Protected Areas and Biodiversity Conservation II: Management and Effectiveness

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Protected Areas and Biodiversity Conservation II: Management and Effectiveness

Synthesis

Madhu Rao, Eugenia Naro-Maciel, and Eleanor J. Sterling

ABSTRACT

This is the second of a two-part series covering protected areas and biodiversity conservation. Part II looks at real-world protected area theory, management, implementation and effectiveness. There are different types of PAs including government-regulated, community-conserved areas, and private reserves. Adequate financial support is necessary for PAs, however it is often difficult to come by. The module also examines the effectiveness of PAs and how they can be successfully monitored.
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### TABLE OF CONTENTS

**INTRODUCTION** .......................................................................................................................................................... 5

**GOVERNANCE OF PROTECTED AREAS** .......................................................................................................................... 6

- **INTERNATIONAL AGREEMENTS AND PROGRAMS ON PROTECTED AREAS** ........................................... 6
- **GOVERNMENT MANAGED PROTECTED AREAS** ........................................................................................................ 7

**CO-MANAGED PROTECTED AREAS, COMMUNITY CONSERVED AREAS, AND PRIVATE RESERVES** ........................................................................................................................................................................ 7

**CO-MANAGED PROTECTED AREAS** ............................................................................................................................. 8

- **Box 1. Co-management of the Kaa-yá Iya del Gran Chaco National Park (Bolivia)** .................................................. 8

**COMMUNITY CONSERVED AREAS** ............................................................................................................................. 9

- **Box 2. A role for conservation concessions in protected area implementation: customary land tenure and community conservation agreements in the Solomon Islands, by Chris Filardi** .......................................................................................................................... 10

**MODEL STEPS FOR COMMUNITY CONSERVATION AGREEMENTS** ........................................................................... 12

**COMMON PROPERTY REGIMES AND COMMON POOL RESOURCES** ........................................................................ 12

**PRIVATE RESERVES** .................................................................................................................................................. 13

**EQUITY AND CONSERVATION IN GOVERNANCE** .................................................................................................... 14

**PARKS AND PEOPLE** ................................................................................................................................................. 14

- **Box 3. IUCN Categories and human use of protected areas** ..................................................................................... 15

- **Box 4. Potential costs of protected areas to the poor** ............................................................................................. 16

- **Protected areas and poverty alleviation** .................................................................................................................. 17

- **Protected areas and sustainable development** .......................................................................................................... 17

**PROTECTED AREA SERVICES** ..................................................................................................................................... 19

**FINANCING PROTECTED AREAS** .................................................................................................................................. 20

**FINANCIAL SUSTAINABILITY FOR PROTECTED AREAS** ......................................................................................... 21

**PROTECTED AREA FINANCING MECHANISMS** ......................................................................................................... 21

- **Annual Governmental allocations** ............................................................................................................................ 21

- **User fees, fines, and taxes earmarked for conservation** ............................................................................................ 22

- **Grants and donations** ............................................................................................................................................. 22

- **Box 5. The Bhutan Trust Fund for Environmental Conservation** ............................................................................ 23

**PAYMENTS FOR ECOSYSTEM SERVICES (PES)** .......................................................................................................... 24
Box 6. Payment for ecosystem services for watershed protection in Latin America

EFFECTIVENESS OF PROTECTED AREAS

DESIGN ISSUES

MANAGEMENT EFFECTIVENESS IN PROTECTED AREAS

PROTECTED AREAS, THREATS AND ECOLOGICAL INTEGRITY

Box 7. Analysis of deforestation rates in and around protected areas

MONITORING PROTECTED AREAS

FUTURE OF PROTECTED AREAS

Box 8. Protected areas as living landscapes

CONCLUSION

REFERENCES

APPENDIX I

Protected areas and the Convention on Biological Diversity

CBD’s Program of Work on Protected Areas

World Parks Congress and the Durban Accord

Box 9. Relevant articles of the Convention on Biological Diversity

Tables and figures

Table 1A. Major international initiatives recognizing or designating specific sites

Table 1B. Examples of other conventions and programs with a commitment to establishing protected areas

Table 2. Components of protected area costs

Table 3. A brief description of financing mechanisms for PAs (user fees and taxes)

Table 4. Measuring PA effectiveness

Table 5. Protected area design issues

Table 6. Ecological integrity and protected areas

Table 7. Monitoring and PAs

Figure 1. Growth of the PA system

Glossary
This module is the second in a two-part series entitled “Protected Areas and Biodiversity Conservation”. The objective of this module is to elaborate on real world aspects of protected area (PA) theory, management, implementation, and effectiveness. For an introduction to theoretical and planning considerations in reserve design, please see the NCEP module “Protected areas and Biodiversity Conservation I: Reserve planning and design”. This module will focus almost entirely on terrestrial protected areas. For complementary information pertaining to PAs in the marine realm, please see the NCEP module “Marine Protected Areas and MPA Networks”.

INTRODUCTION

During the past century, the standard practice for safeguarding the maintenance of biodiversity and reducing the rate of biodiversity loss has been the establishment of protected areas (Lovejoy 2006). There has been a steady and significant increase in the area protected and number of protected areas created over the past three to four decades (Figure 1). Over the years, the design of protected areas (sometimes referred to as PAs) has evolved from the creation of small refuges for particular species to the protection of entire ecosystems that are large enough to maintain most if not all of their component species. Although many other important measures to conserve biodiversity (e.g., comprehensive land-use planning, sustainable development) have been developed, protected areas remain the cornerstone of many conservation strategies aimed at limiting the destruction of biodiversity (Kramer et al. 1997; Brandon et al. 1998).

However, protected areas are subject to a wide array of pressures that influence their ability to fulfill their role of biodiversity protection. Direct threats to biodiversity include loss of habitat due to clearing for agriculture, hydroelectric power (dams), mining, road development, and overexploitation of natural resources through illegal hunting and logging. Poverty, population pressures, urbanization, and escalating demand for natural resources from both the developing and developed countries are primary drivers of these threats. Often, these drivers are compounded by conflicting national policies, poor governance, and weak institutions.

Protected area management is therefore strongly influenced by complex and interacting social, economic, and cultural dimensions. The long-term success or failure of PAs particularly, but not only, in developing countries depends significantly on the degree of ownership, engagement, and commitment of local communities, stakeholders, and local governments. The complexity that characterizes PA management is attributable to the diversity of attitudes towards conservation. Creating a protected area sometimes challenges the identity, values, and livelihoods of affected communities. Hence,
understanding traditional power structures and resource tenure systems can be particularly important in determining the success or failure of PAs.

Protected areas have a critical role to play in conserving biodiversity against a backdrop of complex and interacting threats. Multiple issues influence the performance of protected areas, ranging from fundamental aspects such as what is being protected (species, ecosystem services), who is protecting (governance issues), to more complex and emerging factors related to financing and effectiveness. This synthesis provides a broad overview of such issues that are both directly and indirectly linked to the performance of PAs in conserving biodiversity.

GOVERNANCE OF PROTECTED AREAS

Governance of protected areas is of fundamental relevance to their performance and presents a significant challenge for effective management. For purposes of this module, we identify two broad categories of protected area governance: a) government managed protected areas, and b) co-managed protected areas, community conserved areas, and private reserves. The latter are protected areas governed either jointly, or independently owned and managed, by local and indigenous communities, cooperatives, private individuals, corporations, etc. There is wide variation across and within these broad categories of PAs in terms of governance arrangements, ecological representation and functional performance. Some of these areas have been designated under international and regional treaties and agreements.

INTERNATIONAL AGREEMENTS AND PROGRAMS ON PROTECTED AREAS

There are a number of international and regional policy instruments that designate or recognize specific protected areas directly or indirectly, giving them an international status (Table 1). In general terms, the different initiatives vary in both geographical and thematic coverage. For example, the World Heritage Convention (Convention concerning the Protection of the World Cultural and Natural Heritage) and the Ramsar Convention (Convention on Wetlands of International Importance especially as waterfowl habitat) have both developed lists of specific sites where governments have made commitments to protection under the convention, adding an important international dimension to protected areas. The UNESCO Man and the Biosphere Program establishes Biosphere reserves, or 'sites which innovate and demonstrate approaches to conservation and sustainable development' (http://www.unesco.org/mab/BRs.shtml). Certain other conventions, such as the Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aim to conserve terrestrial, marine, and avian migratory species throughout their range through a number of measures including the creation and strengthening of protected areas. For additional information on international and other agreements related to conserving biodiversity in protected areas, please see the NCEP modules: “Protected Areas and Biodiversity Conservation I: Reserve Planning and Design” and “International Treaties in Marine Conservation and Management”.
Frequently, specific sites are recognized under multiple conventions or agreements. Each of the different conventions and programs discussed here have a different nomination form and process, and monitoring and reporting requirements vary widely. Although there is much variation in the legal standing of the international agreements described above, the fact that governments have made an international commitment has in practice provided extra incentive for the site’s good management. With many of these agreements, there is a considerable element of prestige associated with international recognition, which may provide a powerful factor in strengthening protection. The Convention on Biological Diversity and the Durban Accord, signed at the World Park’s Congress, have significant implications for protected areas (Appendix I).

**GOVERNMENT MANAGED PROTECTED AREAS**

This type of protected area represents the most common category of governance, as government agencies have the main responsibility for PA systems globally (Dearden et al. 2005). A government body, such as a Ministry or Park Agency reporting directly to the government, holds the authority, responsibility and accountability for managing the protected areas. This body also determines the PA’s conservation objectives, subjects it to a management regime, and often also owns the PA’s land, water, and related resources. For example, the system of 20 protected areas in Lao People’s Democratic Republic (Lao PDR), known as National Biodiversity Conservation Areas (NBCA), covers 12-14% of the land area and is entirely managed by the Government of Lao PDR. Specifically, the Department of Forestry’s Division of Forest Resources Conservation (DFRC) is the national focal agency for the coordination of NBCA management (Robichaud et al. 2001). Over the years, many countries have encouraged decentralization of central government agencies responsible for PA management, thus resulting in decision-making becoming less centralized and more delegated to regional authorities (Dearden et al. 2005).

**CO-MANAGED PROTECTED AREAS, COMMUNITY CONSERVED AREAS, AND PRIVATE RESERVES**

In addition to government-managed protected areas, there are a variety of other governance arrangements for protected areas that are on lands not owned by the government. These types of protected areas fall under individual, cooperative, community, or corporate ownership. Authority for managing the protected land and resources rests with the landowners, who determine conservation objectives, impose a conservation regime, and are responsible for decision-making, subject to applicable legislation. Some forms of accountability may be negotiated with the government, in exchange for specific incentives (as in the case of Conservation Easements or Land Trusts). Like publicly protected areas, these lands vary dramatically in size and uses.

The overlapping categories of governance described in this section (co-managed protected areas, community conserved areas and private reserves) complement government-managed protected areas as they often protect habitats under-represented in a country’s public park system, lands under heavy development pressure, or the last
remnants of rapidly disappearing habitat. These types of protected areas enhance a country’s network of PAs as they can provide corridors and linkages, often between two or more officially protected areas. In the Himalayan state of Uttarakhand in India, two critical protected areas (the Nanda Devi National Park and Biosphere Reserve, and the Askot Sanctuary) are linked by hundreds of square kilometers of community forest land managed under the traditional van panchayat (village council) system. Together they form a contiguous forest swathe of almost 300,000 hectares (3,000 sq. km). These protected areas overlap with two important social and political conservation themes: the transfer of resource control, and public participation in resource decision-making (Langholz and Lassoie 2001).

**CO-MANAGED PROTECTED AREAS**

In these protected areas, complex processes and institutional mechanisms are generally employed to share management authority and responsibility among a number of stakeholders. These can range from national to sub-national (including local) government authorities, from representatives of indigenous, mobile, and local communities to user associations, as well as private entrepreneurs and landowners. The various stakeholders recognize the legitimacy of their respective entitlements to manage the protected area, and agree on subjecting it to specific conservation objectives.

Distinct co-management categories may be identified for these protected areas. In collaborative management, for instance, formal decision-making authority, responsibility, and accountability may rest with one agency (often a national government agency). However, the agency is required—by law or policy—to collaborate with other stakeholders; in practice, collaboration can take various forms. In its weaker form, collaboration means informing and consulting stakeholders. In a stronger framework, collaboration could mean that a multi-stakeholder body develops management processes, to be submitted later to the decision-making authority. The Kaa-ya Iya del Gran Chaco National Park in Bolivia represents a co-management regime (Box 1).

**Box 1. Co-management of the Kaa-ya Iya del Gran Chaco National Park (Bolivia)**

The Kaa-ya Iya National Park is the largest park in Bolivia (83.4 million hectares) and contains the world’s greatest area of dry tropical forest under legal protection (Beltran 2000; Winer 2003; Borrini-Feyerabend et al. 2004). The park was created in response to demands for territorial recognition by the Guarani Izoceno people. It is the first protected area in the Americas to be declared at the behest of indigenous people, and it is the only park in the Americas where an indigenous peoples’ organization (Capitania del Alto y Bajo Izozog, CABI) has primary administrative responsibility. The creation of the park helped to halt the rapid expanse of the agro-industrial sector there, and ensured that vast expanses of traditional lands were not clear-cut for farming. The Park’s Management Committee comprises staff of the Ministry of Sustainable Development and Planning, as well as representatives of CABI, the Wildlife Conservation Society (an international non-governmental organization or NGO), local
municipalities, a community group of Chiquitanos®, the Ayoreo Community of Santa Teresita and a group of women from the Izozog indigenous communities. CABI and the indigenous people have legal management authority over the Park. CABI was able to procure significant compensatory payments (US $3.7 million) for the impact of a gas pipeline that runs through their indigenous territory and the park, from industry (the owners of the pipeline). This and other income was invested by CABI in the running of the park, greatly strengthening their standing as co-management partners (Beltran 2000; Winer 2003; Borrini-Feyerabend et al. 2004).

COMMUNITY CONSERVED AREAS

Community conserved areas (CCAs) can be broadly described as ecosystems under minimum to substantial human influence that are conserved by concerned indigenous, mobile, and local communities through customary laws or other means (Pathak et al. 2005). These ecosystems can be natural or modified, and may have significant biodiversity or cultural values, or provide ecological services. Typically, the communities involved would have substantial dependence on the natural resources contained in the ecosystems for survival, livelihoods, and cultural sustenance. At the same time, many CCAs include areas where many or all forms of use are prohibited, ranging from very small to large stretches of landscape and waterscape within their areas of control. CCAs are therefore subject to extreme pressures from developers, from both the private sector and the government.

CCAs enhance livelihood security by providing access to economic opportunities including natural resource based enterprises (for example, community-based ecotourism) and employment in conservation and land/resource management. Furthermore, they provide strengthened or new access to ecological services that are critical for survival of human communities such as water, productive soil and microclimatic stabilization.

Authority and responsibility for the management of these areas rest with the communities through a variety of forms of governance or locally agreed upon organizations and rules. For instance, land may be collectively owned and managed, but other resources may be individually owned or managed on a clan-basis. Communities have developed management regulations and organizational structures, which may or may not be legally sanctioned at the national level. In general terms, CCAs offer crucial lessons for participatory governance of official PAs, useful to resolve conflicts between PAs and local people. Specifically, they offer lessons in systems of conservation that integrate customary and statutory laws.

There are a number of key factors that emerge as being major determinants of the success or failure of CCAs. These include:

(a) **Tenurial security** - the most successful community conservation initiatives are those where the communities have legal ownership of the area, tenurial security through rights over resources, or de facto control over the resources;
(b) *Equity and transparency in decision-making* - the equal representation of all sections of the community in information sharing, and a transparent and impartial process of decision-making, are essential features of successful and sustained community initiatives. Unequal access to funds or power, and social inequities of other kinds, often threaten or undermine community-based conservation initiatives;

(c) *Local leadership* - in most successful community initiatives, local leaders play a crucial role. These leaders generally need to be apolitical and inclined to focus on the wider social good.

Globally, 400-800 million hectares of forest are owned/administered by communities. In the 18 developing countries with the largest forest cover, over 22% of forests are owned by or reserved for communities. In some of these countries (e.g., Mexico and Papua New Guinea) community forests cover 80% of the total (Molnar et al., 2003). Box 2 describes Community Conservation Agreements in the Solomon Islands.

**Box 2.** A role for conservation concessions in protected area implementation: customary land tenure and community conservation agreements in the Solomon Islands, by Chris Filardi

Much of the intact biological wealth on earth is located in areas that are relatively poor and economically underdeveloped. In a protected areas context, this means that relatively daunting opportunity costs for conservation will generally fall disproportionately on the shoulders of economically disenfranchised local people and communities. Conservation concessions provide an explicit approach to addressing this dilemma. In their simplest form, conservation concessions directly transfer money into local stakeholder or landholding communities in return for some carefully defined conservation outcome. This approach is not without potential problems. However, in some areas, particularly those in which indigenous people still maintain control over land use decision-making, a thoughtfully crafted incentive-based approach may provide a critical avenue for large-scale protected areas work that would otherwise prove exceedingly difficult. A closer look at a concessions-style approach being used in the Solomon Islands of the tropical Pacific Ocean provides a sense of the potential for community-based conservation incentives to function as an important tool in regional protected areas initiatives.

Protected areas presently cover less than 0.5% of the land and seascapes of the Solomon Islands. Patterns of land tenure complicate the creation of protected areas, as land use is determined by holders of customary rights to the land, namely individuals within local communities. Extractive industry has used the vulnerabilities of Solomon land tenure systems, and the escalation of unregulated timber and mining operations threatens globally significant patterns of diversity upon which the subsistence livelihoods of about 84% of Solomon Islanders depend.

Paradoxically, the same traditional land tenure systems that have permitted industry exploitation in the past provide opportunity for biodiversity conservation and more
sustainable development in the future. Landholding communities have autonomy over their land, and with appropriate incentives, these communities can protect a remarkable component of the Earth’s living diversity.

The protected area approach being implemented by the American Museum of Natural History’s Center for Biodiversity and Conservation (AMNH-CBC) in partnership with Conservation International, World Wildlife Fund (WWF)-Solomons and The Nature Conservancy, seeks to provide incentives for combined forest and nearshore marine biodiversity conservation through Community Conservation Agreements (CCAs). The key to the approach lies in the explicit quid-pro-quo engagement with sovereign landholding groups, the terms of which are set down in a written and an oral contract.

Benefits are provided annually, upon completion of an annual conservation status audit, and will be commensurate with the biodiversity importance and opportunity costs associated with the area designated for protection. The benefit packages avoid direct cash payments and will be exclusively for in-kind services (e.g., school fees, scholarship funds, improvements to community medical clinics), and small-scale development assistance at the community level (e.g., capacity building in resource management and livelihood alternatives). Importantly, benefits like education have proven to be worthwhile to communities: they are consistent, evenly distributed, and often difficult for communities to organize on their own.

Perceived strengths of a CCA approach to conservation in the Solomon Islands include:
  • CCAs clarify land tenure issues, which for many communities may be a sufficient incentive
  • CCAs encourage good land stewardship by promoting both pride and value in traditional livelihoods in the face of a rapidly changing world
  • CCAs can provide a concrete agenda around which communities can organize when time is of the essence and opportunity costs are immediate
  • CCA design can ensure equitable benefit distribution through customary decision-making structures
  • Well-crafted CCAs avoid problems of paying for conservation in part by linking pre-existing international donor interest to resource management and biodiversity conservation
  • CCAs provide a real, equitable, and respectable alternative to large-scale resource extraction that has clear, reliable development benefits
  • CCAs in the Solomons are being designed as a complementary form of engagement to be used in the context of other resource management or sustainable development initiatives
  • Centralized funding of a CCA protected areas network has a variety of advantages including economies of scale\(^6\) and the efficiency of a single centralized administrative structure
  • CCAs may be one of the few approaches that can bind protection of large areas in a way that is potentially compatible with cultural survival of human communities still bound to place
MODEL STEPS FOR COMMUNITY CONSERVATION AGREEMENTS

The main idea of CCAs is to define agreements with communities that provide benefits and build capacity in exchange for delivering conservation outcomes. This process consists essentially of five stages.

The first stage, Site Selection and Feasibility Analysis, involves picking the site, and is followed by Engagement. Criteria include biological priority, whether the community is interested and has capacity to bind an equitable agreement (e.g., indigenous decision-making structures), and whether the potential agreement will be affordable. The next phase, Engagement, involves the following key steps: 1) presenting and discussing the general idea of a CCA to see if there is a likely match between what can be offered and what communities want; and 2) if the community is interested, making a formal agreement with them to work together on designing the specifics of the agreement. The process for design can also be agreed at this point.

Next, stakeholders engage in Defining the agreement. In this third stage, the specifics of the agreement are defined and should include: 1) determining the conservation outcome: this can be protecting a species, protecting an area, or agreeing to specific activities; 2) outline what benefits will be provided to the community, including what they are, how they will be delivered, and how often; 3) define the duration of the agreement: while long term agreements are ideal, in many cases an initial trial agreement of 1 or 2 years may be useful; and 4) set up sanctions for unsatisfactory performance: what happens if the community does not comply with the agreement? At the end of this stage, and prior to finalizing the agreement, the cost of implementation of the agreement should be estimated, and an outside group of experts should review the agreement and costs and make recommendations for final adjustments.

In the next stage, Implementation and evaluation of the agreement, key activities include: 1) effective delivery of benefits; 2) helping the community to keep its commitment; 3) monitoring biological factors, compliance, and community satisfaction; and 4) considering and evaluating what changes are appropriate. If the agreement is shown by monitoring to be successful, the last stage, Moving towards sustainability involves raising funds for a trust fund and formalizing a long-term agreement.

COMMON PROPERTY REGIMES AND COMMON POOL RESOURCES

Common property regimes refer to institutional arrangements for the cooperative use, management, and sometimes ownership of natural resources. Common-pool resources such as forests, oceans, pastureland etc. are defined as goods that can be kept from potential users only at great cost or with difficulty, but are subtractable in consumption and can thus disappear through overexploitation (McKean 2003). There is a vast body of theory that addresses governance aspects of ‘common property regimes’ for forests and other natural resources that are relevant to CCAs (Ostrom 1990; Ostrom et al. 2002; Gibson et al. 2000). Common-property regimes are immensely variable and a wide range of institutions have been found to have the potential to protect and manage...
common-pool resources (Bromley 1992; Keohane and Ostrom 1995; Ostrom et al. 2002).

PRIVATE RESERVES

Private reserves include areas under individual, cooperative, corporate for-profit, and corporate not-for-profit ownership. Authority for managing the protected land and resources in these reserves rests with the landowners, who determine conservation objectives, impose a conservation regime and are responsible for decision-making, subject to applicable legislation. It is sometimes difficult to distinguish between private reserves and co-managed or community conservation areas. One could also argue that in the final analysis these reserves are “game reserves” or “ecosystem service-related”, and have an overriding “business plan” approach to financing PAs.

Preliminary data also suggest that the amount of land they protect could be substantial. Alderman (1994), for example, estimated that 63 Latin American and sub-Saharan private reserves protected approximately 1 million hectares. Langholz (1999) estimated that private reserves in Costa Rica covered 63,832 hectares, an area equivalent to 1.2% of the national territory. In Africa, the significant potential for nature tourism and a long history of game ranches have provided many opportunities for private reserves. Like all conservation approaches, there are both advantages and disadvantages of private parks.

A principal disadvantage of private reserves from an ecological standpoint is their potentially tenuous status. Unlike government-authorized and permanently supported public parks, most private reserves are informally protected. Compounding this problem is their typically small size. Although some reserves are quite large—examples include the 80,000-hectare Hato Pinero in Venezuela, the 270,000-hectare Pumalin in Chile, and several reserves of over 100,000 hectares in Brazil—most lack sufficient area to protect megafauna, or to avoid the adverse effects of fragmentation (Alderman 1994; Langholz and Lassoie 2001).

One of the key attributes of private reserves is their potential profitability (Langholz and Lassoie 2001). For-profit private reserves, when engaged in ecotourism, frequently represent a conservation strategy capable of both economic and ecological viability. Economic benefits of private parks accrue not just to landowners, but also to governments, since they represent an augmentation of public PA systems with lands that governments might otherwise need to purchase and protect. However, private reserves are frequently dependent on ecotourism, and this poses an economic risk since ecotourism as an industry is vulnerable to wide fluctuations, due to terrorism, political unrest, natural disasters, etc.

A more serious shortcoming of for-profit private reserves is the potential conflict of interest between ecological and economic considerations. By emphasizing profit over protection, reserve owners may contribute to the degradation rather than conservation of resources. This conflict of interest takes many forms, one of which is keeping
animals captive on the premises to encourage tourism. An ecotourism reserve situated high in Costa Rica’s Talamanca Mountains, for example, keeps a wild caiman (*Caiman crocodilus*) on site, far from its native habitat. Related problems include excessive visitation by tourists at some reserves, and inappropriate construction of cabins, roads, and other infrastructure, which facilitates tourism but incurs ecological costs. Also, many times the economic returns, not only on private reserves, never reach the local communities, who may be paid only minimum wage with most of the profits benefiting wealthy landowners and international corporations etc.

**EQUITY AND CONSERVATION IN GOVERNANCE**

Ethical, moral and practical considerations have strongly influenced perceptions of protected area governance. A key concern is that of social equity in conservation (Borrini-Feyerabend et al. 2004). It is frequently argued that many communities have been harmed through conventional conservation initiatives relating to PA establishment and management by government agencies. This includes some of the world’s poorest and most marginalized communities, which have been dislocated from newly protected territories and sometimes involuntarily resettled, with negative socio-cultural and economic consequences. Critics of the concept of creating strictly protected areas for the purpose of conserving biodiversity contend that communities have been disempowered, and that conservation should provide benefits to the local communities and people directly concerned (Ghimire and Pimbert 1997; Colchester 2004). More broadly, a concern for social equity in conservation covers a range of issues, from human rights to sustainable use of natural resources, and from participation of civil society, to issues of gender equality and poverty alleviation.

**PARKS AND PEOPLE**

Some of the world’s poorest countries have a significant proportion of their territories designated as PAs, and there is a considerable degree of spatial overlap of poverty, inequality, and biodiversity (McNeely and Scherr 2001). For example, most PAs in the Lower Mekong countries in Southeast Asia are reported to lie entirely within or overlap significantly with regions of “high” poverty (ICEM 2003). Consequently, most PAs are unavoidably linked to the welfare of resident and neighboring human populations.

The philosophy that PAs in developing countries will survive only insofar as they address human concerns was first highlighted at the 1982 World Parks Congress in Bali. At that Congress, suggestions on how to support communities living adjacent to parks were made, including: local participation, education, revenue sharing, development activities, and opening park resources to local use. In response, a variety of organizations began implementing projects known as Integrated Conservation and Development Projects (ICDPs) linking biodiversity conservation in parks with local social and economic development (see NCEP module "Biodiversity Conservation and Integrated Conservation and Development Projects (ICDPs)" and below).
The Convention on Biological Diversity also clearly links conservation with development, recognizing in its preamble that "economic and social development and poverty eradication are the first and overriding priorities of developing countries". Article 8 of the CBD on in situ conservation calls for systems of PAs and various measures to conserve and sustainably use biological diversity, as well as requiring countries to promote efforts to support "environmentally sound and sustainable development in areas adjacent to PAs with a view to furthering protection of these areas". This provides a legislative justification for linking poverty issues to in situ conservation and declaring that poverty can pose a threat to the survival of PAs. The creation of new PA categories by the IUCN is another example of a response to the multiple mandates imposed on PAs (Box 3).

Box 3. IUCN categories and human use of protected areas

In an attempt to accommodate the multiple mandates of protected areas, the IUCN created a recently updated system of PA categories which recognizes that, while some PAs are more strictly protected against consumptive human activities (e.g., Categories I and II), others (e.g., Categories V and VI) allow for certain types of interventions such as the sustainable use of natural resources (see NCEP module: “Protected Areas and Biodiversity Conservation I: Reserve Planning and Design). Categories V and VI have obvious relevance in the context of rural poverty.

Category V landscapes and seascapes are protected areas where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural, and scenic value; and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values (excerpted from Dudley 2008). Category V PAs recognize the value of human interactions with nature, and the role that humans have had in shaping many of the world’s ecosystems. These areas can accommodate diverse management regimes, including customary laws governing resource management (Oviedo and Brown 1999). Examples of Category V areas are the buffer zones of Royal Chitwan National Park in Nepal, and the Gobi Gurvan Saikhan National Park in Mongolia (Phillips 2002). Category V areas have proven to work well in places where strict PAs have failed due to lack of community support (Oviedo and Brown 1999).

Category VI, or protected areas allowing the sustainable use of natural resources, is the latest innovation in the IUCN PA management category system. Category VI protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area (excerpted from Dudley 2008).

Category VI allows for the sustainable flow of goods and services to meet community needs through multiple resource use. However it differs from other categories in that it
comprises ‘an area of predominantly unmodified natural systems’ (as opposed to human-modified landscapes) which is to be managed so that at least two-thirds of it remains that way (Phillips 2003).

There is much contention surrounding the relationship between protected areas and people, with conservationists and those concerned with human welfare locked in debate (West and Brockington 2006). Conservationists argue that environmental regulations are essential to ensuring the sustainability of the planet’s biological systems and the health and welfare of people, and that PAs are an indispensable tool in that regulatory toolbox (Peres 1995; Kramer et al. 1997; Brandon et al. 1998; Terborgh 1999). Social advocates, on the other hand, contest the establishment and management of PAs, and support the belief that: (1) only initiatives related to poverty alleviation will lead to successful biodiversity conservation since poverty is a root cause of environmental destruction (Duraiappah 1998; Ravnborg 2003); (2) PAs have been frequently established at the expense of local communities (in and around PAs) through displacement and dispossession, and are responsible for perpetuating poverty by the continued denial of access to land and other resources (Ghimire and Pimbert 1997; Colchester 2004); and (3) even if parks do generate economic value, the distribution of these benefits is so skewed against poor rural people that the role of parks in local development is negligible, and they neither justly compensate for lost property and rights nor contribute to poverty alleviation (Brockington 2003; McShane 2003; Box 4).

**Box 4. Potential costs of protected areas to the poor**

Critics of PAs point out that the creation of PAs causes (a) Displacement of people, where people are geographically relocated; and (b) Dispossession, where people are deprived of access to resources such as land, timber, and wildlife. They claim that indigenous communities are denied their traditional rights and responsibilities for the stewardship of those resources, thus exacerbating all the dimensions of poverty. Communities adjacent to protected areas may suffer from crop-raiding animals or predators that kill their livestock. This in turn can result in ill-feeling and resentment that increases threats to the survival of the PA through illegal incursions to collect fuelwood or to hunt, or through encroachment by agriculturalists or pastoralists.

Economists refer to the on-going loss of access to land and resources by the creation of PAs as *opportunity costs*, which can exacerbate and perpetuate poverty. Estimates at a national level have shown that states can incur considerable opportunity costs from the loss of agricultural land to protected areas (e.g., Norton-Griffiths and Southey 1995; Howard 1995). Ferraro (2002) estimated that the local costs of establishing the Ranomofana National Park in Madagascar averaged $19 to $70 per household per year over a 6-year time frame, when average household cash income was $50-60 per year. However, the costs to people at a local level generally remain poorly researched.

Overall, our understanding of the actual impacts of PAs on human welfare is still very incomplete, and it is difficult to show causal links between PAs and poverty, or to prove
that PAs themselves perpetuate poverty. It is many times simpler to demonstrate that poverty often has a deleterious effect on PAs.

**PROTECTED AREAS AND POVERTY ALLEVIATION**

More often than not, PAs are expected to contribute significantly to economic development and alleviate human poverty in addition to fulfilling their primary mandate for biodiversity conservation. However, many believe that the goals of economic development and poverty alleviation strongly conflict with the goal of conserving biological diversity, and that protected areas cannot effectively fulfill a mandate beyond that of biodiversity conservation (Kramer et al. 1997). In general, the conflicting mandates imposed on PAs pose significant challenges for their management and effectiveness. In particular, the relationship between parks and people will continue to dominate international and national dialogues on biodiversity conservation and stimulate the evolution of innovative approaches for reconciliation.

Protected areas may not be able to alleviate poverty, but they may have an important role in sustaining the livelihoods of the poor, and preventing further impoverishment (Angelsen and Wunder 2003). Some argue that poverty is a national and regional concern that needs to be addressed through targeted and integrated programs across all sectors (ICEM 2003). There may be too great an emphasis placed on PAs as a solution to surrounding poverty, while in fact they may only constitute a part of the solution. They can significantly help to prevent and reduce poverty by maintaining ecosystem services and supporting livelihoods. However, outcomes depend on complex factors including the demographics of local or surrounding populations as well as some indigenous people’s cultures and beliefs. The management skills, authority and resources are not available to PA agencies to treat poverty reduction as a principal objective alongside biodiversity conservation. In general, there is need for broader policy reform beyond the boundaries of PAs for them to become effective in conserving biological diversity and sustaining local livelihoods (Naughton-Treves et al. 2005). PAs could be viewed as a tool for promoting effective planning of land and water use so that they can better contribute to broader socio-economic development plans. This broader landscape approach could potentially enable PAs to be linked to poverty alleviation.

**PROTECTED AREAS AND SUSTAINABLE DEVELOPMENT**

ICDPs represent one of the earliest approaches that aimed to integrate conservation with development in and around PAs (Wells and Brandon 1993). Although ICDPs vary considerably in form and size between sites, the underlying model throughout is to establish “core” protected areas in which uses are restricted and in the surrounding areas (buffer zones) promote socioeconomic development and income generation compatible with park management objectives.

Overall, the effectiveness of ICDPs has been extensively analyzed (Western et al. 1994; Barrett and Arcese 1995; Kramer et al. 1997; Wells et al. 1999; Newmark and Hough...
2000; Roe et al. 2001; Hulme and Murphree 2001; McShane and Wells 2004; see NCEP module “Biodiversity Conservation and Integrated Conservation and Development Projects”). Reviews of ICDPs have consistently found limited success in achieving biodiversity conservation or in improving social welfare (McShane and Wells 2004). Most of the projects have been hampered by design and implementation problems, and many have identified serious problems with the ICDP approach. However, many conservation agencies remain broadly committed to ICDP approaches and lessons from ICDPs will continue to influence future projects addressing poverty alleviation. New models have started to incorporate elements of adaptive management, new types of partnerships with stakeholders, and integration of site-level work with policy initiatives and institutional development.

There is other evidence to suggest that sustainable development and biodiversity conservation within PAs may not always be compatible. For instance, analyses of the potential for forest-based sustainable development through forestry and non-wood forest products have shown that there are few synergies between natural forest use and poverty alleviation (Neumann and Hirsch 2000; Fisher 2001; Salafsky et al. 2001; Wunder 2001). There have been few successful examples of sustainable harvesting regimes for non-timber forest products (NTFPs), although overall expectations for NTFPs in poverty reduction have subsequently been criticized as unrealistic, and, in some cases, counter-productive (Angelsen and Wunder 2003; Neumann and Hirsch 2000).

There are some examples of successful ecotourism initiatives within protected areas that have benefited local communities (e.g., Annapurna Conservation Area, Nepal, Wells and Brandon 1993) but tourism is not a universally viable strategy with some protected areas being more suited to it than others. Furthermore, a number of external factors related to economic, social, and political conditions influence the sustainability of tourism as a successful conservation strategy. In many cases, ecotourism as an income-generating measure for local communities engaging in unsustainable exploitation of natural resources has not benefited local communities. However, there are several challenging measures that could ensure that ecotourism benefits local communities as well as nature conservation (Kiss 2004). Despite its potential advantages, ecotourism does not guarantee biodiversity conservation and when poorly planned or inadequately controlled, can impact negatively on conservation and biodiversity values. For example in the Nam Ha National Protected Area in Lao PDR, ecotourism has not benefited the western black crested gibbon (Nomascus concolor) (Brown 2007). In a similar vein, critics argue that there may be no working models of sustainable socio-economic development based on wildlife harvest in tropical forests (Robinson and Bennett 2000).

There are concerns that, although linking conservation with development may be desirable, the simultaneous achievement of these two objectives may be impossible because of inherent contradictions (Newmark and Hough 2000). In many cases, success may be enhanced by addressing each of these objectives separately but in parallel, tightly-linked interventions, rather than within the same project. Proponents of
the broad view of decoupling conservation and development suggest the need to develop new and creative ideas about park management without expecting them to bear the entire burden for biodiversity conservation. One suggestion has been to link agricultural intensification and park management (Brandon 2001). In this context, agricultural intensification as a strategic element of project activities is seen as one way of stabilizing local land-use, helping increase local incomes, absorbing local labor and limiting migration.

**PROTECTED AREA SERVICES**

PAs can provide a wide range of goods and services to people living in and around them, and to society as a whole. The *Millennium Ecosystem Assessment* (MEA 2003) divides these services into four categories: provisioning services, regulating services, cultural services, and supporting services.

**Provisioning services** are those that yield natural products such as food, fresh water, fuelwood, and herbal medicines that have direct use value to rural communities. In theory, these products would only be legally accessible to local people living in and around those PAs that allow the sustainable harvesting of such resources (categories IV, V, and VI and extractive reserves). However, even the most strictly regulated PA could provide additional food security for surrounding communities in times of famine. PAs also act as reservoirs of fish and wildlife that disperse into surrounding areas. For example, freshwater fisheries make an important contribution to the economies of the lower Mekong basin countries. Maintenance of key hydrological functions and important aquatic habitats within PAs is essential to the maintenance of fisheries productivity. Thus, PAs are a key component of long-term fisheries management strategy. In addition, the importance of marine protected areas and no–fishing zones as sources of catch for local fisheries, particularly those which incorporate fish spawning and nursery habitats such as estuaries, coral reefs and mangroves, is now well documented (e.g., Wells and Hildesley 1999; Roberts et al. 2001; Shanks et al. 2003; Mumby et al. 2006).

**Regulating services** are those that provide benefits from ecosystem services such as climate regulation, watershed protection, coastal protection, water purification, carbon sequestration, and pollination (Loreau et al. 2001; Palmer et al. 2004; Wormald et al. 2006). **Cultural services** include religious values, tourism, education, and cultural heritage. **Supporting services** (e.g., soil formation, nutrient cycling, and primary production) may translate into economic benefits. Recently, studies have emerged showing the economic benefits of PAs. One study of 41 reserves covering approximately 1.5 million ha in Madagascar found that the economic rate of return of the PA system was 54% (Naughton-Treves et al. 2005). The main benefits were from watershed protection, although ecotourism benefits were significant and expected to increase over time, providing greater returns to surrounding communities. PAs constitute a source of income for local community members through jobs as park rangers or guides in the tourism industry. According to Wilkie et al. (2006), understanding whether and how PAs influence the welfare of households that reside
close to parks and reserves is a critical first step in developing and implementing policies to address any adverse effects of parks on people, and in identifying policy options that increase local benefits associated with parks.

FINANCING PROTECTED AREAS

Adequate financial support is key for the effective functioning of PAs. While funding is only one of several basic needs for creating functional PA systems, inadequate financial support plays a central role in the loss and degradation of natural resources as it limits PA management effectiveness. Many PAs in the developing world currently suffer from an extreme funding deficit, and many areas have no budget at all (James et al. 1999, 2001; Wilkie et al. 2001). Insufficient funding means that many PA systems have inadequate staff, equipment, and other management necessities. Overall, lack of sufficient financial investment has led to the creation of ‘paper parks’ with ineffective or insufficient management, and the progressive degradation of the resources that the parks and reserves were established to protect. However, funds allocated to PAs have not always resulted in long-term sustainable conservation outcomes. Much PA finance has been short-term and focused on capital investment, with very limited support for sustaining structures and institutions over time.

International and domestic funding for protected areas has struggled to keep pace with the growth in the number and area of PAs, especially in the tropics. Many governments have reduced their budgets for protected areas. Changing global and national priorities and development imperatives have also had major impacts on both the amount and the purpose of funding for protected areas and biodiversity conservation. Some argue that there has been a shift in official donor and government priorities away from biodiversity conservation and protected areas and towards social and poverty reduction goals (Emerton et al. 2006).

Bruner et al. (2004) evaluate the cost of effectively managing all existing protected areas in developing countries, as well as the cost of expansion in high-priority new areas. The costs of a protected area system were usefully divided into three categories: (i) Recurrent management costs for existing areas; (ii) System-wide expenses needed to support a network of protected areas; and (iii) Costs of expanding the protected area system (see Table 2). Bruner et al. (2004) found that studies converge on a funding shortfall of $1 billion to $1.7 billion per year to manage all existing areas. The costs of establishing and managing an expanded protected area system would total at least $4 billion per year over the next decade, an amount that far exceeds current spending. The funding gap is acute in developing countries and for marine protected areas in the high seas. For example, the current protected area budget as a percentage of necessary annual spending is estimated to be approximately 20% in Cameroon (Bruner et al. 2004) and across the Congo Basin (Wilkie et al. 2001), 35%-45% in Ghana, and 70% in Bolivia (Bruner et al. 2004).
In recognition of the importance of PAs, the CBD program of work on protected areas contains a useful target to address the funding gap, although to date this has not been achieved:

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 (Secretariat of the CBD 2005).

FINANCIAL SUSTAINABILITY FOR PROTECTED AREAS

Financial sustainability of protected areas is defined as “the ability to secure sufficient, stable and long-term financial resources, and to allocate them in a timely manner and in an appropriate form, to cover the full costs of protected areas, and to ensure that they are managed effectively and efficiently with respect to conservation and other objectives” (Emerton et al. 2006). Securing adequate funds is a necessary, but not sufficient, condition for protected areas to be managed effectively and financed sustainably. Elements of protected area financial sustainability include: 1) building a diverse, stable and secure funding portfolio while minimizing funding risks and fluctuations; 2) improving financial administration and effectiveness; and 3) taking a comprehensive view of costs and benefits: ensuring that those who bear PA costs are recognized and adequately compensated, and that those who benefit from protected areas make a fair contribution to their maintenance.

PROTECTED AREA FINANCING MECHANISMS

There are broadly three basic mechanisms to finance protected areas (Spergel 2002): (1) annual allocations from a government’s budget; (2) user fees, fines, and environmental taxes that are earmarked for parks and nature conservation; and (3) grants and donations from individuals, corporations, foundation, nongovernmental organizations (NGOs) and international donor agencies.

Annual governmental allocations
Most governments in developing countries give higher priority to funding economic development and social programs than parks and wildlife conservation. However, governments can sometimes be persuaded to increase their budget allocations for PAs if it can be demonstrated that protected areas provide substantial economic benefits. These can be garnered for example through wildlife and nature-based tourism, protecting watersheds (to ensure the supply of drinking water and hydroelectric power), protecting spawning grounds for fish that can later be commercially harvested, and carbon sequestration. For many parks around the world, annual government allocations constitute the only source of funds for park management. These funds are frequently insufficient to cover PA management costs.
User fees, fines, and taxes earmarked for conservation
Many countries collect fees, fines, and taxes from people who “use” protected areas. These include fees for entry, fishing, hunting, diving, climbing, hiking, etc. These fees also include concessions and taxes paid by businesses operating in protected areas, such as visitor lodges, stores, and tour operators, or fines for environmental transgressions. In many cases, however, only a small part of such revenues is used to support protected areas and biodiversity conservation. More commonly, the generated revenue flows into the government treasury and is then allocated for other budgetary purposes. A second problem is that these fees and taxes are often set much lower than what many people would be willing to pay. Surveys have shown that most park visitors are willing to pay significantly higher fees and taxes if this money is used solely for conserving parks. Table 3 describes these fees in more detail.

Notwithstanding the large revenue-generating potential of earmarked user fees, fines, and taxes, they cannot be relied upon to cover the core costs of managing PAs. Revenues generated from tourism can suddenly and dramatically decline as a result of domestic or international political or economic crises. Similarly, the revenues generated from user fees and taxes on natural resource extraction such as logging or mining can also fluctuate dramatically as economic conditions change, or as the resource itself becomes depleted. Hence, user fees, fines, and earmarked environmental taxes should be regarded as a supplement to regular government budget allocations and donor funding, rather than as a replacement for those two sources.

Grants and donations
The third main source of financing for protected areas and biodiversity conservation is grants and donations from individuals, corporations, foundations, NGOs and international donor agencies. These include conservation trust funds and debt-for-nature swaps.

Conservation trust funds are an increasingly common way of providing long-term funding for parks and conservation in developing countries. A trust fund can be broadly defined as money or other property that: (1) can only be used for a particular purpose; (2) must be kept separate from other sources of money, such as a government agency’s regular budget; and (3) is managed by an independent board. Conservation trust funds can offer a number of important benefits including providing long-term sustained funding, financing recurrent costs, serving as a catalyst for environmental policy reforms, strengthening the role of civil society, increasing local participation, and decentralizing decision-making.

Establishment of a trust fund is often a very political process. These funds can lack a clear focus or clear criteria for making grants, and may experience excessive political interference, high administrative expenses, and low returns. Designing the trust fund is a complex process, but good design is a requirement for success. There is no single model or set of “best practices” for an ideal conservation trust fund. Each trust fund needs to be custom designed to fit a country’s political circumstances, its legal code, its human resource capacity, its environmental problems and the requirements of the
fund’s donors. As an example, Box 5 describes a trust fund created for Bhutan’s PA system.

**Debt-for-nature swaps** represent a financial mechanism that has enabled developing countries to reduce external debt while generating funds for conservation activities. Debt-for-nature swaps can take three forms: (1) swaps of debt owed by developing country governments to international commercial banks; (2) swaps of debt owed by developing country governments to the governments of developed countries; and (3) swaps of debt owed by corporations or commercial banks in developing countries to international commercial banks. For example, in 1993, the World Wildlife Fund (WWF) was able to purchase US $19 million worth of Philippine government debt from the international commercial banks that originally made the loans. The purchase price was discounted to $13 million, as the banks determined it was better to receive a smaller amount than they loaned when the alternative was no return on their loan at all. The United States Agency for International Development (USAID) provided the funds to cover the purchase. In exchange for WWF’s agreement to cancel the debt, the Government of the Philippines agreed to allocate an amount of Philippine pesos equivalent to US $17 million (i.e., 90 percent of the debt’s face value) for the purpose of establishing a conservation trust fund.

Debt-for-nature swaps offer transparent, accountable and multi-stakeholder mechanisms for mobilizing and administering large amounts of funding. They can provide long-term and sustainable finance for protected areas, as well as ensure that a degree of control over the allocation of funds remains with PA managers and other local stakeholders. Debt-for-nature swaps are complex instruments to negotiate, set up and administer, requiring elaborate legal and institutional structures and strong technical capacities. Moreover, substantial inputs are often required from third parties (usually international NGOs). In addition to the technical complexities of the debt swap process, the ultimate success of a debt-for-nature swap depends on the success of the conservation programs that it finances (Spergel 2002).

**Box 5. The Bhutan Trust Fund for Environmental Conservation**

Source: [http://www.worldwildlife.org/conservationfinance/projects/bhutan.cfm](http://www.worldwildlife.org/conservationfinance/projects/bhutan.cfm)

In 1991, the World Wildlife Fund (WWF) created and established the world’s first conservation trust fund in the Himalayan Kingdom of Bhutan. The Trust Fund is financed through a US $1 million investment from WWF, as well as additional investments from the Global Environment Facility (GEF), World Bank, the Royal Government of Bhutan, and the governments of Denmark, Finland, the Netherlands, Norway, and Switzerland. It provides Bhutan with an autonomous financial mechanism through which to fund local conservation activities.

The trust fund’s permanent endowment (approximately US $32 million) generates at least $1.5 million annually to support biodiversity conservation programs in Bhutan. The agreement establishing the trust fund includes a legal covenant by the Royal
Government of Bhutan that it will maintain 60 percent of Bhutan's 77.9 million acres under permanent forest cover in perpetuity (a total of 48.1 million acres protected).

The trust fund has helped to finance the conservation and improved management of these forested areas, supporting activities that include:
1) Capacity building of foresters, ecologists, natural resource managers, and other professionals;
2) Surveys of Bhutan's forest resources and development of an ecological information base;
3) Review of the protected area system, and development and implementation of conservation management plans;
4) Institutional support for community management;
5) Environmental education and public awareness campaigns; and
6) Projects integrating conservation and development.

The BTF is governed by a fully Bhutanese, seven-member management board with ultimate program and fiduciary responsibility. The board has high-level membership, reflecting the importance placed on the fund’s objectives, and conferring prestige and credibility to implementation of the fund. Due to the specialized nature of investment instruments in use today, BTF relies on independent expertise to advise on investment policy and strategy. In addition, the government of Bhutan is integrating environmental management across all sectors.

**PAYMENTS FOR ECOSYSTEM SERVICES (PES)**

Biodiversity conservation is increasingly justified in terms of “ecosystem services” provided to people (Emerton et al. 2006). Examples include the natural water filtration function of wetlands (which often benefits people far downstream), the storm protection function of coastal mangrove forests (which benefits coastal properties and infrastructure), and carbon sequestration in biomass (which benefits the entire global community by abating climate change). Ecosystem services provided by PAs are typically enjoyed by offsite producers and consumers at low or zero cost, who make little or no contribution to PA finance. Systems of payments for ecosystem services (PES) seek to create financial incentives for resource users and managers to voluntarily adopt activities and technologies that generate environmental benefits. The use of PES to generate funding for PAs is a relatively recent phenomenon; most schemes have been developed in the last decade or so.

Payments by government to farmers to conserve or restore native vegetation, or to adopt low-external input farming practices, are two common examples of PES (Emerton et al. 2006). Other examples of PES used to generate funding for PAs include payments for watershed protection, carbon sequestration, and biodiversity conservation (Box 6). Payments for hydrological services have been applied in a wide range of cases and countries, and range from transfers between public hydropower and water utilities to PA
agencies and conservation NGOs, to direct payments by governments to small-scale farmers (Emerton et al. 2006).

**Box 6.** Payment for ecosystem services for watershed protection in Latin America

Protected areas can be a cost-effective means of maintaining healthy watersheds that produce a steady and reliable source of water. Protected forests, in particular, have significant influence on the hydrological cycle, especially in mountainous areas. While empirical data on the relationship between vegetation cover and water supply is scarce, some studies suggest that forest conservation and appropriate farming methods can: 1) **reduce sediment loads in waterways**, decreasing sedimentation of reservoirs and associated construction and maintenance costs for irrigation systems, hydro-electric power (HEP) plants, water supply systems and fisheries; 2) **regulate water-flows** so as to reduce flood risk in the wet season and the likelihood of water shortages in the dry season; 3) **increase the volume of water** available, either year-round or specifically in the dry season; and 4) **improve the quality of water** for domestic use. Overall, the economic value of watershed services provided by PAs can be substantial. For example, 7,600 ha of cloud forest in the La Tigra National Park in Honduras provide the capital city of Tegucigalpa with about 40% of its drinking water supply, at only 5% of the cost of the city’s second main water source.

Payments for watershed protection are provided under several different initiatives in Costa Rica. At a national level, since 1997, the National Fund for Forest Financing (FONAFIFO) pays forest owners and protected areas for reforestation, forest management, and forest conservation. FONAFIFO acts as an intermediary between landowners and buyers of various ecosystem services, including carbon sequestration, watershed protection, scenic beauty, and biodiversity conservation. Landowners involved in the scheme receive payments over five years for specified land-use changes. Payments are set at slightly more than the opportunity cost of relatively low-value land uses such as pasture, about US $35–40/ha/yr for conserving forest, and approximately US $100/ha over five years for reforestation. At these prices, most landowners prefer to conserve existing forest, rather than undertake more expensive reforestation. Note that landowners are legally bound to honor their commitments under the scheme for 10–15 years after the payments cease. Funding for the scheme has come from various sources, including a fossil fuel tax, sales of carbon credits, a World Bank loan and a GEF grant.

**EFFECTIVENESS OF PROTECTED AREAS**

Are PAs working? For a number of reasons, this seemingly simple question has extremely complex answers. PAs frequently have multiple mandates (see NCEP module: “Protected Areas and Biodiversity Conservation I: Reserve Planning and Design”). Biodiversity conservation or the preservation of ecological integrity is only one of several objectives of protected areas that may include other diverse goals related to sustainable development, poverty alleviation, peace, social equity, etc. Furthermore, the
poor availability of data on ecological and social conditions, and their change over time, has resulted in the lack of a unified measure of protected area integrity (Naughton-Treves et al. 2005). Hence, measuring PA effectiveness in a meaningful way is often a very difficult task.

Still, there are a number of approaches that have been developed, and studies that examine PA effectiveness broadly address the following three questions (Hockings et al. 2000): (1) is the design of the site or system appropriate to the values it seeks to maintain; (2) are the management systems and processes adequate and appropriate for the needs of the site; and (3) is the site or system effective in maintaining biodiversity, abating threats, and achieving other management objectives? These three questions have evolved into three separate areas in PA assessments: design, management processes, and ecological integrity. The first, design, provides parameters for assessing the adequacy of the design of a protected area or system, and provides criteria for determining new reserves. The second, management processes, includes assessments of a range of management elements. The third, ecological integrity, includes concerns such as intactness, species viability, ecological processes and functioning, and the threats and pressures facing a protected area. Table 4 (modified from Ervin 2003a) provides a non-exhaustive review of park effectiveness studies within these broad categories.

**DESIGN ISSUES**

A number of studies have examined the effectiveness of PAs focusing on ecological representation. These studies address the following questions: Are key biodiversity areas included within PAs? Are there gaps in protected area networks? Table 5 provides a summary of the main findings in selected studies (also, see the NCEP module: “Protected Areas and Biodiversity Conservation I: Reserve Planning and Design”). At the global scale, these studies broadly analyze species represented within protected areas, and identify unprotected areas with high conservation value, bioregional gaps in the PA network, and areas where conservation investments could potentially have the greatest impact in preventing biodiversity losses (Andelman and Willig 2003). At the country level, studies examine the representativeness of the PA network with regard to species, life zones, habitats, and other factors.

**MANAGEMENT EFFECTIVENESS IN PROTECTED AREAS**

A number of studies assess management effectiveness in protected areas (Singh 1999; Rao et al. 2002; Ervin 2003b; WWF International 2004). For example, WWF International (2004) examines issues related to legal establishment, boundary demarcation, monitoring, education, and awareness in 200 PAs in 37 countries using a tracking tool. They found that effectiveness declined with the extent to which people had access to and conducted activities within the PAs. Studies that address management effectiveness often examine factors such as physical infrastructure, number of on-site personnel, management plan implementation, environmental education activities, and other factors (for example, Rao et al. 2002). The Rapid Assessment and Prioritization of
Protected Area Management (RAPPAM) methodology outlined by Ervin (2003b) helps identify management strengths and weaknesses, and analyzes the scope, severity, prevalence, and distribution of various threats and pressures within protected areas.

**PROTECTED AREAS, THREATS AND ECOLOGICAL INTEGRITY**

Protected areas are more often than not subject to varying degrees of threats and pressures that ultimately influence their effectiveness in maintaining ecological integrity. Broadly, there appear to be two approaches to examining PA effectiveness in this context:

The first approach involves examining the prevalence of threats and pressures affecting PAs at various geographic scales. Studies provide an overview of threats at a regional scale (for example Mesoamerica, Brandon et al. 1998) or at the country level (e.g., Singh et al., 1999; Rao et al. 2002). In general, the aim is to determine the effectiveness of management actions in mitigating threats. Two methodologies that can be used to conduct such assessments include the Threat Reduction Assessment method, developed by Salafsky and Margoluis (1999), and the RAPPAM methodology outlined by Ervin (2003b). Both of these methodologies are discussed in detail in the NCEP module “Assessing Threats in Conservation Planning and Management”.

The second approach investigates various measures of ecological integrity such as species extinctions, loss and degradation of habitat, levels of natural resource extraction, and other factors. Table 6 lists relevant studies and provides a summary of their main findings. There are many reports of local extinctions of species, loss or degradation of habitat, and overextraction of natural resources within PAs. The effectiveness of PAs in stalling deforestation is outlined in Box 7.

**Box 7. Analysis of deforestation rates in and around Protected Areas**

To investigate the effectiveness of protected areas in slowing land conversion, Naughton-Treves et al. (2005) compiled results from 20 recently published studies on deforestation rates in 49 protected areas across the tropics. Avoiding deforestation is only one measure of PA effectiveness, since biodiversity can be significantly compromised by threats such as hunting in ‘intact’ forests. Nevertheless, intact forest is an important indicator of the impacts of protected areas on land-use change. In almost 90% of the 36 cases for which the authors explicitly compared deforestation rates outside and within PAs, the deforestation rates were faster outside PA boundaries than within. In 4 cases the PAs were ineffective, as there was no difference in rates, or rates were actually faster inside the protected areas. Overall, the size of the PA did not appear to correlate with deforestation outcomes, but the category of the PA did. IUCN Category V and VI PAs, which provide for greater human activity within PA boundaries, appear to be less effective in mitigating deforestation than Category II protected areas, which have more restricted access (the IUCN categories are reviewed in Box 3, and in the NCEP module: “Protected Areas and Biodiversity Conservation I: Reserve Planning and Design”, as well as at www.iucn.org). Overall, the majority of PAs in their study
appear to be significantly slowing deforestation within boundaries despite inadequate funding and weak institutions (Naughton-Treves et al. 2005).

**MONITORING PROTECTED AREAS**

Monitoring is critically essential to determining the extent to which protected areas are effective in conserving biodiversity or achieving other management objectives. Danielsen et al. (2000) define ‘monitoring’ as data sampling which is: repeated at certain intervals of time for management purpose; replicable over an extended time frame; and focuses on rates and magnitude of change. Monitoring helps to identify priority areas for research and conservation, and to quantify the response of plant and animal populations to disturbance and management interventions. Countries contracting to the Convention on Biological Diversity are obliged to monitor biodiversity (Article 7b), and donors increasingly demand accountability and quantifiable achievements in return for their assistance. Given that biodiversity conservation is one of the key objectives of protected areas, the development of biodiversity monitoring systems for protected areas now attracts a significant proportion of the international funding for biodiversity conservation.

There are conflicts between the scientific ideals and practical realities of monitoring that influence the implementation and effectiveness of monitoring systems. For instance, most practitioners agree that in an ideal world, monitoring programs would always be spatially and temporally comprehensive, rigorous in their treatment of sampling error, and sustainable over the time scales necessary to examine population and community level processes (Yoccoz et al. 2001). Nevertheless, monitoring of biodiversity and resource use in the real world is often costly and hard to sustain, especially in developing countries, where financial resources are limited. Moreover, such monitoring can be logistically and technically difficult, and is often perceived to be irrelevant by resource managers and the local communities.

Conflict between the scientific ideals and practical realities of monitoring is perhaps most evident in developing countries where limited internal resources and sporadic international funding condemn many data collection efforts to failure (Danielsen et al. 2003). Many suggest the need to identify some middle ground between requirements for rigor and goals for program sustainability. Practitioners disagree about whether such a balance exists, and the issue has become a source of healthy debate (e.g., Yoccoz et al. 2001, 2003; Danielsen et al. 2003). At the centre of this debate is the fact that where suggestions or examples of ‘appropriate’ monitoring in developing countries exist, they generally are unproven in their ability to detect ‘true’ trends (Danielsen et al. 2003). On the one hand, poor statistical power and bias may turn overly simplistic monitoring schemes into wastes of time and precious resources (Yoccoz et al. 2001) – yet equally wasteful are programs so intensive they cannot be sustained long enough to address questions fundamental to effective management (Danielsen et al. 2003).
However, there are a number of methodologies and approaches to protected area monitoring that are being implemented. Table 7 gives a summary of the most relevant methods that are in use. The methods presented span a spectrum, from participatory monitoring, where aims and objectives are defined by the community and carried out at a local scale and by individuals with little formal education, to statistically rigorous monitoring that requires specialist knowledge. For general overviews on monitoring in protected areas, see also Vreugdenhil et al. (2003) and Parrish et al. (2003).

Some argue that many biodiversity data collecting activities implemented as monitoring may not be related to local conservation requirements. Given the limited resources available to address the ever-increasing threats facing protected areas, the relative value of monitoring activities should be related to their contribution to achieving basic conservation goals (Sheil 2001). Monitoring and evaluation that provides assessment and identification of threats and problems, in a manner that allows managers to respond effectively, is central to good conservation management. Overall, it will be critically important to achieve sustainability of monitoring efforts while ensuring effectiveness of project activities.

**Future of protected areas**

Given the rapid rate of biodiversity loss, protected areas can be expected to assume unprecedented significance as the last bastions for the maintenance and protection of biodiversity. The following is a brief summary of the challenges and opportunities for future protected area management:

- By global mandate, in addition to conserving biological diversity, PAs are often expected to provide economic benefits, alleviate poverty, protect threatened cultures, and promote peace. The challenges for PAs in the future will be to implement these multiple objectives in the face of population growth, increasing demand for resources, and political, social and economic instability (Naughton-Treves et al. 2005). Although the lack of sufficient financial resources is a significant obstacle to the effectiveness of PAs, increases in the allocation of financial resources for PAs would not eliminate challenges associated with managing PAs to fulfill multiple, often conflicting mandates (Naughton-Treves et al. 2005).

- Innovative approaches to PA management, such as payments for ecosystem services, direct payments, sustainable financing mechanisms, and inventive institutional arrangements for governance, will dominate a dynamic dialogue on the reconciliation of human needs with the biodiversity protection goals of PAs.

- An important trend in PA management is greater attention to environmental governance (Borrini-Feyerabend 1996). Beyond recognizing that a specific type of PA is appropriate for a given place, conservationists are addressing the issue of responsibility of management for individual PAs. It is being increasingly acknowledged that governance regimes need to reflect the complex web of
relationships that connect multiple groups with the protected landscape and resources (Naughton-Treves et al. 2005).

• Land-use zoning projects are being increasingly explored as the means to balance conservation goals with economic development goals across large areas and among diverse stakeholders. For example, many projects seek to establish ecological corridors or no-take zones amidst areas of resource extraction.

• A key issue influencing the future role of PAs involves their integration into the broader ecological, rural, and institutional landscape (Brandon 2001; Franks and Blomley 2004; Deguise and Karr 2006). A growing vision includes PAs as one land-use component of a diverse geographical landscape, interspersed with human-dominated land-uses such as agricultural lands and urban areas. For example, the Wildlife Conservation Society has adopted the ‘Living Landscape’ approach to wildlife conservation (Box 8). While parks are essential for conservation, the larger landscape adjacent to protected areas, with both humans and animals living within it, is often as important as the protected core. Thus, the NGO has created an approach that involves not only parks and protected areas, but also resident people, government agencies and the private sector.

• Planning, implementation and monitoring of effectiveness of protected areas are key aspects of PA management that require the engagement and commitment of a range of stakeholders with diverse interests. To ensure that protected areas fulfill their objective of biodiversity requires a shared vision for biodiversity conservation.

Box 8. Protected areas as living landscapes

Landscape considerations are key to management in the Atlantic forest of Brazil. This highly fragmented area is a biodiversity hotspot reduced to less than eight percent of its original size. The remaining forest is currently distributed in small parcels isolated within a predominantly agricultural landscape. A system of several small parks or other lands, including those under private ownership and employed in agriculture, is being established to conserve remaining biodiversity. These provide refuge for endangered endemic species such as the Golden lion tamarin (Leontopithecus rosalia). Captive bred or wild tamarins have been reintroduced or translocated among protected fragments to maintain viability and genetic diversity (Dietz et al. 2000). Corridors are being put into place between parcels to link areas, and maintain large-scale processes, habitat heterogeneity, and genetic diversity. Other efforts that integrate reserves with protected and unprotected surrounding landscapes include the Mesoamerican Biological Corridor (Lambert and Carr 1998; Miller et al. 2001) and the Yellowstone to Yukon initiative (Yellowstone to Yukon Conservation Initiative 1998; Soulé and Terborgh 1999).
CONCLUSION

Protected areas continue to represent an important cornerstone for biodiversity conservation. However, the disparate and often conflicting global mandates for PAs pose the greatest challenge for the development of effective strategies. Greater awareness of the need for and the importance of PAs has led to the creation of many opportunities to increase their effectiveness in meeting human needs and achieving biodiversity conservation goals. The need for reconciliation of conflicting mandates will drive the design and implementation of innovative approaches for management, governance, financing, and monitoring of PAs, all of which will directly and indirectly impact their effectiveness in conserving biodiversity.
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Dudley, N. 2008. Guidelines for applying protected area management categories, IUCN World Commission on Protected Areas, Gland, Switzerland.


Robichaud, W., C.W. Marsh, S. Southammakoth and S. Khounthikoummane. 2001. Review of the National Protected Area System in Lao PDR. Ministry of Agriculture and Forestry, Lao PDR.


APPENDIX I

PROTECTED AREAS AND THE CONVENTION ON BIOLOGICAL DIVERSITY

The Convention on Biological Diversity (CBD) is the most important international legal instrument addressing and supporting protected areas. This was the first global intergovernmental agreement that set measurable targets and timetables for protected areas, elaborated a variety of actions for meeting those targets, and called for expanded international protected areas funding. Article 8 specifically calls for establishment of protected area systems, and the importance of protected areas is repeatedly emphasized (Secretariat of the CBD 2005; Box 9). The Convention recognizes protected areas as a tool for in situ conservation that should be used in conjunction with other relevant provisions of the Convention.

The CBD was negotiated under the auspices of the United Nations Environment Program (UNEP) between March 1991 and May 1992; it was opened for signature at the “Earth Summit” in Rio de Janeiro in June 1992 and entered into force on 29 December 1993. To date, 190 countries and the European Community have ratified and thus become Parties to the CBD. By ratifying the Convention, Parties commit themselves to undertaking national and international measures aimed at achieving three objectives: the conservation of biological diversity; the sustainable use of its components; and the equitable sharing of benefits arising out of the utilization of genetic resources. Since 1992, Governments have further defined these commitments through decisions of the Conference of the Parties (COP)—the Convention’s governing body—and translated general provisions contained in the Convention into practical actions.
CBD’s Program of Work on Protected Areas

At its seventh meeting, held in Kuala Lumpur in February 2004, the Conference of the Parties adopted in its decision VII/28, a Program of Work on protected areas (Secretariat of the CBD, 2005).

The overall purpose of the Program of Work is:

To support the establishment and maintenance by 2010 for terrestrial and by 2012 for marine areas of comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas that collectively, inter alia through a global network contribute to achieving the three objectives of the Convention and the 2010 Target.

The essence of the Program of Work is a commitment that countries develop participatory, ecologically representative and effectively managed national and regional systems of protected areas, stretching where necessary across national boundaries, integrated into other land uses and contributing to human wellbeing.

The Program of Work identifies four main elements, 16 goals (each with a more specific target) and 92 activities for the Parties, many of which have specific timetables.

The four main program elements are:

1) Direct actions for planning, selecting, establishing, strengthening, and managing protected area systems and sites;
2) Governance, Participation, Equity and Benefit Sharing;
3) Enabling Activities; and
4) Standards, Assessment and Monitoring.

Fourteen of the 16 targets contain deadlines of either 2008 or 2010 (for terrestrial areas) and 2012 (for marine areas), with broader integration into wider landscapes and seascapes by 2015. Reaching these targets will require implementing a range of supporting activities, including for example the establishment of an enabling policy environment, provision of financial and technical resources, capacity building, monitoring and evaluation, and ensuring that protected areas are established and managed in an equitable and participatory manner.

WORLD PARKS CONGRESS AND THE DURBAN ACCORD

The fifth IUCN World Parks Congress (September 2003) marked a turning point for protected areas. The four previous of these ten-yearly meetings, which provide an important international arena for determining PA strategies, had made significant inroads in helping national governments to establish new PAs and invest in conserving biological diversity. The fifth meeting placed them at the center of international efforts to conserve biodiversity and promote sustainable development.

By taking the theme, “Benefits Beyond Boundaries”, the fifth Congress recognized that protected areas cannot exist in isolation from the surrounding land and sea; the protected areas community needs to reach out to the wider population that can benefit

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**Box 9. Relevant articles of the Convention on Biological Diversity**

Paragraphs (a), (b), (c) and (e) of Article 8 contain specific references to protected areas and provide that Parties should:

(a) Establish a system of protected areas or areas where special measures are taken to conserve biodiversity;
(b) Develop guidelines for the selection, establishment and management of protected areas;
(c) Regulate or manage biological resources important for biodiversity conservation whether within or outside protected areas; and
(e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas.

In addition, several other articles are relevant:

(a) Provisions on sustainable use in Articles 6 and 10, given the fact that protected areas are increasingly managed for multiple purposes
(b) Provisions on *ex situ* conservation (Article 9) and restoration/rehabilitation (Articles 8f and 14.2) to complement on-site efforts
(c) Provisions on tools important for protected area management and planning such as biodiversity monitoring (Article 7) and impact assessment (Article 14)
(d) Other provisions such as 8(j) on traditional knowledge, Article 11 on incentive measures, Article 12 on research and training and Article 13 on public education and awareness

The convention’s work on protected areas will be undertaken in the context of an ecosystem approach, to relate protected areas to the wider landscape and seascape and to ensure proper valuation of their goods and services.
from the existence of well-managed protected areas. This need to make those connections is the underlying message of “The Durban Accord: Our Global Commitment for People and Earth’s Protected Areas”.

To realize the goals of the Accord, action involving many stakeholders is needed at global, regional, national, and local levels. The Durban Action Plan sets out the required targets and actions for implementation of the Accord. The Durban Action Plan is organized around ten desired outcomes and related targets. Under each outcome, it identifies the required levels of action. For more information on the Durban Accord, please refer to: http://www.iucn.org/themes/wcpa/wpc2003/pdfs/english/Proceedings/durbanaccord.pdf.
# TABLES AND FIGURES

## TABLE 1A. MAJOR INTERNATIONAL INITIATIVES RECOGNIZING OR DESIGNATING SPECIFIC SITES

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Geographical coverage</th>
<th>Thematic coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Heritage Convention</td>
<td>Global</td>
<td></td>
</tr>
<tr>
<td>Ramsar Convention</td>
<td>Global</td>
<td>Wetlands</td>
</tr>
<tr>
<td>UNESCO MAB Biosphere Reserves</td>
<td>Global</td>
<td></td>
</tr>
<tr>
<td>Helsinki Convention</td>
<td>Baltic</td>
<td>Marine and Coastal</td>
</tr>
<tr>
<td>Barcelona Convention and SPA Protocol</td>
<td>Mediterranean</td>
<td>Marine and Coastal</td>
</tr>
<tr>
<td>Cartagena Convention and SPAW protocol</td>
<td>Caribbean</td>
<td>Marine and Coastal</td>
</tr>
<tr>
<td>Antarctic Treaty and Madrid Protocol</td>
<td>Antarctic</td>
<td></td>
</tr>
<tr>
<td>Bern Convention</td>
<td>Europe</td>
<td>Listed Species/habitats</td>
</tr>
<tr>
<td>EU Birds Directive</td>
<td>European Union</td>
<td>Listed Species</td>
</tr>
<tr>
<td>EU Habitats Directive</td>
<td>European Union</td>
<td>Listed species/habitats</td>
</tr>
<tr>
<td>Council of Europe Biogenetic Reserves</td>
<td>Europe</td>
<td></td>
</tr>
<tr>
<td>ASEAN Declaration on Heritage Parks and Reserves</td>
<td>South East Asia</td>
<td></td>
</tr>
</tbody>
</table>
**Table 1b. Examples of other conventions and programs with a commitment to establishing protected areas**

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Geographical coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article 8a of the Convention on Biological Diversity</td>
<td>Global</td>
</tr>
<tr>
<td>Article X of the African Convention</td>
<td>Africa</td>
</tr>
<tr>
<td>Article II of the Western Hemisphere Convention</td>
<td>Americas</td>
</tr>
<tr>
<td>Convention for the Conservation of Biodiversity and Protection of Wilderness Areas in Central America</td>
<td>Central America</td>
</tr>
<tr>
<td>Article 13 of the ASEAN Declaration</td>
<td>South East Asia</td>
</tr>
<tr>
<td>Article 14 of the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region</td>
<td>South Pacific</td>
</tr>
<tr>
<td>Convention on Conservation of Nature in the South Pacific</td>
<td>South Pacific</td>
</tr>
<tr>
<td>Other regional seas agreements, including South East Pacific and Eastern Africa</td>
<td>Various</td>
</tr>
<tr>
<td>Pan-European Biological and Landscape Diversity Strategy</td>
<td>European</td>
</tr>
</tbody>
</table>
### Table 2. Components of Protected Area Costs

<table>
<thead>
<tr>
<th>Component of Protected Area costs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Recurrent management costs</td>
<td>These costs include operations (e.g. staff salaries, training, fuel, maintenance, monitoring, evaluation), site-level administration, development projects, and recurrent compensation costs. Factors that influence these costs include management objectives, accessibility, and size (Bruner et al. 2004).</td>
</tr>
<tr>
<td>(ii) System-wide expenses</td>
<td>System-wide expenses include national and regional administration, new site selection, budgeting, securing financial allocations within the political system, and other activities necessary to support the network. Primary determinants of costs across national systems include countrywide cost levels (Wilkie et al. 2001; Bruner et al. 2004) and the size of the protected area network.</td>
</tr>
<tr>
<td>(iii) Costs of expansion of the PA system</td>
<td>These costs include expenditures associated with identification, designation and setting up of management processes for new sites.</td>
</tr>
<tr>
<td>Financing Mechanism</td>
<td>Characteristics</td>
</tr>
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<td>-------------------------------------</td>
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</tr>
<tr>
<td>Park Entry Fees</td>
<td>Fees paid at the entrance to PAs by visitors. Higher entry fees for foreigners than for local citizens and during peak visitation periods has led to dramatic increase in total revenues for PA management in certain countries. Higher park fees may not be viable for PAs that are less unique or do not have large numbers of easily observable wildlife; Visitor numbers are only likely to increase when revenues from entry fees are “earmarked” to support PAs and biodiversity conservation.</td>
</tr>
<tr>
<td>Fees and Taxes on Resource Extraction</td>
<td>Individuals and companies involved in the extraction of resources from PAs pay for mining leases, gas exploration leases, logging, etc. Some countries require that a percentage of the money paid to the government as timber royalties or logging concession fees must be allocated for the conservation of protected areas.</td>
</tr>
<tr>
<td>Watershed Protection Fees</td>
<td>Protected forests and watersheds play a critical role in ensuring a reliable supply of potable water. Hence water users and investors in water projects maybe expected to pay towards watershed protection. In Laos, the developers of the proposed $1.3 billion Nam Theun hydroelectric dam have agreed to pay $1 million per year for thirty years into a “watershed conservation fund” to protect the pristine forests and endangered wildlife on the steep mountain slopes above the dam.</td>
</tr>
<tr>
<td>Carbon Emissions Trading</td>
<td>The Kyoto Protocol obligates developed countries to reduce their carbon emissions by significant percentages to reduce global warming. Developed countries can achieve part of their required reductions in carbon emissions by paying developing countries to conserve (or plant) forests to increase the sequestration of carbon.</td>
</tr>
<tr>
<td>Property and Gasoline Taxes</td>
<td>Costa Rica imposes a “carbon tax” on gasoline and other fossil fuels to finance an environmental fund that makes payments to small landowners who are willing to sign contracts not to cut the trees on their land for a given time period.</td>
</tr>
</tbody>
</table>
Table 4. Measuring PA Effectiveness

<table>
<thead>
<tr>
<th>Park Design</th>
<th>Park Management</th>
<th>Park Integrity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adequacy of protected area system design</strong></td>
<td><strong>Management processes at a system level</strong></td>
<td><strong>Threats and pressures; ecological integrity</strong></td>
</tr>
<tr>
<td>Ecological representativeness</td>
<td>Assessing multiple management elements system wide (Singh 1999; Rao et al. 2002; Ervin 2003b)</td>
<td>Prevalence of threats within a single protected area system (Parks Canada 2000; Rao et al. 2002)</td>
</tr>
<tr>
<td>(Pressey et al. 1993; Powell et al. 2000; Scott et al. 2001; Jepson et al. 2002; Rodrigues et al. 2004b)</td>
<td><strong>Management processes at a site level</strong></td>
<td>Regional sampling of protected areas (Brandon et al. 1998; Carey et al. 2000).</td>
</tr>
<tr>
<td>Gap analysis of species coverage (Jennings 2000)</td>
<td>Assessing multiple management elements at the site level (Ervin 2003b; Lacerda et al. 2004).</td>
<td>Measuring and ranking of threats and pressures at the system level (Singh 1999; Ervin 2003b).</td>
</tr>
<tr>
<td>Human dimensions of gaps (Gorenflo and Brandon 2006)</td>
<td></td>
<td>Protected area integrity</td>
</tr>
<tr>
<td>Effectiveness of the current reserve network at protecting species at risk in Canada (DeGuise and Kerr 2005)</td>
<td></td>
<td>Intactness, measured in land use changes (Jepson et al. 2002; Bruner et al. 2002).</td>
</tr>
<tr>
<td><strong>Design criteria for assessing new reserve selection</strong></td>
<td></td>
<td>Measuring degrees and types of degradation from individual stressors (Farrell and Marion 2001)</td>
</tr>
<tr>
<td>Taxonomic richness, rarity, and abundance (Prendergast et al. 1999)</td>
<td></td>
<td>Landscape stability/habitat integrity/forest cover (Friedman and Zube 1992; Liu et al. 2001; Kinnaird et al. 2003; Bedunah and Schmidt 2004; Curran et al. 2004; DeFries et al. 2005)</td>
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<tr>
<td>Irreplaceability (Pressey et al. 1994)</td>
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<table>
<thead>
<tr>
<th>Reference</th>
<th>Scale/ Location</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rodrigues et al. 2004a</td>
<td>Global: Provides an assessment of coverage of species by global network of PAs</td>
<td>The global PA network is incomplete (out of 11,633 species analyzed, 12.2% are gap species not covered by any PA</td>
</tr>
<tr>
<td>Rodrigues et al., 2004b</td>
<td>Global: Provides a framework for the strategic expansion of network to cover mammals, amphibians, freshwater turtles and tortoises and globally threatened birds.</td>
<td>Identify unprotected areas of the world with high conservation value (irreplaceability) and under serious threat mostly in tropical and sub-tropical moist forests, particularly on tropical mountains and islands.</td>
</tr>
<tr>
<td>Brooks et al. 2004</td>
<td>Global: Summarizes PA coverage across each of the terrestrial biomes and biogeographic realms to identify bioregional gaps in the protected-area network</td>
<td>Most protected biomes: Temperate conifer forests (25%), flooded grasslands and savannas (18%), and tropical or subtropical moist broadleaf forests (18%). Least protected biomes: Temperate grasslands, savannas, and shrublands (5%), Mediterranean forests, woodland and scrub (6%) and tropical or subtropical conifer forest (6%). In relation to total area, habitat protection has been most substantial in the Neotropical (16%), Neoarctic (16%), and Afrotropical (15%) realms, but less so in the Indo-Malay (10%), Palearctic (9%), Australasian (8%) and</td>
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<tr>
<td>Reference</td>
<td>Region</td>
<td>Methodology</td>
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<tr>
<td>Andelman and Willig 2003</td>
<td>Western Hemisphere: Examine size and geographical distribution of PAs</td>
<td>Skewed geographical and size distributions of PAs. 811 of 1413 reserves in the Western Hemisphere are smaller than 10 km², and 35% of the total area of these reserves is in Alaska. 82% of threatened and small-range bat species are not protected adequately. Many of the most vulnerable species occur in the areas of highest human density.</td>
</tr>
<tr>
<td>Powell et al. 2000</td>
<td>Costa Rica: Compares existing protected areas in Costa Rica with Holdridge Life Zones to assess their coverage of biodiversity.</td>
<td>Only nine of the 23 life zones or transitional life zones were adequately represented (in PA &gt;10,000 ha.). These zones plus three with between 5000 and 10,000 ha protected, account for 98% of the total area protected in the country. The 11 remaining life zones contained only 2% of Costa Rica's protected area, hence significant portion of the country's biodiversity is at risk.</td>
</tr>
<tr>
<td>Scott et al. 2001</td>
<td>United States of America</td>
<td>Low-elevation biota associated with the more productive soils are not adequately protected, and many are very likely not even represented in existing large nature reserves; Current system of nature reserves does not adequately protect</td>
</tr>
<tr>
<td>DeGuise and Kerr 2005</td>
<td>Canada</td>
<td>Ineffective at protecting species at risk; Size issues and land use conflicts, established for Canada’s benefit, education and enjoyment and not to protect biodiversity</td>
</tr>
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<td></td>
<td>biodiversity and natural variation across the nation.</td>
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</tbody>
</table>
**Table 6. Ecological Integrity and Protected Areas**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Scale and Location</th>
<th>Main Findings on Park Integrity</th>
<th>Underlying Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newmark 1995</td>
<td>14 Western north American PAs</td>
<td>Local extinctions of mammal populations</td>
<td>Small size and isolation due to surrounding habitat modification</td>
</tr>
<tr>
<td>Parks and Harcourt 2002</td>
<td>13 National Parks in western U.S.A</td>
<td>Species extinctions driven by local human density</td>
<td>Reserve size correlated with local human density; small reserves suffer more intense edge effects than larger ones and maybe more isolated</td>
</tr>
<tr>
<td>Newmark 1996</td>
<td>6 PAs in Tanzania</td>
<td>Local extinctions of mammal populations</td>
<td>Insularization due to human settlement, agricultural development and active elimination of wildlife in adjacent lands.</td>
</tr>
<tr>
<td>Coggins 2000</td>
<td>3 PAs in subtropical forest, China</td>
<td>Loss of wildlife habitat to bamboo monocultures</td>
<td>Need for more equitable systems of land tenure, improved cooperative cottage industries, greater local economic diversification</td>
</tr>
<tr>
<td>Liu et al. 2001</td>
<td>Wolong Nature Reserve, China-flagship reserve established to protect giant panda</td>
<td>Fragmentation, habitat loss rates within the reserve equal to or exceeded those outside the reserve</td>
<td>Overuse by local people-agriculture, fuelwood collection, timber harvesting, road construction and maintenance, Chinese herbal medicine collection and tourism.</td>
</tr>
<tr>
<td>Curran et al. 2004</td>
<td>Protected lowland tropical forest, Indonesian Borneo</td>
<td>Loss of 56% over 6 year period (&gt; 29,000 sq.km); protected forests isolated, deforested and buffer zones degraded</td>
<td>Weak institutions, timber extraction and plantation establishment- need for monitoring, regional land use planning and enforcement</td>
</tr>
<tr>
<td>DeFries et al. 2005</td>
<td>198 of the most highly protected areas (IUCN status I and II) located throughout the</td>
<td>Loss of forest cover within 50-km periphery in moist and dry tropical forests; some loss of forest habitat within</td>
<td>Need to manage PAs within the land-use context of the larger regional setting</td>
</tr>
<tr>
<td>Study</td>
<td>Area Description</td>
<td>Issue</td>
<td>Management Need</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Kinnaird et al. 2003</td>
<td>Bukit Barisan Selatan National Park, Sumatra, Indonesia</td>
<td>Near-total loss of forest in the 10-km buffer adjacent to the park and a 28% reduction in forest cover inside the park boundary. Deforestation linked to potential loss of large mammals.</td>
<td>Conversion to agriculture and expansion of village enclaves. Need for improvement in management and increased participation of communities and NGOs in management decisions.</td>
</tr>
<tr>
<td>Kala 2003</td>
<td>7 protected areas in the Indian Himalayas</td>
<td>Overharvesting of medicinal plants</td>
<td>Illegal extraction for trade and subsistence; need for the establishment of medicinal plant conservation areas and sustainable harvesting (including the establishment of harvest limits).</td>
</tr>
<tr>
<td>Bedunah and Schmidt 2004</td>
<td>Gobi Gurvansaikhan National Park, Mongolia</td>
<td>Overgrazing, habitat loss and degradation</td>
<td>Significant increase in the number of herders, size of herds, problems with marketing of livestock and livestock products, declining stock movements due to transportation costs, loss of water sources</td>
</tr>
<tr>
<td>Inogwabini et al. 2005</td>
<td>DRC (Democratic Republic of Congo) PAs</td>
<td>Partial to no protection; reduction in populations of large mammals</td>
<td>Understaffing, insufficiently qualified personnel, inadequate long-term financial investment</td>
</tr>
<tr>
<td>Jepson et al. 2002</td>
<td>PA system of E. Kalimantan Province, Indonesia</td>
<td>Key reserves not established or degraded. Gaps in representation. Only 9 out of 23 reserves remain intact</td>
<td>Threats due to natural causes (ENSO-related droughts and fire events); Government and commercially-driven land conversion programs, activities of in-migrants; illegal and semi-legal business activities of corrupt government officials. Paper parks. Need to establish reserves in key ecosystems and for complete re-evaluation of PA system.</td>
</tr>
<tr>
<td>Authors</td>
<td>Area</td>
<td>Threats</td>
<td>Solutions</td>
</tr>
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<tr>
<td>Dearden and Dempsey 2004</td>
<td>PA system in Canada</td>
<td>Isolation, habitat fragmentation, development of mines, oil and gas activities, housing development, etc.</td>
<td>Small park size; Need for changes in park policy, legislation and management</td>
</tr>
<tr>
<td>Tsering 2003</td>
<td>4 Pas in Bhutan</td>
<td>Major threats are poaching, grazing, road construction and collection of NTFPs</td>
<td>Strengthening anti-poaching and law enforcement measures, research (inventory), gaining local support through creating opportunities and benefits, financial management practices, availability of equipment and facilities, strengthening the Nature Conservation Division</td>
</tr>
<tr>
<td>Jim and Xu 2004</td>
<td>China PA system</td>
<td>Problems in designation process due to omission of key biota and ecosystems escalating people-park conflicts and paper parks</td>
<td>Deficiencies in designation procedures; small PA size, degraded Pas, not located in areas of conservation significance.</td>
</tr>
</tbody>
</table>
**TABLE 7. MONITORING AND PAs**

<table>
<thead>
<tr>
<th>Focus of Monitoring</th>
<th>Aspects covered</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management effectiveness and threats</td>
<td>Consists of a score-based system that looks at legal status, protected area regulations, law enforcement, PA objectives, design, boundary demarcation, management plan etc.</td>
<td>Stolton et al. 2003</td>
</tr>
<tr>
<td>RAPPAM methodology</td>
<td>To help identify management strengths and weaknesses and analyzes the scope, severity, prevalence, and distribution of various threats and pressures.</td>
<td>Ervin 2003b</td>
</tr>
<tr>
<td>Threat Reduction Assessment</td>
<td>Monitors threats as a proxy measurement of conservation success. Assessment of the progress in reducing threats provides a framework for measuring conservation success. Threats are ranked on the basis of three criteria: area, intensity, and urgency.</td>
<td>Salafsky and Margoluis 1999</td>
</tr>
</tbody>
</table>

**Ecological Integrity**

Monitoring trends in biodiversity and biodiversity use

<table>
<thead>
<tr>
<th>Mammal populations in Costa Rican PAs under different hunting restrictions</th>
<th>Carillo et al. 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important Bird Areas in Africa- focusing on threats to and status of IBAs and effectiveness of conservation efforts</td>
<td>Bennun et al. 2005</td>
</tr>
<tr>
<td>Wildlife species in Ghana's Reserves</td>
<td>Brashares and Sam, 2005</td>
</tr>
<tr>
<td>Trends in biodiversity and biodiversity use (with local participation) in the</td>
<td>Danielsen et al. 2000, 2005ab</td>
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<td>Philippines</td>
<td>Dustin Becker et al. 2005</td>
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<tr>
<td>Fog capture and bird communities in Ecuador</td>
<td>Gray and Kalpers 2005</td>
</tr>
<tr>
<td>Ranger based monitoring of key species of flora and fauna, illegal activities, threats, habitat integrity, etc. in the Virunga-Bwindi region of East-Central Africa.</td>
<td>Andrianandrasana et al. 2005</td>
</tr>
<tr>
<td>Participatory monitoring of key species and natural resources in wetlands in Madagascar.</td>
<td>Topp-Jorgensen et al. 2005</td>
</tr>
<tr>
<td>Community-based monitoring of natural resource use and forest quality in montane forests and miombo woodlands of Tanzania</td>
<td></td>
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<tr>
<td>Marine protected areas in the Mediterranean Sea</td>
<td>Fraschetti et al. 2005</td>
</tr>
<tr>
<td>Sustainability of palm leaf extraction in Kwazulu-Natal, South Africa</td>
<td>McKean 2003</td>
</tr>
<tr>
<td>Resource and wildlife abundance, resource use, wildlife damage to crops, and land use in Yunnan, China</td>
<td>Van Rijsoort and Jinfeng 2005</td>
</tr>
<tr>
<td>Hunter self-monitoring, offtakes of subsistence game species</td>
<td>Noss et al. 2005</td>
</tr>
<tr>
<td>Wildlife, natural resource use and threats in Xe Pian National Protected Area, Laos</td>
<td>Poulsen and Luanglath 2005</td>
</tr>
<tr>
<td><strong>Land Cover change within PAs</strong></td>
<td></td>
</tr>
<tr>
<td>Forest monitoring in Madagascar PAs</td>
<td>Corbley et al. 1999</td>
</tr>
<tr>
<td>Vegetation change detection in protected forests, landscape fragmentation, India</td>
<td>Nagendra 2001</td>
</tr>
<tr>
<td>Species abundance in PAs</td>
<td></td>
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<tr>
<td>Neotropical butterflies</td>
<td>Sparrow et al. 1994</td>
</tr>
<tr>
<td>Harbour Seals, Scotland</td>
<td>Thomson et al. 2001</td>
</tr>
<tr>
<td>Freshwater turtles, Ecuador</td>
<td>Townsend et al. 2005</td>
</tr>
<tr>
<td>Forest Elephants, Central Africa</td>
<td>Walsh et al. 2001</td>
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<tr>
<td>Tigers, India</td>
<td>Karanth et al. 2004; Karanth and Nichols 2002</td>
</tr>
</tbody>
</table>
FIGURE 1. GROWTH OF THE PA SYSTEM
(Source: Chape et al. 2003)
GLOSSARY

1 **Biodiversity**: the variety of life on Earth at all its levels, from genes to ecosystems, and the ecological and evolutionary processes that sustain it.

2 **Conservation Easements**: in the United States, a conservation easement is an easement—a transfer of usage rights—which creates a legally enforceable land preservation agreement between a landowner and a municipality or a qualified land protection organization (often called a "land trust"), for the purposes of conservation. It restricts real estate development, commercial and industrial uses, and certain other activities on a property to a mutually agreed upon level.

3 **Land Trust**: local, regional, or statewide nonprofit conservation organizations directly involved in helping protect natural, scenic, recreational, agricultural, historic, or cultural property. Land trusts work to preserve open land that is important to the communities and regions where they operate.

4 **Chiquitanos**: the word chiquito means 'small' in Spanish and is used to designate various indigenous groups that inhabit the regions along the border between Brazil and Bolivia.

5 **Tenurial**: holding something such as real estate in one’s possession.

6 **Economies of scale**: an increase in scale causes a decrease in cost.

7 **Adaptive Management**: a way of thinking about and implementing natural resource management that recognizes that any management we impose on the system can be viewed as an experiment that we can learn from (NCEP module on Adaptive Management in Conservation Biology). The uncertain and experimental nature of natural resource decision-making makes adaptive management a critical tool for effective management of PAs.

8 **Millennium Ecosystem Assessment**: a four-year international work program launched in 2001, that was designed to meet the needs of decision-makers for scientific information on the links between ecosystem change and human well being.

9 **Paper parks**: These are parks that exist in written documentation but in reality (on the ground) are degraded and/or suffer from insufficient/ineffective management due to a number of factors that could include lack of sufficient financial resources.

10 **Program of Work**: the overall purpose of the Program of Work on protected areas is “to support the establishment and maintenance by 2010 for terrestrial and by 2012 for marine areas of comprehensive, effectively managed, and ecologically representative national and regional systems of protected areas that collectively, inter alia through a global network contribute to achieving the three objectives of the Convention and the 2010 target to significantly reduce the current rate of biodiversity loss at the global,
regional, national and sub-national levels and contribute to poverty reduction and the pursuit of sustainable development, thereby supporting the objectives of the Strategic Plan of the Convention, the World Summit on Sustainable Development Plan of Implementation and the Millennium Development Goals”

11 **2010 Global Biodiversity Target**: recognizing that biodiversity is currently being lost at unprecedented rates due to human activities, the Conference of the Parties to the Convention on Biological Diversity adopted a Strategic Plan (decision VI/26). In its mission statement, Parties committed themselves to a more effective and coherent implementation of the three objectives of the Convention, to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth.