 1989. *For the Common Good: Redirecting the economy toward community, the environment, and a sustainable future*. Boston: Beacon Press.

de Moore, A. and P. Calamai. 1997. *Subsidizing Unsustainable Development: Undermining the Earth with Public Funds*. San José, Costa Rica: Earth Council.

Deacon, R. and B. Mueller. 2004. *Political Economy and Natural Resource Use*. University of California, Santa Barbara. Working Paper Series, Department of Economics. www.econ.ucsb.edu/papers/wp1-04.pdf

Dixon A. and P. Sherman. 1990. *Economics of Protected Areas: A new look at benefits and costs*. Washington, DC: Island Press.

Dudley, N., *et al*. 2004. *How effective are protected areas? A preliminary analysis of forest protected areas by WWF*. Report prepared for the 7th Conference of Parties to the Convention on Biological Diversity, February 2004. Gland, Switzerland: WWF.

Freeman, A. 1991. "Valuing environmental resources under alternative management regimes." *Ecological Economics*, 3: 247–256.

Goldstein, W. (Ed.) 2003. *Communication, Education and Public Awareness for Protected Areas: West Asia and Northern Africa*. Workshop Report for the Joint IUCN Communication and Education Commission and World Commission on Protected Areas Workshop, September 13–14 2002. Gland, Switzerland and Cambridge, UK: IUCN.

Hagen, R.T. nd. *A Guide for Countries Preparing National Biodiversity Strategies and Action Plans*. New York: United Nations Development Programme.

Hanemann, W. 1994. "Valuing the Environment Through Contingent Valuation." *Journal of Economic Perspectives*, 8:19–43.

Heal, G. 2000. *Nature and the Marketplace: Capturing the value of ecosystem services*. Washington, DC: Island Press.

Hesselink, F., E. Idle, and G. van Boven. 2003. *Beyond Training: Protected Area Institutions as Learning Organizations, Developing capacity to change towards management in partnership*. Report of the PIN Matra project on Effective Communication for Nature Conservation. www.iucn.org/webfiles/doc/CEC/Public/Elecronic/External/Educaion/CaseStudy/Protected_Area_Institutions_as_learning_organizations_5.pdf. Accessed 18 May, 2004.

Holling, C.S. 1978. *Adaptive Envrionmental Assessment and Management*. Wiley: Chichester.

Hough, J. 2003. "What do we mean by capacity development?" Paper contributed for the workshop stream "Developing the Capacity to Manage" at the Vth World Parks Congress, Durban, South Africa. September 2003.

James, A.N., M. Green, and J. Paine. 1999. *A Global Review of Protected Area Budgets and Staffing*. Cambridge, UK: World Conservation Monitoring Centre.

Jansson, A., M. Hammer, and R. Costanza. 1994. *Investing in Natural Capital: The Ecological Economics Approach to Sustainability*. New York: Island Press.

Marsh, J. 1999. *Training for Planning and Managing Protected Areas Around the Mediterranean*. Background Paper for the IUCN World Commission on Protected Areas Mediterranean Regional Meeting, Cilento, Italy, November 1999.

Miller, K.R. and S. Lanou. 1995. *National Biodiversity Planning. Guidelines Based on Early Experiences Around the World*. Washington, DC: World Resources Institute, in cooperation with the UNEP and IUCN.

Munla, A.S. 2002. "Bridges for Conservation: Experience of an awareness campaign around four protected areas in Lebanon." In Goldstein 2003.

Myers, N. and J. Kent. 2001. *Perverse Subsidies: How misused tax dollars harm the environment and the economy*. Washington, DC: Island Press.

Myers, N. and J. Kent. 1998. *Perverse Subsidies: Tax $s Undercutting our Economies and Environments Alike*. Winnipeg, Manitoba, Canada: International Institute for Sustainable

Development (IISD).

Oglethorpe, J. (Ed.) 2002. *Adaptive Management: From Theory to Practice*. Gland, Switzerland and Cambridge, UK: IUCN.

Pearce, D. and D. Moran. 1994. *The Economic Value of Biodiversity*. London, UK: Earthscan.

Phillips, A. (Ed.) 2002. *Management Guidelines for IUCN Category V Protected Areas: Protected Landscapes/Seascapes*. World Commission on Protected Areas. Gland, Switzerland and Cambridge, UK: IUCN.

Pimm, S. 1997. "The value of everything." *Nature*, 387: 231–232.

Prescott, J., B. Gauthier and J.N.B. Sodi. 2000. *Guide to Developing a Biodiversity Strategy from a Sustainable Development Perspective*. IEPF, UNDP and UNEP. September.

Pritchard, L., C. Folke, and L. Gunderson. 2000. "Valuation of ecosystem services in institutional context." *Ecosystems*, 3(1): 36–40.

Salafsky, N., R. Margolius, and K. Redford. 2001. *Adaptive management: A tool for conservation practitioners*. Washington, DC: Biodiversity Support Program.

Sheppard, D. 2001. "Twenty-first Century Strategies for Protected Areas in East Asia*." The George Wright FORUM*, *Vol. 18(2): 40–55.*

Simpson, R. and N. Christensen. 1997. *Ecosystem Function and Human Activities: Reconciling Economics and Ecology*. New York: Chapman and Hall.

Spergel, B. 2001. *Raising Revenues for Protected Areas. A Menu of Options*. Washington, DC: WWF.

Thomas, L. and J. Middleton. 2003. *Guidelines for Management Planning of Protected Areas*. Gland, Switzerland and Cambridge, UK: IUCN.

UNEP (United Nations Environment Programme) and WCMC (World Conservation Monitoring Centre). 1997. *World Heritage Data Sheet: Manu National Park, Peru*. www.wcmc.org.uk/protected_areas/data/wh/manu.html

Valenzuela, S. 2001. *Una Alternativa Legal y Participative para el Ordenamiento en las Areas del Sistema de Parques Nacionales: bases juridicas y conceptuales para el caso ASCAL-G*. Ministerio del Medio Ambiente, Parques Nacionales de Colombia. Parques con la Gente. Bogota, Colombia.

Vreugdenhil, D., *et al*. 2003. *Comprehensive Protected Areas System Composition and Monitoring*. World Institute for Conservation and Environment (WICE).

Williams, P. *et al*. 1996. "Value in biodiversity, ecological services and consensus." *Trends in Ecology and Evolution*, 11(9): 385.

Chapter 5

Allen, W. 1997. "Towards improving the role of evaluation within natural resource management R&D programmes: the case for 'learning by doing'." *Canadian Journal of Development Studies*, XVIII: 629–643.

Brown, M. and B. Wyckoff-Baird. 1992. *Designing integrated conservation and development projects*. Washington, DC: Biodiversity Support Program.

Brunner, R. and T. Clarke. 1997. "A practice-based approach to ecosystem management." *Conservation Biology,* 11(1): 48–58.

Cifuentes, A.M., V. Izurieta and H.H. de Faria. 2000. *Measuring Protected Area Management Effectiveness*. San Jose, Costa Rica: WWF Centroamerica and CATIE. Technical Series No. 2.

Courrau, J. 1999. *Strategy for monitoring the management of protected areas in Central America*. Programa Ambiental Regional para Centroamérica (PROARCA), Central American Protected Areas System (CAPAS), Comisión Centroamericana de Ambiente y Desarrollo (CCAD), United States Agency for International Development (USAID).

Environmetrics. 2003. *Evaluation of Dingo Education Strategy and Programs for Fraser Island.* Prepared by Environmetrics Pty Ltd for Queensland Parks and Wildlife Service, Australia.

Ervin, J. 2001. *Improving protected area management: WWF's Rapid Assessment and Prioritisation Methodology*. Gland, Switzerland: WWF.

Ervin, J. 2003. *Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) Methodology*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia. 4–7 February, 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

Foundations of Success, Wildlife Conservation Society and Conservation International. 2003. *Conservation Synthesis for the Measuring Conservation Impact Study*. (Draft.) www.fosonline.org.

Hockings M. 2000. *Evaluating protected area management: a review of systems for assessing management effectiveness of protected areas*. Occasional Paper 7(3). University of Queensland, School of Natural and Rural Systems Management. Lawes, Australia.

Hockings, M., S. Stolton, and N. Dudley. 2000. *Evaluating effectiveness a framework for assessing the management of protected areas*. Gland, Switzerland and Cambridge, UK: IUCN.

Hockings, *et al*. 2001. *The "Enhancing our Heritage" Toolkit: Book I.* UNESCO and IUCN. www.enhancingheritage.net/docs_public.asp

Holling, C. 1986. "The resilience of terrestrial ecosystems: local surprise and global change." In W. Clark and R. Munn. 1986. *Sustainable Development in the Biosphere*. Oxford, UK: Oxford University Press, 292–320.

Izurieta, A. 2000. "Case study 4: Management effectiveness evaluation of protected areas in Brazil." In Hockings, *et al*. 2000. 93–97.

Jones, G. 2000. "Outcomes-based evaluation of management for protected areas – a methodology for incorporating evaluation into management plans." Paper presented at the "Beyond the Trees" conference, 8–11 May 2000, Bangkok, Thailand. Also available at <www.parks.tas.gov.au> under "Publications."

Leal, I.S. 2003. *Sian Ka'an Biosphere Reserve: Evaluation of management effectiveness*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

Lemos de Sa, R., N. Bensusan and L. Ferreira. 2000. "Non-governmental organisations and protected area management agencies working together to assess P.A. effectiveness: successes, problems and prospects - the experience of WWF-Brazil." Paper presented at the "Beyond the Trees" conference, 8–11 May, 2000, Bangkok, Thailand.

Leverington, F. 2003. *Case study on Queensland parks rapid assessment and integrity statements*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February, 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

MacKinnon, K. 2003. *Reporting progress at protected area sites: a simple site-level tracking tool developed for the World Bank and WWF*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What

lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

Mallarach, J.M. 2003. *Assessing the condition of the entire system of protected areas of Catalonia.* Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

Mapesa, M. 2003. *Evaluation of Bwindi Impenetrable National Park: Uganda.* Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

Margolius, R. and N. Salafsky. 1998. *Measures of success: designing, managing and monitoring conservation and development projects.* Washington, DC: Island Press.

Margolius, R. and N. Salafsky. 2001. *Is our project succeeding? A guide to threat reduction assessment for conservation*. Washington, DC: Biodiversity Support Program.

Margolius, R. and C. Stem. 2003. *Learning about the Effectiveness of Specific Conservation Tools across Protected Areas: Lessons from Sustainable Agriculture in Central America and Mexico*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

O'Connor, B. nd. *Management Reform in Victoria: Resource Allocation in Victoria's Parks System. A Case Study of Parks Victoria*. www.parkweb.vic.gov.au

Parks Canada Agency. 2000. *Unimpaired for future generations? Conserving ecological integrity with Canada's national parks*. Report of the Panel on the Ecological Integrity of Canada's National Parks. Minister for Public Works and Government Services, Ottawa, ON, Canada.

Peterson, M. 2003. *Developing a "State of the Park" Program to Assess Natural and Cultural Resource Conditions in U.S. National Parks*. www.npca.org/stateoftheparks

Pomeroy, R., J. Parks, and L. Watson. 2004. *How is your MPA doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness*. Gland, Switzerland and Cambridge, UK: IUCN.

Queensland National Parks and Wildlife Service. 2000. *Master Plan for Queensland Parks - discussion paper*. Brisbane, Australia: Queensland National Parks and Wildlife Service.

Salafsky, N. and R. Margolius. 1999. *Greater than the sum of their parts: designing conservation and development programs to maximize results and learning*. Washington, DC: Biodiversity Support Program.

Salafsky, N., R. Margolius and K. Redford. 2001. *Adaptive management: a tool for conservation practitioners*. Washington, DC: Biodiversity Support Program.

Singh, S. 2003. *Evaluating the management effectiveness of Protected Areas in India*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

Stolton, S. *et al*. 2003a. *Reporting Progress at Protected Area Sites: A simple site-level tracking tool developed for the World Bank and WWF*. Gland, Switzerland and Washington, DC: WWF and the World Bank.

Stolton, S., M. Hockings and N. Dudley. 2003b. *The "Enhancing our Heritage" Project*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

TNC (The Nature Conservancy). 2000. *The Five-S Framework for Site Conservation: A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success*. Arlington, VA, US.

TNC (The Nature Conservancy). 2002. *Assessment of Target Viability*. Arlington, VA, US.

Väisänen, R. 2003. *Evaluation of Oulanka National Park, Finland for PANpark Status*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

Watson, L. 2003. *IUCN WCPA-Marine/WWF MPA Management Effectiveness Initiative*. Case Study presented at World Parks Congress Preparatory Workshop: "Managing Effectively in the Face of Change: What lessons have we learned?" Linley Estate, Victoria, Australia, 4–7 February 2003. www.iucn.org/themes/wcpa/pubs/mgteffectpdfs/casestudyset.pdf

Woinarski, J., D. J. Milne, and G. Wanganeen. 2001. "Changes in mammal populations in relatively intact landscapes of Kakadu National Park, Northern Territory, Australia." *Austral Ecology*, 26: 360–370.