CHAPTER 10
PROTECTED AREAS

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10.1 INTRODUCTION

This chapter assesses the evidence on the contribution of Protected Areas (PAs) to the wider economy and contrasts this against the current status of financing for PAs in Latin America and Caribbean.

PAs have crosscutting effects. They contribute to the economies of LAC countries through each of the other sectors reviewed in this book: agriculture, fisheries, forestry, tourism, and hydrological services. This chapter relates the varied functions of PAs and of the ecosystem services (ES) they support to productive processes in each of those sectors. The chapter also compares the effects of contrasting management regimes — from not managed to minimally- and well-managed — on the crosscutting contributions of PAs.

The chapter illustrates how PAs contribute to sustain ES and examines the potential decline in productivity due to the degradation of ecosystems as a consequence of under-investment in PAs. To this end, three scenarios are considered: a "not protected" scenario, in which habitats are not safeguarded and, thus, likely to be degraded; a "business as usual" (BAU) scenario, where basic PA protection is available but can mitigate only low level threats; and a "sustainable ecosystems management" (SEM) scenario, with sufficient funding to support comprehensive, cost-effective PA system management plans. In the SEM case, threats are fully managed (mitigated), and new business opportunities may be created in areas like eco-certification, sustainable sourcing, and novel ES.

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Growing evidence indicates that the economic benefits of well-managed PAs are multiple: increased production (GDP) in selected sectors, more jobs in rural areas, higher tax revenues, and higher foreign exchange earnings, especially though international tourism. Additional sectors can be affected as a result of economic ripple or multiplier effects.

KEY FINDINGS

Despite gaps in the data, the existing evidence is compelling on the economic value of the ES provided by PAs. Overall, PAs raise productivity in agriculture, fisheries, forestry, hydropower, and nature-based tourism, among other sectors.

Both terrestrial and marine PAs provide restricted-take zones where biodiversity can re-build, and species heavily fished or hunted can recuperate and re-stock neighboring areas.

Further sector-based research is needed to quantify the economic benefits derived from PAs, like jobs, income, local and national tax revenues, and their role as drivers of foreign exchange earnings and investment — and on how these benefits are distributed.

BAU and SEM practices are not diametrically opposed but, rather, stages in the evolution of PA management. BAU approaches create the initial conditions upon which SEM later builds.

The transition from BAU to SEM is often feasible and cost effective, based on the hidden costs of BAU and the broader benefits of SEM.

Nonetheless, barriers to the transition from BAU to SEM can be significant, especially given the need to increase resources through national funding or self-financing mechanisms, as well as to the play of interests around the tighter regulation of natural resource exploitation under SEM.

The benefits of PAs are not equally distributed. Stakeholder involvement, empowerment of local actors, and transparency are keys to success in SEM, especially in transitioning toward this approach.

PAs under SEM can contribute to equity and poverty alleviation; women, rural communities, and indigenous peoples have been provided opportunities and have used them to build self-sufficiency.

PAs drive foreign exchange earnings and local employment, especially via tourism. Nature-based tourism in PAs has brought jobs, local development, and a modicum of prosperity to many remote sites, while contributing to GDP, tax revenues, and foreign exchange earnings.

Growing biodiversity and ecosystems markets will open significant opportunities to PA-related business. For instance, SEM can secure savings in hydropower dam operations (avoided replacement costs).

Agriculture, fisheries, and forestry benefit from PAs, even while responsible for considerable biodiversity loss, ecosystem degradation, and PA encroachment.

Forested PAs provide opportunities to generate income from concessions, fees and taxes, and payment of environmental services (PES).

High quality water resources from PAs for use in irrigation, hydropower, and consumption are critical to human well being.

Marine protected areas contribute both to fisheries growth and to biodiversity conservation.

10.2 CONTEXT OF PROTECTED AREAS

Protected Areas

The World Conservation Union (IUCN) defines a protected area as: "An area of land and/or sea especially dedicated to the protection of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means" (IUCN 1994). IUCN determines six different management categories (Box 10.1). The 1992 Convention on Biological Diversity (CBD) describes a protected area (PA) as a geographically defined area that is designated or regulated and managed to achieve conservation objectives. Although useful, these definitions do not express the economic and social roles of PAs. They reinforce the common understanding that PAs are mostly a refuge for species unable to survive in intensely-managed terrestrial and marine landscapes.

The Millennium Ecosystem Assessment (MEA) (2005) emphasizes that PAs provide critical ES that support human prosperity and survival, like clean water, flood and storm mitigation, fish stock replenishment, and carbon sequestration. In this context, it is critical that countries establish PA systems to protect viable populations of diverse species and representative ecosystem samples. The system-level approach aims at broadening PAs from a set of scattered sites that protect few species to a system that provides viable support to biodiversity and ecosystems at the national level.

PAs do not require exclusion of human settlements nor of sustainable use of natural resources. Cases in point are Brazil's "indigenous reserves" and "extractive reserves."

According to the 2009 Millennium Development Goals Report, only 12% of the planet was under some form of protection. That amounts to about 18 million km2 of protected lands and 3 million km2 of protected territorial waters (marine areas under national jurisdiction). Since those waters represent only a small part of the oceans, this means that less than 1% of the world's oceans are protected.

The LAC region hosts a particularly large number of PAs (Table 10.1). Brazil alone has 1280 (excluding indigenous lands), while South America (excluding Brazil) currently has 1507 terrestrial PAs covering 22% of its land surface and 114 marine reserves. In Central America, terrestrial PAs cover more than a quarter of the land area, with Costa Rica, Guatemala, and Panama accounting for particularly

Box 10.1. IUCN Protected Area Management Categories

CATEGORY Ia. Strict Nature Reserve: protected area managed mainly for science.

CATEGORY Ib. Wilderness Area: protected area managed mainly for wilderness protection.

CATEGORY II. National Park: protected area managed mainly for ecosystem protection and recreation.

CATEGORY III. Natural Monument: protected area managed mainly for conservation of specific natural features.

CATEGORY IV. Habitat/Species Management Area: protected area managed mainly for conservation through management intervention.

CATEGORY V. Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation.

CATEGORY VI. Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems.

See detailed definitions in Annex 10.3.

Table 10.1. Some statistics on protected areas in the LAC region

Region	Total sites	Total protected area	Total protected land area (Km2)	Total marine sites	Total protected marine area	Total land area (Km2)	% land area under protection
Caribbean	973	80,770	36,469	370	44,301	234,840	15.5%
Central America	677	151,058	133,731	103	17,327	521,600	25.6%
South America (except Brazil)	1507	2,217,725	2,056,559	114	161,166	9,306,560	22.1%
Brazil	1280	1,321,751	1,305,864	88	15,887	8,547,400	15.3%

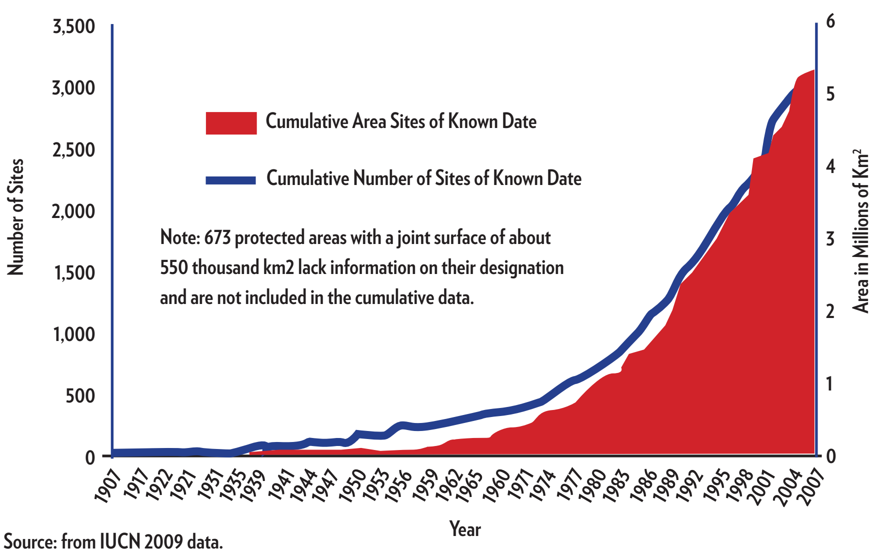
Source: Chape et al. 2005

large shares of protected land (Harvey et al. 2004). The Caribbean has 973 protected sites, of which many are marine.

Globally, as well as in LAC, the number of PAs has rapidly increased. The number of PAs listed by the UN has risen tenfold in the past four decades. Similarly, in the last five decades, PAs in LAC have grown from under 100,000 km2 in fewer than 100 PAs to over 5M km2 in 4,400 PAs (Figure 10.1).

PAs shelter a large variety of organisms and ecosystems. Ecosystems provide fundamental life-support services upon which humans depend. PAs provide continuous natural habitats that enable ecosystems to function and continue to deliver those ES, though ES are not exclusively provided by ecosystems within PAs. Carbon sequestration, hydrological cycling, and erosion control are examples of ES provided outside of PAs. Table 10.2 lists some types of ES delivered by PAs.

Figure 10.1. Trends in growth in number and coverage of LAC protected areas



Source: from IUCN 2009 data.

Threats to Protected Areas

PAs face a situation of disequilibrium characterized by external pressures related to both encroachment and degradation (Alers et al. 2008). Although threats vary between sites, direct threats to PAs can be classified in two major categories: (1) habitat loss and degradation due to conversion to agriculture, and (2) unsustainable exploitation of natural resources, including logging, collection of non-timber forest products (NTFP), extraction of minerals and oil, overuse, and poorly managed tourism. In addition, there are indirect threats such as those from climate change.

Despite the growing area under protection, the current PA network is widely believed to be insufficient to curb biodiversity loss and ecosystem degradation in the region. This situation is aggravated by the existing gaps in representation (critical areas for biodiversity that are not protected), poor management capacity, lack of appropriate legal and regulatory frameworks, limited understanding of the economic impact of loss of ES, and a history of underfunding, resulting in under-staffed and poorly-equipped PA agencies.

Despite the region's many PAs, most ecoregions are considered to be threatened. For example, the 26 ecoregions of Central America are threatened by agriculture-related threats including sedimentation, extraction of firewood, hydrological changes, pesticide use, agrochemical run-off, fire, soil erosion, squatting and land invasion, hunting, and road building (Harvey et al. 2004). This is also the rule In the rest of LAC, such as in the Andean Amazon or Brazil's Atlantic forest.

Large PAs in LAC often coexist with indigenous or rural communities that depend on natural resources, creating additional challenges. However, there is evidence of effective conservation in indigenous territories. This is discussed in Section 10.4.

Table 10.2. Main ecosystems services delivered by PAs

Ecosystem Services	PA Categories					
	I	II	III	IV	V	VI
Freshwater (watershed services)	•	•		•	•	•
Food (wild fruits, greens, meats, seafood)		•		•	•	•
Timber, fuel (fire wood), and fiber		•				•
Novel products	•	•		•	•	•
Biodiversity maintenance (habitat for wild species)	•	•	•	•	•	•
Nutrient cycling	•	•	•	•	•	•
Air quality and carbon sequestration	•	•	•	•	•	•
Human health	•	•		•	•	•
Detoxification	•	•	•	•	•	•
Natural hazard regulation	•	•	•	•	•	•
Development / reinforcement of cultural values		•	•	•	•	•
Diving, sport fishing, hiking, nature/ wildlife viewing		•		•	•	•

In addition to the above-mentioned known threats, there are other management-related aspects that increase the vulnerability of PAs to threats, for instance, gaps in coverage, fragmentation, and weak management capacity. More important to this chapter, however, are the finance-related threats.

INSUFFICIENT FUNDING TO COVER THE COSTS OF PA MANAGEMENT

The lack of diversified funding to PAs has become a major threat to ecosystems in PAs and undermines PA benefits. Without the necessary funding to PAs, it is unlikely that national conservation strategies and benefits will become long-term operational realities. Examples of finance-related critical issues follow.

Financial gaps: PAs do not generally receive adequate funding to protect biodiversity and ecosystems. UNDP assessed the financial sustainability of national PA systems during 2008-2009, applying the UNDP Financial Sustainability Scorecard in 18 LAC countries (see Box 10.2). Existing funding, financial needs (costs), and financial gaps (i.e., the difference) were estimated for basic and optimal conservation scenarios.[44] The assessment estimated the regional financial gap for basic conservation at $317 million/year. The largest gaps corresponded to Brazil, with $169 million and Mexico, with $40 million. Together, Brazil and Mexico account for over 60% of the basic financial gap in the region. The PA systems in LAC have, on average, 54% of their basic financial needs covered. The gap is much wider for the optimal management scenario or what is also known as the sustainable ecosystem management (SEM) approach. This regional financial gap is estimated at $700 million/year. In the optimal scenario, the largest gaps also correspond to Brazil and Mexico, again with approximately 60% of the financial gap. On average, the region's available funding covers 34% of the financial needs for optimal management scenario. However, Mexico, El Salvador, Argentina, Bolivia, and Costa Rica have more than 50% of their needs for the optimal scenario. Table 10.3 shows these results for 18 LAC countries.

Box 10.2.

The Financial Sustainability Scorecard for National PA Systems was developed by UNDP in 2007 to assist governments, donors, and NGOs to assess significant aspects of a PA financing system – its accounts and its underlying structure – to show both its current status and to indicate if the system is moving toward an improved financial situation. The Scorecard could also be used by sub-national units or networks. It has three parts:

- Part I – Overall financial status of the PA system, including basic PA data and a financial analysis of the national PA system;
- Part II – Assessing the finance system;
- Part III – Scoring.

Funding needed to expand PA systems: The establishment of new PAs will increase the financial gap even at current low levels of support. Preliminary estimates suggest that over 19 million ha of new PAs will be needed to in order to improve ecosystem coverage in seven countries: Brazil, Bolivia, Chile, Colombia, Ecuador, Peru, and Venezuela (TNC 2007). At the average Business as Usual (BAU) investment of $1.18/ha-year, this would widen the overall basic scenario financial gap by another $22 million yearly.

Low and poorly diversified PA income: Historically, the majority of PAs in the LAC region have been highly dependent on dramatically low government investment and insufficient funding from

[44] The basic scenario describes the minimum level of funding and management capacity required to operate key conservation programs that will sustain essential ecosystem functions in PAs. The optimal scenario corresponds to the level of funding and capacity needed to achieve fully satisfactory operation and coverage of all PA programs: to reach and sustain optimal functioning of the ecosystems and their services. The optimal scenario describes an ideal state of the programs if all needed funding, personnel, equipment, and other resources were available to attain the short-, medium-, and long-term goals for the PAs, in accordance with the highest environmental, social, and economic standards (Flores et al. 2008).

TABLE 10.3. PA SYSTEM MANAGEMENT COSTS AND FINANCIAL GAPS IN 18 COUNTRIES

PA MANAGEMENT COSTS AND FINANCIAL GAPS IN SELECTED LAC COUNTRIES ($)					
COUNTRY	BAU (CURRENT FUNDING)	FINANCIAL NEEDS (COSTS)		FINANCIAL GAPS	
		BASIC SCENARIO	OPTIMAL	BA SIC SCENARIO	OPTIMAL
ARGENTINA	31,309,584	39,512,820	60,366,666	8,203,236	29,057,082
BOLIVIA	5,102,653	5,374,940	9,000,000	272,287	3,897,347
BRAZIL	133,415,026	302,573,314	471,731,602	169,158,288	338.316.576
CHILE	9,194,339	17,974,193	26,754,046	8,779,854	17,559,707
COLOMBIA	18,026,595	25,150,153	42,755,260	7,123,558	24,728,665
COSTA RICA	29,645,948	31,934,374	44,000,000	2,288,426	14,354,052
CUBA	14,587,030	21,639,821	36,787,695	7,052,791	22,200,665
DOMINICAN REPUBLIC	10,380,071	22,574,294	27,974,294	12,194,223	17,594,223
ECUADOR	3,977,600	6,730,054	14,040,147	2,752,454	10,062,547
EL SALVADOR	3,803,223	4,445,738	7,557,755	642,515	3,754,532
GUATEMALA	8,339,504	16,118,443	27,401,353	7,778,939	19,061,849
HONDURAS	4,122,552	6,618,629	11,251,670	2,496,077	7,129,118
MEXICO	80,214,239	120.321,358	160,428,478	40,107,119	80,214,239
NICARAGUA	5,314,245	19,546,456	43,321,382	14,232,211	38,007,137
PANAMA	9,506,948	19,880,360	33,796,612	10,373,412	24,289,664
PARAGUAY	1,240,665	9,700,000	19,500,000	8,459,335	18,259,335
PERU	13,067,100	25,172,664	41,842,414	12.105.564	28,775,314
URUGUAY	816,000	3,409,002	4,355,947	2,593,002	3,539,947
TOTAL	382,063,32	698,676,61	1,082,865,32	316,613,291.0	700,801,99

*Federal level PAS only.
Source: UNDP 2010.

trust funds and international projects; and extremely low private sector participation at national levels. For example, based on the Scorecard Assessment, public expenditure on PAs in 19 countries (including Venezuela) account for 0.0059% of GDP (see Table 10.4). Public spending on the broader category of environment amounts to less than 1% of GDP on average in the region (Barcena et al. 2002). The level of investment in PAs by 19 LAC countries averages $1.18/ha/year (range: $0.00 to $7.95/ha, in Table 10.4). By comparison, European and North American nations spend, on average, 0.08% of their national budgets on PAs, about $28/ha/year (Wilkie et al. 2001).

Lack of skills and political commitment to improve PA financing: There are several types of financial mechanisms that can be harnessed to raise funds for PAs, but which are rarely used due to limited know-how and lack of political will. When employed, they are all too often used as stand-alone stratagems, disconnected from priority investment needs. Still, progress has been made toward rationalizing design of solutions, defining specific financial needs, and tailoring strategies to fill the gaps and address institutional capacity issues (Analysis of Financial Needs of SINANPE, Peru 2005; Financial Strategy for the SINAC, Costa Rica, 2007; Analysis of Financial Needs of the SNAP, Ecuador, 2006; Pillars for the Financial Sustainability of the SNUC, Brazil, 2007; and Financial Strategy of the National Parks of Colombia, 2002). Cases in point are Mexico, Peru, and Colombia where sizeable increases in central government allocations to PAs have been won in recent years.

Further, there has been extremely low public and private sector commitment to introduce environmental fiscal reform (EFR)45 to support SEM approaches in PAs; and, therefore, explains in part the almost absent private sector funding to PAs.

45 Environmental fiscal reform (EFR) refers to a range of taxation or pricing instruments to raise revenue while furthering environmental goals. This is done by providing economic incentives to correct market failures in the management of natural resources and pollution. Broadly speaking, EFR can (1) mobilize revenue for governments, (2) improve environmental management practices and conserve resources, and (3) reduce poverty. By encouraging more sustainable use of natural resources and reducing pollution from energy use and industrial activities, EFR addresses environmental problems that threaten the livelihoods and health of the poor. Revenues raised can also be used to finance poverty reduction measures (World Bank 2005).

Table 10.4. PA Budgets, Investments per Hectare and Budget as Percentage of GDP.

Country	Government PA Budget	Budget/ HA*	Budget as % of GDP
Argentina	16,610,320	4.54	0.0049%
Bolivia	73,041	0.00	0.0004%
Brazil	104,691,806	1.39	0.0063%
Chile	5,705,515	0.37	0.0031%
Colombia	12,600,584	1.09	0.0050%
Costa Rica	14,302,091	7.95	0.0545%
Cuba	2,259,551	2.07	0.0050%
Dominican Republic	7,103,393	5.77	0.0195%
Ecuador	1,160,000	0.24	0.0021%
El Salvador	395,404	4.09	0.0019%
Guatemala**	4,353,715	1.89	0.0129%
Honduras	677,057	0.55	0.0055%
México	49,046,698	2.12	0.0055%
Nicaragua	576,337	0.26	0.0101%
Panamá	1,132,000	0.40	0.0057%
Paraguay	257,466	0.04	0.0016%
Peru	1,810,016	0.10	0.0014%
Uruguay	606,000	3.20	0.0019%
Venezuela	20,628,837	1.01	0.0062%
Total for LAC Region	243,989,830	1.18	0.0059%

* Government budget divided by number of hectares in PAs.

** Data of CONAP only. Excludes other government institutions managing PAs

Source: UNDP 2010.

However, studies on the economic valuation of PAs and of related ES are now emerging. Such studies will help mobilize political will to improve PA funding (including EFR) and performance. For example, in Colombia a study in 2007 noted that the Water and Aqueduct Company of Bogota (EAAB) is spending $4.5 million yearly to remove sediments, but that if the company invests in watershed protection, it will save millions. The data on the value of ES was key to winning financial support to protect the upper watershed of the Chingaza National Natural Park.

Lack of cost-efficiency: PA cost-efficiency is a critical element to achieve financial sustainability. It is essential that agencies managing PA systems address current issues related to outdated financial management systems, introduce result-oriented conservation programs linked to realistic costs, establish diversified sources of domestic revenue, and strengthen both transparency and accountability. To date, little is known about how much money PAs lose because inefficient use of financial resources.

10.3 BAU and SEM in Protected Areas

To help structure the analysis of the contribution of PAs to economic growth, this chapter distinguishes between two PA management approaches: Business as Usual (BAU) and Sustainable Ecosystem Management (SEM). These approaches are discussed next. In addition, to further distinguish benefits from PAs, this chapter also refers to a "no PAs" situation. In the "no PAs" scenario, when threats are present, the habitats are not protected, and, therefore, likely to be degraded, converted, and fragmented until only small patches of poor quality habitat and ecosystem function remain. The no-PAs scenario excludes other types of protection, such as indigenous territories and forest concession. For the purpose of this report, the "no PAs" is considered a BAU approach.

SEM complements the commonly used "protected area management effectiveness[46] (PAME)" approach. PAME is used to assess how well a PA is managed —primarily the extent to which it is protecting values, and achieving goals and objectives (Hockings et al. 2006). SEM brings an additional dimension of "ecosystems management," which is useful to better understand the economic costs of ES loss in PAs; SEM thinking can build economic arguments to promote increased funding to protect biodiversity and ecosystems in PAs.

Defining BAU and SEM

Figure 10.2 is helpful for illustrating the difference between the BAU and SEM approaches. When PAs are underfunded and facing severe threats, they are unlikely to provide basic protection to biodiversity and ecosystems functions — in this case, PA management is considered to be the BAU approach. PAs in BAU have limited funding and lack management capacity; most PAs are currently considered to be in this situation. On the other hand, when funding and capacity are available to meet basic to optimal protection needs, PA management is considered a SEM approach. The shift from BAU to SEM takes place as funding and management capacity (to address threats) increases.

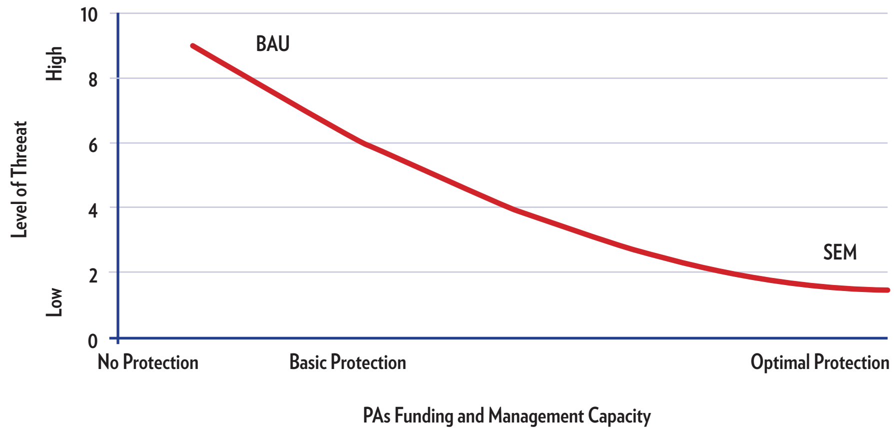
It is assumed that PAs are a "means" to control, or manage, threats, but not to eliminate them. For example, PAs in Ecuador such as Sumaco-Napo Galeras, Yasuní and Cuyabeno, are helping reduce the impact of the increasing threat level generated by oil exploration

46 IUCN-WCPA has developed a management effectiveness evaluation framework that provides a consistent basis for designing PA evaluation systems. The evaluation of management effectiveness is generally achieved by the assessment of series of criteria (represented by carefully selected indicators) against agreed objectives or standards. The term management effectiveness reflects three main themes: (a) design issues relating to individual sites and PA systems, (b) adequacy and appropriateness of management systems and processes, and (c) delivery of PA objectives (http://www.cbd.int/protected/PAME.shtml).

and extraction in the Amazon (e.g., deforestation, contamination, illegal logging, hunting, road construction). Threats are not necessarily eliminated by the PAs; threat elimination may require policy reform, law enforcement, and public and private sector action outside the PA. SEM leads to minimizing the impact of threats but not necessarily to their elimination (see Figure 10.2).

Moreover, in the "no PAs" scenario, if PAs are eliminated or new PAs are not created in areas of high biodiversity that are not yet protected, this lack of action will result in environmental damage, caused by the immediate escalation of the impact of threats. Thus, the BAU and SEM scenarios are also likened to low and optimal levels of ecological representativity.

Figure 10.2. BAU and SEM as a function of funding and capacity levels (for threat management)



Differences in the BAU and SEM management approaches

Although this simple Threat Impact vs. Funding & Capacity approach is convenient[47], it does not explain all the characteristics of BAU and SEM; BAU and SEM approaches also differ with respect to other aspects of PA management, as shown in Table 10.4.

In BAU, for example, planning and management functions are typically supported by limited human, financial, institutional, and informational resources (Lockwood et al. 2006). Too often, PA conservation goals and objectives are poorly linked to conservation programs and costs, and existing budgets are not linked to programmatic priorities. All together, this makes it difficult to measure effectiveness, estimate realistic needs, and determine financial gaps.

Further, at national levels in the BAU scenario, domestic funding for PAs is often stagnant as a result of constrained national budgets, obsolete legal and regulatory frameworks, lack of transparency, poor accountability[48], as well as a lack of political will to support "greening" of national development plans. Besides, protected area budgets may simply be based on previous-year expenses, while transfers to PA system agencies are often late and less than what was actually approved; and due to limited implementation capacity, protected area agencies often fail to execute their allocated resources. It is also undetermined how much money PAs are losing as a result of the inefficient use of financial resources (both related to international and domestic funding).

SEM is understood as an advanced management approach in which protected area management functions are more aligned with human, financial, institutional, and informational resources. In SEM, protected area's conservation goals and objectives are linked to ecosystems conservation programs and realistically linked to funding; and, resource allocation is based on defined ecosystem-based priorities. As a result, the health of both the contained biodiversity and ecosystems improves and their benefits, in terms of increased productivity and equity, expand. By and large, the benefits of SEM outweigh its costs. Additional characteristics of BAU and SEM are included in Table 10.5. It is important to recognize that in many cases, PA management programs include both characteristics of BAU and SEM, or their approaches could be in-between the BAU to SEM axis.

There has been significant movement toward more cost-efficient PA management (SEM) in recent years. Examples include Costa Rica, Mexico, Colombia, Peru, and several states in Brazil, where national and sub-national governments are actively promoting result-oriented, cost-effective PA management and have significantly improved PA financial planning and funding. For instance, between 1995 and 2008, Mexico implemented an impressive increase in funding, which accelerated the transition of PAs from BAU to SEM. The budget allocated to PAs rose from 11 million pesos (SEMARNAP-INE 2000) in 1995 to 143 million (INE-SEMARNAP 2006) in 2000, then 984 million pesos in 2008[49] (about $66 million). Another key feature in Mexico was institution of the Regional Sustainable Development Program by CONANP (National Commission for Natural PAs), which supports community development in and around PAs. The funding allocated to this in 2008 was about $19 million[50]). This record growth in funding significantly reduced the existing financial gap of the PA system in Mexico from $35million to $15 million (UNDP 2009).

47 Threat Impact vs. Funding & Capacity analysis is useful to map PAs to determine capacity building and funding priorities.

48 According to the Worldwide Governance Indicators (WGI), all countries in Latin America, with the exception of Chile, have a low rank in all six governance indicators. Ecuador, Paraguay, and Venezuela have the lowest rating in Latin America.

49 Com. Pers. Rene Macias – CONANP 08/2008. This figure does not include the investment made by CONANP on Priority Regions for Conservation and Priority Species. All budgetary figures refer to the modified budget.

50 Exchange rate from February 2010.

TABLE 10.5. DIFFERENCES IN MANAGEMENT APPROACHES OF BAU AND SEM

BAU	SEM (OPTIMAL SITUATION)
Economic activities continue to threaten PAs, encroachment by agriculture, illegal timber harvesting, tourism development etc.	Threats are minimized
Incomplete ecological representativity.	Full ecological representativity.
Lack of inter sector collaboration, substantial institutional fragmentation (poor interaction of environmental agencies with agencies outside the environmental sector).	Strong inter-sector collaboration, delegation of responsibilities and shared leadership.
Insufficient financial management capacity and absence of diversified long-term financial mechanisms.	Sound PA financial planning and diversified long-term PA funding mechanisms are an integrated part of natn'l developm't agenda.
Institutions managing PA are isolated from national development policies.	Institutions managing PAs are aligned with national development policies.
Poor PA management capacity.	Strong PA management capacity.
Absent legal and regulatory framework for PA financing.	Coherent legal and regulatory framework for PA financing.
Poor compliance and no enforcement.	Strong compliance and enforcement.
Absence of transparency and accountability standards.	Standards and transparency and accountability are enforced.
Limited participation of local communities in PA management and planning and PA's benefits sharing.	Strong PA's benefits sharing amongst the civil society, including vulnerable groups.
Funding to support PA management is below basic needs or at basic level needs.	Funding to support PA management meets medium to optimal needs.
Finance and economic information is absent from the decision-making process.	Informed decision-making based on sound financial and economic information.

The current contribution of PAs to the economy in Mexico is over $3.5 billion/year. According to Bezaury and Pabon (2009), every peso invested in PAs generates 52 pesos in the economy.

A key issue is the need to shift the regional focus to threats to ecosystems, rather than simply threats to PAs. Currently, there is no coordination mechanism to facilitate introduction of a new ecosystem-based management policy. This evident institutional gap was acknowledged by the G8/G20 Summit in Canada in June 2010, in which governments called for, in the Joint Statement, creation of an Intergovernmental Platform on Biodiversity and Ecosystem Services (The G8/G20 Summit 2010).

10.4 IMPORTANCE OF PROTECTED AREAS TO GROWTH: BENEFITS AND COSTS UNDER BAU AND SEM

PAs provide a variety of ES that result in greater productivity or other use values in a number of sectors in BAU scenarios and even more so under SEM. Examples of key services include biodiversity protection and ecosystem health (self-sustaining or homeostatic biosphere systems); water supply and quality; maintenance of valuable wild species providing foodstuffs, medicinals, pollinators, pest control, and many other benefits; attractions for tourism; climate change mitigation and adaptation; and preservation of cultural resources. Benefits from resource-depleting interventions under BAU tend to be concentrated, immediate, and market-driven, like logging, NTFP-gathering, cattle ranching, and farming. PA benefits under SEM are more broadly distributed, long-term, and often non-market (though some are market-driven such as tourism, water supply, and carbon sequestration).

The provision of PA benefits, however, is not free; there are significant costs associated with PA management, both in terms of direct expenditures, and in terms of indirect costs or impacts, and opportunity costs (alternative uses foregone). Governments must either set aside funding for PAs every year or establish self-financing mechanisms. The tendency of direct expense to grow with improved PA coverage or quality provides an easy argument for those that choose to favor BAU with its short-term gains, which can be quite attractive, even if resource-depleting.

For example, under BAU in the Brazilian Amazon (Para, Mato Grosso, and Rondonia), forest industries are a major source of income, employment, and wealth, generating 15% of GDP and 5% of employment (Lele et al. 2002). In 1998, the forest sector in the Brazilian Amazon generated about $2.2 billion in sales. About 70,000 people worked in extractive activities, with another 107,000 working in the processing subsector. Employment in the processing sector is distributed among sawmills (70%), plywood manufacturers (16%), laminate production (8%), and other processors (6%). For each direct job created, two indirect jobs are also generated (in transport, supplies, and services, etc.). Direct and indirect employment in forest activities amounted to 510,000 jobs in 1998. Workers in the forest industry earn an average annual salary of $4,329, well above the Amazon average of $1,620 and the national yearly minimum wage of about $1000 (Amend et al. n.d.). Even though only a very small share of the revenue generated by logging goes into public coffers, the timber sector contributes about 10% of taxes collected in Para and Mato Grosso states (Barreto et al. 1998).

The Brazilian Amazon also provides an example of the way direct costs, already high under BAU and largely unmet, can pose an even greater challenge to the transition to SEM. Although State governments in the Amazon expanded the land under protection in recent years, PAs still lack capacity and resources to carry out effective protection. Shortcomings of Brazil's PA system revolve around severe under-funding: only 44% of basic needs are being funded, leaving a $169 million annual gap (Table 10.3, earlier). This results in under-staffing and, consequently, poor policing and protection of PAs (Lele et al. 2002). WWF Brazil has reported that 23% of Brazil's PAs are at extreme risk and 20% at high risk. Illegal logging is one of the biggest sources of that risk (WWF 1999). The critical issue with respect to Brazil's PA system is the limited government attention given to PA policy and finance vis-á-vis its forestry sector policy that promotes immediate, tangible returns. In Brazil, the estimated cost of a fully functional SNUC at Federal level (Optimal scenario) is $471.7 million, and the current funding is only 28% of what is needed ($133 million), shown in Table 10.3).[51] Additionally, $1 billion is needed for investments in infrastructure and planning for the federal and state systems. These figures do not include the Private Natural Heritage Reserves nor are they integrated in the Union of Federal States budget (Ministério de Meio Ambiente do Brasil 2007).

It has been widely documented that humans benefit from conserving wild habitats and ecosystems such as tropical forest, wetlands, mangroves, coral reefs, and nature's goods and services as a whole. For instance, studies indicate, that "on average, for every hectare of intact or sustainably managed tropical rainforest converted, we lose 39 percent of its total economic value (TEV)" (Papageorgiou 2008).

Ecosystem valuation is not new. For example, Constanza (1997) systemized over 100 attempts to value ecosystem goods and services, using a range of methods. The results have been sometimes criticized for apparent inconsistencies in macroeconomic extrapolations and indicators, with national or site-level marginal data. Further, studies often present impressive overall values and costs, but seldom break them down into concise, politician-friendly data to translate them into employment, income, and government revenues. Finally, in-depth scrutinizing of economic valuation design to validate assumptions and methods used is, indeed, required to overcome inconsistencies and to advance informed decision making.

Using a sector approach, this section provides evidence of the economic benefits, both direct and indirect, of PA ecosystems. The analysis looks at these benefits in terms of the potential decline in productivity due to ecosystem degradation that would result from no action or change (BAU). When possible, it assesses the impact that could be had under SEM. The importance of PAs to growth in agriculture, fisheries, forestry, nature-based tourism, and human settlements is discussed by subsections, including references to drinking water, disaster prevention, and hydropower.

Agriculture

PA ecosystems are economically important for agriculture in a number of ways. Water is critical for irrigation and other uses. A sustainable, high-quality water supply depends on well-maintained ecosystems that are often preserved within PAs. Tropical forest PAs provide natural habitats for genetically-important crop wild relatives, not to mention for many species that pollinate crops and control pests. These services are frequently under-valued; in the BAU scenario, farmers are not paying for them.

This section argues that PAs contribute essential services to agriculture and, thus, are linked to this sector. However, agriculture also requires conversion of natural habitat. Demand for food, fiber, and biofuels will continue to rise; thus, it is critical to balance converted lands with PAs, and to improve agricultural efficiency. Unbalanced conversion of natural land (BAU scenario) will lead to suboptimal agriculture, overall.

IRRIGATION

PA water resources in LAC are poorly managed, despite their contribution to agricultural production and jobs, and negatively impacted by the agricultural sector itself. Further research is needed to assess the links between reduced water quality, lower flows, and PA ecosystem management. Some results are available other regions. For instance, a study of river conservation inside and outside PAs in South Africa concluded that only 50% of rivers within PAs are intact, but that even fewer (28%) are intact outside PAs, providing insight into the positive role PAs can play in conserving river ecosystems (Nel et al. 2007). PAs can be of use in developing solutions to degradation in freshwater ecosystems. Annex 10.1 gives an overview of threats to freshwater ecosystems and the possibility of mitigation by PAs in LAC.

51 Exchange rate US$1.00 = R$1.77, as of 13 May 2010.

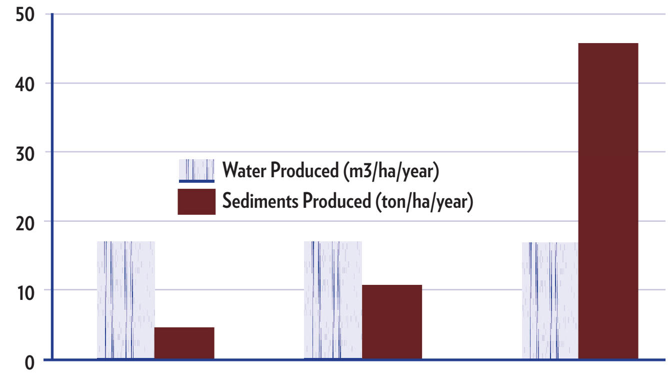
It is estimated that water availability for urban consumption in **Venezuela** could diminish by between 0.5% and 1%/year, if the combined pressure of deforestation and erosion levels currently observed in non-protected areas occurr in the basins of National Parks (Gutman 2002). The reduction in water supply would also have a direct negative impact on irrigated agriculture. Well-managed PAs are fundamental to continued water supply for agriculture in the region. The following examples testify to the effects of forest ecosystems in PAs on irrigation in Colombia, Peru, Venezuela, and El Salvador.

In **Colombia**, there is evidence of major benefits from irrigation supplied by rivers of the National System of Natural Parks (SPNN) (Carriazo et al. 2003). These parks provide water directly to 31% of the population of Colombia, including the main irrigation districts. Out of the 207,089 ha with small and large-scale irrigation, 176,745 ha (85%) receive irrigation water from PAs, which accounts for 40% of water demand nationally (INAT 2002). The SPNN includes four of the six most important water systems in the country; 12 major agricultural districts use water from the SPNN. The water originating from the SPNN grows valuable crops like rice, potatoes, and peas. For example, the Districts of Córdoba and Tolima depend on water sources from Paramillo and Las Hermosas Natural Parks. Both districts are among the larger rice producers and account for 37% of national rice production (FAO 2010). The value of rice produced in Colombia in 2000 reached $521 million, 2% of industrial GDP (Espinal, Martínez & Acevedo 2005).

Farmer willingness to pay for irrigation water is reckoned at $734 / ha/harvest for rice, $2,782 for potato, and $444 for peas. Clearly, water is a valued input to production. Water is also vital to stockraising, where it is used for beef, dairy cattle, and pigs. About 10% of water demand in Colombia goes to cattle (Venegas 2001).

The current BAU PA management adversely impacts water quality and quantity. In the Chingaza PA above Bogota, paramo plants help regulate water flows (CIAT 2007). Human activities that reduce paramo vegetation and forests not only affect water volumes but also generate sediment that lowers water quality. Figure 10.3 compares levels of sediment produced in PAs with good conservation (SEM), PAs with human impact (BAU,) and sites outside of PAs with heavy impact. Places with high human impact generate more sediments than PAs with good conservation, given the same level of water production. Lower sedimentation reduces water treatment costs. The Water and Aqueduct Company of Bogota (EAAB) invests $4.5 million annually to remove sediments; it can save millions by investing in watershed conservation. The cost to improve watershed management in the PAs is only a fraction of the current costs of sediment removal. The budget for managing PAs in Colombia was quite low, about $142,000/PA/year (Carriazo et al. 2003); it has at least doubled in recent years. Willingness-to-pay for better water quality due to conservation activity inside the PAs is about $0.001/m^3$, which represents an aggregate benefit of about $1.2 million/year (Carriazo et al. 2003).

Figure 10.3. Water and sediments produced with increasing human impacts



In **Venezuela** about 20% of the area under irrigation (450,000 ha) depends on forest ecosystems in national parks. PAs contribute 10%-30% of the water provided through irrigation systems during the 30-year lifespan of the infrastructure (World Bank 2006); that lifespan will be longer if sedimentation is low. According to Gutman (2002; cited in Cartaya and Pabón 2009), the average annual benefit from public and private irrigation systems supported by PAs in Venezuela is $316 million over the life of the facilities. An example in Venezuela of the importance of PAs to irrigated agriculture is that of the 4,600 people living in the Sierra Nevada National Park, where local farmers benefit from 29 small irrigation systems that originate in the park (Cartaya 2007).

In **Peru**, 376,000 ha are irrigated with water from PAs, producing agricultural output worth $514 million/year. Agricultural exports were valued at $1.3 billion in 2005; thus 40% of agricultural exports were dependant on PAs (León 2006). It is assumed that output will decline over time due to deterioration of the water resources under the current BAU approach; research is needed to estimate the size of the decline in water supply and the impact on irrigated agriculture, if PAs continue to be underfunded.

El Salvador is an example of mismanagement of water and forests inside and outside PAs under BAU. The most densely populated country in Latin America, El Salvador struggles with land-related issues. Population pressure has resulted in multiple encroachments on PAs, leading to habitat destruction and deterioration, with conversion of forests, pollution, and overexploitation of natural resources — stemming in part from poverty and lack of environmental awareness. It is likely that some units of the National PA System no longer contain sufficient natural or near-natural habitats to warrant PA status. Of Mesoamerica, El Salvador has the smallest portion of its territory formally protected (about 75,500 ha, 5% of its area). Most Salvadoran PAs are "paper parks," with weak legal and physical protection. Watersheds and agricultural lands are under severe pressure from unsustainable farming practices and fuelwood use. A quarter of the farms suffer high soil erosion, and 20% have significant productivity losses. In the past 20 years, the yield of a sample of fresh water springs declined by 30% (World Bank/GEF 2005).

Costs of environmental degradation under BAU to the Salvadoran economy and society include both health losses due to water and air pollution, and productivity losses from soil erosion and sedimentation of hydroelectric reservoirs and other water bodies. This cost lies in the range of $300 million-$400 million/year or 3%-4% of the country's GDP (Panayotou 1988). That excludes fishery losses from water pollution and overfishing, infrastructure damage from water pollution and sedimentation, loss of timber and other forest products, loss of biodiversity by deforestation, and the loss of potential tourism and recreation benefits. Lack of data prevented detailed valuation of these additional losses; however, based on fragmentary evidence and experience from other countries, it is unlikely that they will be under $200 million/year, bringing the total estimated loss to over $500 million/year, 5% of GDP. An expanded, well-managed PA system could, in the long run, help reduce these severe losses (Panayotou 1988).

WILD GENETIC RESOURCES

PAs host crop wild relatives of many commercially-important agricultural varieties that may be used by plant breeders to improve their qualities, from size and nutrition to resistance to cold, drought, pests, and disease. In the Andean Region, PAs are an important as germplasm banks for wild crop varieties of potatoes and other solanaceous and root crops, grains, vegetables, spices, and fruits.[52] PAs in Mesoamerica are important for maize, bean, and squash family relatives. Two examples from Mexico illustrate the importance of wild crop relatives.

- The discovery of wild, perennial maize in Mexico's Sierra Madre del Sur in the 1970s led to establishment of the Sierra de Manantlán Biosphere Reserve in 1988 (shifting from BAU to SEM scenario). The wild maize freely interbreeds with cultivated maize and is tolerant to at least seven corn viruses and immune to three.53
- Throughout the 1900s, the wild Mexican Solanum demissum was used to develop resistance against the fungus responsible for potato blight and to improve crop performance. More recently, genetically modified potatoes using a gene from another Mexican potato relative, S. bulbocastanum, are being tested for resistance to the late blight fungus (Cummins 2006). Community PAs in the pine-oak forest in the Sierra Norte of Oaxaca, Mexico, are well known as a center of potato relative diversity.

These plant genetic services are possible because protected ecosystems provide habitat for crop wild relatives. BAU practices, such as fragmentation and deforestation, are resulting in smaller and more isolated populations of crop wild relatives and declining diversity within these populations. Fragmented habitats, cultivated fields, and timber plantations are less likely to sustain a robust and representative gene pool. SEM PAs are critical to supporting ecosystem function and, thereby, to providing continued plant genetic services. Annex 10.2 includes a list of countries, parks, and links to crop wild relative and landscapes in LAC.

52 WWF food stores.

53 Ibid.

Fisheries

Marine PAs (MPAs) are a tool for improving fisheries management and marine protection with seasonal and long-term closures, and to raise income for local fishers (CEFAS – Centre for Environment, Fisheries & Aquaculture Science). They can protect spawning and nursery areas, preserve vulnerable habitats, reduce fishing pressure inside MPAs, restore diversity, and contribute to fisheries management research.

MPAs that protect essential fish habitats provide some insurance against overexploitation elsewhere. Protecting spawning and nursery grounds is a well-established tool of fisheries management (Gell and Roberts 2003). The potential for MPAs to act as insurance against overfishing has been attracting growing attention, especially for stocks whose status is uncertain or in regions where fisheries-wide enforcement is challenging. The movement patterns of target species are critical in determining the effectiveness of MPAs at protecting stocks and generating spillover to support fisheries in surrounding areas. Networks of MPAs may be essential for populations that depend on other sites as sources of eggs and larvae (Murray et al. 1999). MPAs are challenging, and costly to patrol and monitor under BAU; it is difficult to determine their effectiveness. Most monitoring of MPAs is done in tropical and sub-tropical seas (Fogarty and Murawski 2005). Fish there, typically, live in specific habitats (e.g., reef systems) and stay put; the permanence of the fish is critical to MPA success.

Well-designed and managed MPAs may allow fish stocks to increase, with tangible benefit to local fisheries. Establishing MPA networks is a viable way to enhance their efficiency. Recent findings in marine ecology suggest that a single general design of a network of reserves of moderate size and variable spacing can meet the needs of most stakeholders interested in marine resources (Halpern and Warner 2003). By integrating large-scale MPA networks into fishery management, fishery declines can be reversed, while providing urgently needed protection for marine species and habitats (Gell et al. 2003).

The Apo Island (Philippines) reserve studies by Russ and Alcala (1998, 2001, 2004) are among those that provide evidence of enhanced fish catches over long periods, as a result of spillover. Since establishment of the MPA in 1995, a ten-fold increase in fish stock has been recorded in surrounding areas. Similar results are reported from Fiji, where a locally-managed MPA network has led to tripling of fish catches and a 35% increase in local income over only three years (Mulongoy and Gidda 2008).

While no-take reserves and networks are potentially valuable fishery management tools, knowledge gaps can prevent the establishment of MPAs by lowering confidence that they will sustain surrounding fisheries (such knowledge gaps are typical of BAU). According to Sale et al. (2005), the planning of MPA locations, sizes, and spacing is currently decided, to a large degree, by the natural geography of habitats, compromises among different user groups, issues of compliance and governance, and much "educated guesswork" on ecological aspects. In addition to knowledge gaps, the absence of coherent governance frameworks and poor enforcement (the BAU scenario) raise questions regarding the effectiveness of MPAs.

At the global level, there are examples of transitions from BAU to SEM that have improved biodiversity protection, ecosystem function, and local fisher income in MPAs. A study of 44 fully-protected marine reserves and four large-scale fisheries closures showed an increased species diversity of both target and non-target species; an average increase of 23% in species richness was documented. The increased biodiversity was associated with large gains in fisheries productivity; a four-fold average increase in catch per unit effort was seen in fishing areas surrounding reserves (Worm et al. 2006).

Evidence is emerging that MPAs are also a useful tool for maintaining coral cover, as well as for protecting varied coastal and inland fisheries, and the reefs, mangroves, sea grass beds, and forests that support them. In order to illustrate the relation of MPAs to fisheries in the LAC region, examples of positive and negative impacts of MPAs are presented from the Caribbean, Venezuela, Panama, and the Amazon. A case from Indonesia is also considered.

Coral reef MPAs: Selig (2010) compiled a global database of 8,534 live coral cover surveys from 1969–2006 to compare annual changes in coral cover inside 310 MPAs with those in unprotected areas. On average, coral cover within MPAs remained constant, while coral cover on unprotected reefs declined. The results of the study also indicate that older MPAs were generally more effective in preventing coral loss (initially, coral cover continued to decrease after MPA establishment). Coral cover continued to decline for about 14 years after protection started in the **Caribbean**, possibly due to the time needed for the ecosystem and its organisms to rebound from previous over-exploitation. Selig concludes that the effectiveness of MPAs in preventing coral loss depends strongly on the duration of protection. This is consistent with earlier findings on commercial fish stocks in Europe and southern Australian reef communities.

Mangrove ecosystems are believed to be the source of large capture fisheries outputs. In the **Caribbean**, the biomass of several commercially important species was found to be more than double in areas when adult habitats were connected to mangroves. For example, the blue striped grunt presence was found to be 26 times greater on reefs near healthy mangroves (SEM). Under a BAU scenario, species such as the rainbow parrotfish disappeared after mangrove forests were removed (www.panda.org/news_facts/newsroom/index.cfm?uNewsID=11035).

In **Venezuela**, approximately 15,000 ha of mangrove ecosystems exist in MPAs (i.e., Morrocoy, Mochima, Laguna de Tacarigua, and Archipelago de Los Roques marine national parks). There, mangrove degradation has been conservatively estimated at 500 ha/year under BAU. The value of potential losses has been estimated at $12 million over a 30-year period (Gutman 2002 cited in Cartaya and Pabón Zamora 2009). In National Park Morrocoy, the extraction and sale of mollusks and other species from the mangrove forest generate 376 seasonal jobs (Cartaya 2001). During harvest season, fishers and middle-market workers can earn an extra monthly income of about $140 and $485 respectively (FUDENA 2004). Similarly, in National Park Laguna de Tacarigua, annual fish catch is estimated at $1.3 million and fisheries employ 41% of the work force in the area (Salvato et al. 2002). Assuming that these MPAs improve management (transition from BAU to SEM) to progressively eliminate mangrove degradation, the catch may increase and generate additional benefits to local fishers. In these cases, promoting SEM will make economic, social, and environmental sense, while BAU would likely eliminate these values over time.

In **Panama** the Coiba National Park (CNP) was established in 1991 and remained in BAU (limited or no management and low investment) for several years. In 2004, the park was officially given full PA status. A management plan was introduced (shift to SEM started). In total, of a surface area of 254,822 ha, 79% is MPAs. An adjacent area is under the category of Special Marine Protection Zone (SMPZ) with 160,000 ha. CNP fisheries are now being managed (artisan fishers are allowed in some parts). A recent valuation study of the CNP estimated that fisheries in the park generate 275 direct jobs, and an average income of $260/person (Conservation Strategy Fund, Technical Series 16, Ricardo Montenegro, 2008). The total generated by the park's fisheries was $7.2 million in 2007. The average monthly income of fisher households settled around the park was estimated at $327, contrasting with the average of $147 outside the area. The net value of fisheries projected for the next 20 years, assuming that the park continues under SEM, is $20 million. It is expected that both the fisheries and tourism sector will continue to grow and more jobs will be created.

Terrestrial PAs for inland fisheries are also important. Studies in the **Amazon** show the importance of establishing extractive reserves as a way to implement community-based fisheries management. The most well-known case is the pirarucu (*Arapaima gigas*). Presently, pirarucu is endangered because of heavy fishing (under the BAU scenario) since the colonization of the Amazon (Santos et al. 2006 in

Texeira 2002, 2008). It is a very large fish and its population is fast decreasing. Community-based management in PAs (shift to SEM) is helping to rebuild stocks and sustain income for people living in or near PAs.

On the other hand, it is not clear if MPAs can support all fishery management objectives simultaneously. Similarly to terrestrial PAs, they can have negative effects by preventing harvesting in no-catch areas, thus impacting people's livelihoods. A 2005 study by ICRAN et al. (Lutchman et al. 2005). notes that the Sufriere MPA in St. Lucia has significantly increased fish stocks since its establishment (shift to SEM). Although this reserve will eventually provide sustainable benefits to local fishers, it required that 35% of fishing grounds be placed off limits, imposing a cost on local fishers in the form of reduced catch in the interim (and higher fuel cost due to longer travel). This could have been prevented by a temporary financial support policy to compensate fishers for losses during the transition from BAU to SEM.

Forests

Forest in PAs includes many different types of vegetation: tropical wet and moist forests, cloud forests and dry forests, and coastal swamps and mangroves. Across LAC, PAs are home to the richest biodiversity on Earth. This richness, however, is threatened by deforestation that occurs mainly through illegal logging, and slash-and-burn practices in PAs. Moreover, PAs are encroached upon and degraded as a result of deforestation around them. In addition, building infrastructure, especially roads and dams, contributes to deforestation in and near PAs. Such situations are a consequence of traditional BAU practices in PA management.

TRADE-OFFS BETWEEN BAU AND SEM IN FOREST RESOURCE MANAGEMENT

From a global perspective, it may be that, in most cases, the economy would be better off by conserving more at the margin (Pagageourgiou 2008). For every hectare of tropical forest lost, the economy loses more than it gains. The lack of markets for ES hinders the transaction needed to reach efficiency. Forest ecosystems can provide multiple services; when their value is considered, PAs are often an optimal land use.

For example, values were obtained for a variety of benefits — timber and NTFP, water supply and regulation, recreation, and the maintenance of both carbon stocks and endangered species — for forests under SEM management regimes in Selangor, Malaysia. After comparison with two methods of reduced-impact logging, conventional high intensity logging was associated with higher private benefits at least for one harvesting cycle, but reduced net social benefits at national and global levels, due to the loss of NTFP, flood protection, carbon stocks, and endangered species. All together, the total economic value (TEV) of the forest was 14% greater under BAU than when placed under SEM (Kumari 1994 in Balmford et al. 2002). This is a case in which BAU was still preferable, at least for the moment, despite significant SEM values.

In a similar case, low-impact logging in Cameroon was compared with more conventional yet extreme land uses. Private benefits favored conversion for small-scale agriculture. However, it was evident that net benefits including those from NTFP, sedimentation control, and flood prevention were higher under SEM, as well as carbon sequestration, bequest, and existence values. The total economic value (TEV) for the SEM option was 18% greater than for the BAU option of small-scale farming (Yaron 2001 in Balmford et al. 2002, 2004).

The following subsections provide an overview of BAU and SEM cases of PA-related forest contribution to economic growth, in terms of reducing deforestation and generating income to governments through concessions, taxes, and carbon storage.

REDUCTION OF DEFORESTATION

Examples from Costa Rica, Mexico, Peru, and Guatemala are included in order to illustrate how PAs and community forests in them can be the basis of strategies to reduce deforestation.

Andam et al. (2008) evaluated the impact on deforestation of **Costa Rica**'s PA system between 1960 and 1997, and found that protection reduced deforestation: about 10% of the protected forests would have been deforested had they not been protected. Mas (2005), using a method which allows mapping of a buffer area surrounding a PA that presents similar conditions with respect to a set of environmental variables, assessed the effectiveness of the Calakmul Biosphere Reserve, a PA located in SE **Mexico**. The annual rate of deforestation in that PA, as well as in the standard buffer area (based upon distance from the PA only) and the "similar" buffer area (taking into account distance along with some environmental variables,) were 0.3, 1.3 and 0.6%, respectively. These results showed that the PA was effective in slowing land clearing, but that the comparison with the standard buffer area gave an over-optimistic vision of its effectiveness.

Oliveira et al. (2007), using an expanded Carnegie forest damage detection system[54], showed that, between 1999 and 2005, disturbance and deforestation rates in the **Peruvian Amazon** averaged 632 km^2/year and 645 km^2/year, respectively. However, only 1% to 2% occurred within natural PAs; indigenous territories had only 11% of forest disturbances and 9% of the deforestation; and, recent forest concessions effectively protected against clear-cutting. Although there have been recent increases in disturbance and deforestation

54 Carnegie Landsat Analysis System, CLAS, http://asnerlab.stanford.edu

rates, land-use policy involving PAs and remoteness are serving to protect the Peruvian Amazon.

Bray et al. (2008) tested the hypotheses that community forests and PAs are strategies to reduce deforestation. The authors evaluated the community-forestry hypothesis and the PA hypothesis in community forests with commercial timber production and strict PA approaches in the Maya Forest of **Guatemala** and **Mexico**. They concluded that long-inhabited community forests managed for timber can be as effective as uninhabited parks at delivering long-term forest protection, and more effective at delivering local benefits. The study compared 19 communities and 11 PAs in periods from 1988 to 2005. Statistics on deforestation rates, logistic regression analyses, LUCC maps (satellite images), data on local economic impacts, and ethnographic research provided the supporting evidence for the conclusion.

FOREST CONCESSIONS AND TAXES

For many countries with considerable forest resources, income from taxes, timber, and forest products is low. Low tax revenue sends incorrect signals to the market and has a negative impact on government expenditure for forest management, which may result in forest resource degradation, including those in PAs (the BAU scenario). When taxes and fees on timber and other forest products are set at appropriate levels, governments have a vested interest in sound forest management, sustainable commercial logging, and prevention of illegal activity, to ensure future revenue flows. This includes revenue from PAs that allow sustainable use of forest resources (e.g., extractive reserves in the **Brazilian Amazon**). Lost revenues due to illegal logging under BAU can cost governments and economies millions of dollars yearly.

Income from taxes on sustainably-managed forest PAs can be an important source of income to governments. However, in addition to low revenue returns in LAC and in most of the developing world, this potential remains largely untapped (the BAU scenario) and represents significant losses from foregone taxes. This situation is due to significant gaps in the legal and regulatory frameworks, including obsolete tax collection systems, For example, a study funded by the World Bank estimated the direct annual financial losses incurred by governments to illegal logging and related corruption at $12 million-$18 million for **Honduras,** and $8 million-$12 million for **Nicaragua**; where the annual gross economic value of "clandestine timber" is estimated at $55 million-$70 million for Honduras, and $20 million for Nicaragua. These substantial losses could be minimized by introducing new PAs established under management regimes similar to the extractive reserves and national forest (*flonas*) of Brazil.

Logging is the primary means by which market benefits of tropical forests are realized. Logging also constitutes a significant component of tax revenues in many forest-rich developing countries such as Brazil, Bolivia, and Peru. However, the estimated proportion of illegally harvested wood (in 2002) in Bolivia, Brazil (Amazon), and Colombia was 80%, 85%, and 42%, respectively (Fern 2002; Smith, W. 2002).

The introduction of forest concessions in PAs under special regimes has major potential in terms of public revenues. In Brazil, current PAs comprise approximately 28% of the Amazon. Most of these areas are indigenous reservations, part of the national system of conservation units (SNUC). Of the protected regions, only production reserves (3.2% of Amazonia) currently allow logging. Some 72% of the region has no protection and could, in theory, be allocated for timber production, while simultaneously expanding PAs. Studies indicate that 23% of the Brazilian Amazon could be established as FLONAS, connected to PAs. In addition to indigenous reserves, where logging is already permitted, other existing PAs in the Amazon region can be used to establish FLONAS-based buffer zones for fully protected parks and reserves, and to generate revenues (Verissimo et al. 2002; Thurston et al. 2006).

Logging concessions in National Forests (a type of PA) in Brazil is a case in point. The Jamari National Forest (JNF), in Rondonia, was the first case. A federal self-sustainable conservation unit, the JNF has 220,000 ha, of which 90,000 ha has been subject to a forest concession as part of the government strategy for sustainable public forests management (a SEM approach). Sustainable forest use is part of the JNF Management Plan, approved by IBAMA in 2005. According to Brazilian law, revenues from forest concession within national forest are shared by the Chico Mendes Institute, 40% (conservation of biodiversity), the State where the concession is located, 20%, the municipal government, 20%, and the national Fund for Forest Development 20% (Brazilian Forest Service).

According to the Brazilian Forest Service (SFB), the forest concession area planned for the BR 163 District in 2010 is 8.9 M ha. The annual value of the potential output of this concession (2,881,061 m^3) is estimated at $576 million. Further, the potential yearly revenue is estimated at $64 million, and the potential effect on direct and indirect employment is creation of 28,000 and 43,000 jobs, respectively.

These studies indicate that, under sound standards for granting access to timber firms and establishing appropriate taxation levels, creation of an indemnity fund will be feasible. The proceeds of the concession would be deposited in the indemnity fund and, by the end of the harvest period, could be between $140 million and $1.3 billion. This low-impact controlled logging SEM model, combined with the tax scheme and the indemnity fund, provides the capability of generating an optimal long-term pattern of increased tax revenue to governments. For example, the fund's resources can be used to finance forest projects in PAs and buffer zones such as plantation forestry or conservation easements (Proposed by Katzman and Cale 1990 in Thurston et al. 2005), which will also help decrease losses from illegal logging. Although the institutional and regulatory framework needed to establish the fund will require work, such a combined SEM model could be much more attractive to decision makers. Nevertheless, managing timber carries risks to biodiversity and ES, as from increased hunting, susceptibility to fires, and disease (Nepstad et al. 1999, 2004; Pattanayak and Wendland 2007).

CARBON STORAGE

Most recently, in light of governments taking action on mitigation and adaptation to climate change, PAs have emerged as one of the strategies for climate change mitigation. PAs provide an important carbon storage service; millions of tons of carbon are accumulated in PA forests. The value of such services and possible payment for this sequestation is the center of current debate.

Forest clearance contributes 20% of global CO_2 emissions. Reducing forest loss lowers emissions and, thus, is a critical service provided by PAs. Payments for carbon storage in PAs could mean a significant revenue stream to developing nations with standing forest (i.e., foreign exchange transfers and funding to pay for the transition to SEM). The argument for that is valid if PAs are under direct threat of deforestation. Direct threats mainly include illegal logging, and slash-and- burn practices. In this context, it is fundamental to understand the extent to which PAs are, in fact, subject to deforestation (IPCCF 2007).

It is also important to make a distinction between the carbon contained by mature forests in existing PAs, and the carbon captured by reforestation when new PAs are created in areas that were deforested. Both may be linked to incentives from REDD-related programs (Reducing Emissions from Deforestation and Forest Degradation) based on a system of compensated reductions (e.g., Forest Carbon Partnership Facility). Funding would flow from developed to developing countries to support forest conservation.

A recent UNEP study assessed forest loss within the PA network of the humid tropical forest biome during 2000-2005 (Campbell et al. 2008). It concluded that the largest forest area loss was observed in the Neotropics (most of LAC), which hold the greatest amount of standing forests. The rate of observed deforestation was estimated at 2.39%. The study estimated that, during the same period, over 1.7m hectares were cleared within PAs in the humid tropics (0.81% of the forest they contained). The study also found that the deforestation rate in neotropical PAs is low (0.79%), but more than half the global total loss of humid tropical forest from within PAs occurred in this region. About 75% of emissions from deforestation in PAs come from the Neotropics.

Despite the persisting forest loss in PAs, PAs of the humid tropical forest biome contained an estimated 70 Gt of carbon. Neotropical PAs had higher carbon stocks on average, totaling more than twice the combined carbon stocks in PAs of the other regions. Consequently, improving the effectiveness of forest PAs[55] (transition from BAU to SEM) in the region has significant potential for revenue generation and foreign exchange earnings (Campbell et al. 2008). The following examples of Venezuela, Colombia, Chile, Brazil, Bolivia, and Mexico illustrate the value of carbon sequestration in PAs.

In **Venezuela**, preliminary reports estimate the value of the stored carbon in the Canaima National Park at $1 billion, Imataca Forest Reserve at $94 million, and for Sierra Nevada in **Colombia** at $4.5 million (Bevilacqua et al 2006; Gutman 2002; World Bank 2006). Forested areas in **Chile** include a range of forest types, which have different carbon storage capacities. Figueroa (2007) estimated the value of the carbon sequestration service provided by forest PAs in Chile at $414 million.

In Brazil, the Amazon Region Protected Areas Program (ARPA) was created by the Brazilian Government in 2003, with GEF support to protect 50% of the remaining Amazon forests. ARPA supports the National System of Protected Areas (SNUC). Over the decade 2003-2013, ARPA aims to protect 500.000 km^2 of natural ecosystems, mainly forests. Despite its clear benefits to the conservation of biological diversity and protection of great forest carbon stocks, little is known about ARPA's role in the reduction of greenhouse gases. In order to determine ARPA's contribution to carbon sequestration, historical deforestation rates between 1997 and 2007 were used to estimate future deforestation based on scenarios for 2050. The author concluded that the PAs created by the federal government between 2003 and 2008 (including those supported by ARPA), will reduce emissions from deforestation of 3.3 1 B tons of carbon, by 2050. From this expected reduction, 12% can be attributed to the 13 PAs created by the ARPA Program. The contribution of PAs in the Amazon is, therefore, crucial to reducing deforestation in the Amazon and the associated carbon emissions implicit in such a land-use change (Soares et al. 2008).

Bolivia's Noel Kempff Climate Action Project is establishing credible, verifiable methods to quantify greenhouse gas benefits of land-use change and forestry projects. The project was developed under the United Nations Framework Convention Climate Change (UNFCCC) to conserve natural forests that would otherwise have been subjected to continued conventional logging and agricultural conversion. Periodic monitoring of relevant carbon pools recurs over the 30-year project life (in 1999, and then every five years) to establish the difference between the with-project and without-project scenarios (Brown et al. 1999).

In **Mexico**, according to Bezaury and Pabón (2009), the carbon existing on federal PAs, which is about five times the 2004 emissions pro-

55 Potential performance-based payments for having reduced emissions from deforestation and/or forest degradation through REDD programs will depend on country capacity to (a) demonstrate "ownership" on REDD and adequate monitoring capacity, and (b) establish a credible reference scenario and options for reducing emissions. (http://www.forestcarbonpartnership.org accesses May 2010)

duced by the country, would have a value of $28 billion at the average price paid by the international market in 2007.

Information on the value of stored carbon at the regional level in LAC is incomplete. A recent study by FAO (2009) estimated the value of stored carbon in six countries ranging from small to large at $607 million. This information is in Table 10.6.

While these examples illustrate the potential benefits of improving forest conservation in PAs with a shift from BAU to SEM, further research is needed to assess the effectiveness of PAs in reducing deforestation and the viability of mobilizing carbon-based financing. Any such funding flows would be in addition to those from the better-tested mechanisms of revenue generation from forest concessions, taxes, and PES, among others. The cost of shifting from current BAU to SEM in PAs may be significant; but it is certainly not unaffordable.

Table 10.6. Estimated Value of Carbon Stored in Forest in Selected Countries in LAC.

Country	No. of Hectares of Forest (Thousands)	Carbon in Biomass (Million Tons)	Estimated Value ($ million)[1]
Cuba	2,713	347	2,734
Dominican Republic	1,376	82	646
Nicaragua	5,189	716	5,642
Panama	4,294	620	4,886
Bolivia	58,740	5,296	41,732
Brazil	477,698	49,335	388,760
TOTAL	859,925	77,066	607,280

Source: FAO 2009.

1 According to Hamilton et al. (2010), prices for forest carbon credits ranged from $0.65/tCO2 to more than $50/tCO2, but over time, the volume-weighted average price used for this calculation was $7.88/tCO2.

Nature-based Tourism

This subsection discusses the contribution of PAs to nature-based tourism (NBT) and through the analysis to the contribution of tourism in general to growth, which is presented in the Tourism Chapter. NBT, also known as eco-tourism, offers experiences directly related to natural attractions. NBT includes "experiencing nature on various levels: simple adventures, learning about and appreciating man-nature-land relationships and getting back to nature" (www.vcc.vic.gov.au/2008vcs/glossary.htm). NBT is often combined with other categories of tourism.56

PAs provide natural attractions around which NBT is organized. Without the attractions, PA-based NTB will not be possible. PAs provide continuous habitats with wild plants and animals, exotic foods, fresh water and air, viewscapes, and cultural services essential to NBT. Tourists find NBT experiences —trekking, wild life viewing (including bird-watching and whale watching), scuba diving, sport fishing, hunting, whitewater rafting, kayaking, and canoeing— more valuable when they take place in healthy ecosystems, such as those found in PAs. A recent study of 138 Caribbean destinations found that the establishment of marine PAs (MPA) significantly increased scuba diving tourism (Worm et al. 2006). This has been corroborated by studies from Belize, Costa Rica, Dominica, and Ecuador, which indicate that for 50%-70% of tourists, PAs were an important factor in their choice of destination (Boo 1990 in Dharmaratne et al. 2000), and in Costa Rica, 66% of all tourists going to the country between 1992 and 1996 reported visiting a PA.

NBT is one of the fastest growing segments of the tourism industry with an annual growth rate of 10%-30%; currently, over 40% of all international tourists are nature tourists (WTO). NBT-related activities in PAs have an economic value derived from direct use of or interaction with PA ES. This value can be measured using indicators such as spending, employment, tax revenues, and foreign exchange earnings. There is evidence that PAs make a significant contribution to economic growth even in conditions of severe under-funding (BAU practices); it is assumed that if PAs shift to SEM practices, NBT will generate greater economic value. For this report, it is assumed that PA-based NBT can be undermined by insufficient investment in the conditions required to manage NBT and the supporting PA well (BAU scenario, characterized by significant negative externalities).

There is abundant information in LAC about benefits related to NBT in PAs. The following examples provide evidence of the economic impact of NBT on PAs, in terms of jobs and income, foreign exchange, economic multipliers, and funding.

JOB CREATION AND INCOME

NBT creates a range of economic opportunities in rural areas, mainly by providing small-scale business opportunities to local populations and employment in service sector jobs (though mostly low-skilled). In **Mexico,** for example, according to the Tourism Secretariat (2000), tourism (including NBT) generates 1.8 million jobs. In the US, the travel and tourism sector is vital to the US economy; it is the third-largest sector in terms of employment representing approximately 17 million jobs (Travel Industry Association, Discover America Partnership: http://tia-dap.org/about.aspx).

Venezuela's Morrocoy National Park receives some 1.5 million visitors annually. The flow of tourists has a significant effect on the local economy. The average expenditure per visitor in Morrocoy, in 2001,

56 Inclusive tourism categories according to GNABTA: ethnic, cultural, historical, environmental, recreational, and business.

was $135, for an annual total of $203 million. During weekends, because of tourist arrivals, the population in the nearby town doubles; the local population provides the variety of supporting services required. It is estimated that 5,000 permanent jobs have been created in areas adjacent to the national park (half the employment in the area); 80% of the area's tax revenues come from tourism-related activities (Cartaya and Pabón 2009). The most visited PAs in the country, like this one, provide 30%-50% of local jobs. Table 10.7 illustrates Cartaya and Pabón's (2009) findings on job generation by NBT in Venezuelan PAs.

Venezuelan PAs generate many service sector jobs, thus increasing household income, mainly via tourism-related business in PAs. During the high season, households can double their incomes. Cases in point include Canaima National Park, where monthly household incomes go from $103 to $246, and at NPM from $207 to $606 in high season (Cartaya 2007 in Cartaya and Pabón 2009).

Table 10.7. Employment from NBT in Protected Areas in Venezuela

National park	Beneficiaries	Employment
Los Roques	Local people	40% population between 18 and 70 years old
Mochima	Local people	35% of the population live from tourism
Canaima	Local people, Valle de Kamarata (1996)	39% of 328 households receive incomes from tourism, benefitting 544 people (43% of the population in the area); 108 of 157 workers work in tourism (85% men) as guides, drivers, cooks, etc.
	Community Tourism Program (PAT)	57 households associated in tourism cooperative (Cooperativa Emasensen)
Sierra Nevada y La Culata	Community tourism program	135 household enterprises; 1,256 beneficiaries in 28 communities
Sierra Nevada	Local people (Gavidia, Los Nevados)	236 jobs
Morrocoy	Local people in the buffer zone	5,051 permanent jobs and 1,719 during high season, totaling 6,730. Generates about 50% of the jobs in the municipality
	Local people	80% of the households receive income from tourism activities. 58% of jobs are tourism related

Source: Bioparques, various years; Ecology & Environment 2002a and 2002b; Programa Andes Tropicales, unpublished statistics; Cartaya et al. 2002; Medina 2001

The Madidi National Park (NPM) in **Bolivia**, established in 1985, encompasses 18,957 km^2 in the northwest of La Paz Department. Before and during the first years after the establishment of the park, under the BAU scenario, uncontrolled timber extraction was growing at an impressive rate. Slash-and-burn and subsistence agriculture, with intensive use of unsuitable agricultural systems brought from the highlands by settlers, was the only other livelihood of the communities. Jobs were extremely scarce; sawmills and logging were the most prominent sources of temporary employment for the local population. The establishment of the NPM and a shift to SEM has had a significant impact in terms of both conservation and improvement of local livelihoods. A recent study estimated that NPM and the surrounding ANMI (Natural Area of integrated Management) generated over 1,600 tourism-related jobs and total receipts from tourism of $2.4 million in 2007 (Escobar et al. 2009).

According to the Vice-Ministry of Tourism of Bolivia, tourism grew 10% between 2004 and 2007. Over 1.5 million tourists visited Bolivia in 2007 (one third were foreigners), leaving $292 million in foreign exchange earnings. A total of 82,770 visited PAs (16% of foreign visitors). It is estimated that tourism in PAs in Bolivia generates 19,800+ jobs and $50 million in GDP (Escobar et al. 2008).

In **Chile**, the effect of international tourism on the national economy was estimated two ways: first, by the number of tourists who visited PAs in 2005[57] times their daily expenditure; second, by assuming that all tourists coming to Chile are motivated by the existence of PAs. Thus, that all tourist expenditures in Chile are due, in part, to having PAs. The annual contribution of this sector was estimated at $54 million and $336 million, respectively. In addition, the contribution of domestic tourism in PAs was estimated at $10 million annually (Figueroa 2007). Considering the financial gap of the PA system in Chile, estimated at $8.8 million, half the basic conservation needs (Table 10.3), it appears that the Chilean PAs are under BAU practices. It is assumed that by improving management toward SEM, the Chilean PA system will have an enhanced capacity to handle sustainable NBT tourism and that income from tourism will progressively increase. On the other hand, if these PAs are neglected, remaining under BAU, revenue from tourism may decline due to ecosystem wear and tear.

TAX REVENUES

Perhaps the most important economic impact of PA-NBT to local and national governments comes in the form of fees and taxes, including income taxes from people working in the NBT sector, and other proceed types including property tax, VAT, export tax, entry fees, and royalties from concessions. In the US, for example, the travel and tourism industry generates about $105 billion in tax revenues yearly.[58] Data on tax income in LAC is not yet available and revenues are severely undermined by BAU practices: poor investment in tourism in PAs and the conditions of absent or non-functional tax collec-

57 TE=DE*ND*NV. TE (total expenditure), DE (daily expenditure), ND (number of days of stay) and NV (number of visits).

58 Ibid.

tion systems. This critical area of finance policy and implementation area needs research and policy action.

FOREIGN EXCHANGE EARNINGS

Tourism is important to developing countries because the sector is a main "export"— foreign exchange earner — for 83% of developing countries. It is the leading export for many of the poorest countries. In the world's 40 poorest countries, tourism is the second most important source of foreign exchange, after oil. Over the past decade, tourism has been "the only large sector of international trade in services where poor countries have consistently posted a surplus." "International tourism is increasing by 9.5%/year in developing countries, compared with 4.6% worldwide" (The International Ecotourism Society 2000). The contribution of NBT to LAC is most visible in terms of GDP and foreign exchange gains on small islands with a solid base of NBT. In larger countries with more diversified economies, the profile of NBT will be lower. Table 10.8 gives tourism as percentage of GDP and of exports in selected countries.

In **Costa Rica**, though only $12 million was spent annually on PA maintenance in 1991 (a BAU setting), foreign exchange generated by parks was over $330 million from 500,000 visitors (WWF 2008). Given the recognition of the importance of PAs in Costa Rica, the government is now implementing a comprehensive strategy to achieve the optimal funding (the desired SEM approach) for their PA system (SINAC).

THE MULTIPLIER EFFECT OF NBT

Tourists visiting PAs spend on much more than entry fees and NBT experiences; they also pay for travel and local transport, accommodation, food, merchandise, and souvenirs inside and outside of the PA. Thus, tourists generate substantial revenue in a variety of sectors. For example, according to CONANP (2007), some 5.5 million tourists visited federal PAs in **Mexico** in 2006, it is estimated that they spent about $286 million in and around PAs, corresponding to 2.3% of spending by international travelers visiting Mexico.

Like any sector, tourism creates a chain of economic activity that affects not only those delivering services directly to tourists and their employees, who earn more and consume more, but also their suppliers, and the suppliers to the suppliers. This long chain multiplies the initial amount spent by tourists.

According to the Bolivian Ministry of Planning and Development (2001), every dollar spent on cultural and nature tourism in **Bolivia** generates another $1.2 in indirect benefits (Fleck 2006). This was the highest multiplier among a list that includes mining, oil and gas extraction, agrobiodiversity, and the sectors of forestry, hunting and fishing. The high multiplier of cultural and nature tourism in Bolivia may be a result of the sector being relatively human resource-intensive, labor being a main input to produce the services delivered to tourists. Nature-based tourism (NBT) businesses have been flourishing in conjunction with PAs. NBT is particularly beneficial to small business including those in the informal service sector.

Table 10.8. Tourism as Percentage of GDP and Exports in Selected LAC Countries

Country	% of GDP	% of Exports
Belize	14	31
Jamaica	18	37
Barbados	28	51
Bahamas	35	60
Mexico	1.4	4.6
Guatemala	2.7	13.8
Bolivia	1.9	11
Peru	1.7	11

FINANCING TO PAS

The effect of NBT on PA finance under BAU practices is extremely modest, leaving considerable financial gaps in these PA systems (e.g., Table 10.3). Initial estimates by TNC (2008) suggest that combined PA entree fees and tourism concessions make up about 11% of PA financing.[59] Tourism revenue to PAs is poorly diversified under BAU. This revenue is mostly based on rigid entry fees; concessions are the exception, not the rule. A key aspect of the transition to SEM is diversification of entry fees to provide options in terms of types of passes, service fees, points of sale, and forms of payment. Not all PAs have a tourism potential to exploit; some are too remote, lack infrastructure, or limit visitation to protect delicate ecosystems.

PRIVATE PAS

Private PAs (reserves) are becoming an increasingly important tool for conservation, mostly associated with transitions to SEM. In some cases, these reserves are part of the national PA systems (Colombia, Brazil, Costa Rica), and are becoming increasingly important to NBT. Nevertheless, unlike government-authorized and permanently-supported public parks, most private reserves are informally protected and lack sufficient area to protect megafauna or to avoid the adverse effects of fragmentation.

NEGATIVE IMPACTS OF TOURISM (BAU PRACTICES)

Despite the significant economic contribution of NBT, this form of tourism can also have potentially negative effects on PAs, if not man-

59 Aggregated data from Bolivia, Brazil, Chile, Colombia, Ecuador (excluding the Glalapagos), Perú and Venezuela.

aged well. In MPAs, for example, the International Ecotourism Society has documented degradation of coral reefs by cruise ship anchors and sewage, tourists breaking off chunks of coral, and commercial harvesting for sale to tourists (The International Ecotourism Society 2000). The transition from BAU to SEM is not primarily about increasing funding, but, rather, about improving management capacity and ecosystem preservation.

Tourism in PAs is concentrated in a few sites, while most PAs have few visitors. This skewed distribution is reflected in both the income generated and the impacts caused. There is evidence of natural resource depletion due to poorly-managed tourism operations in several national parks in LAC. For example, the number of tourists expanded from 40,000 to 140,000 in Ecuador's Galapagos National Park between 1990 and 2006. That expansion put more pressure on the islands' natural resources due to business development, migration from the mainland as more people are needed to support the growing tourism industry, visitor-mediated ecosystem disturbance, and an increase in non-native plant species on the islands. Consequently, UNESCO and IUCN have formally declared the Galapagos National Park to be "in danger" from these threats (Marine Protected areas News 2007). These issues could undermine the sizeable contribution of tourism in the Galapagos National Park to the Ecuadorian economy.

In the Eduardo Avaroa Reserve (EAR) in Bolivia, BAU is associated with inadequate management of NBT and a backlog of investments in tourist infrastructure. The PA, which is the most visited in Bolivia, faces issues of insufficient infrastructure, and weak personnel and management systems, all necessary to accommodate the growth in tourist numbers. Other problems are poorly-planned tourism operations and excessive, disorderly motor vehicle transit inside the reserve. Tourism, currently, threatens the conservation of biodiversity in this PA. Sustainable tourism management in EAR will result in $800,000 in yearly revenue, up from $160,000 in 2003 (Drumm 2007). Information on the cost of shifting from BAU to SEM practices in EAR is not available, but could easily be covered by the increased revenues.

NBT needs to be well-managed to minimize its negative impact on natural resources.[60] PAs should follow basic guidelines for sustainable tourism development (e.g., Rainforest Alliance) and need to plan better for NBT, starting with their management plans (Drumm 2008; Flores et al. 2008). Some PAs may need to restrict visitor numbers to match the carrying capacity of the setting. Further, it is critical that PAs receive sufficient funding for park operations, as well as for infrastructure investments needed for NBT.

60 "Sustainable tourism development meets the needs of present tourists and host regions while protecting and enhancing opportunity for the future. It is envisaged as leading to management of all resources in such a way that economic, social, and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity, and life support systems" (WTO).

Human Settlements (Potable Water, Disaster Mitigation, Hydropower)

"The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people. These problems, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems" (MEA 2005)

The LAC region's biodiversity hotspots are rich in endemic species, habitats, and ecosystems. These hotspots are particularly threatened by human activities. In 1995, more than 1.1 billion people, nearly 20% of the world population, were living within these hotspots, an area covering about 12% of Earth's terrestrial surface. This situation suggests that substantial human-induced environmental changes are likely to continue in the hotspots and that demographic change remains an important factor in preserving functioning ecosystems (Cincotta et al. 2000).

Human settlements benefit from PAs through the provision of a variety of critical services such as the provision of fresh water, regulation of natural hazards, and natural mitigation of climate change (see Box 10.3). These services are discussed next in the context of the BAU and SEM.

DRINKABLE WATER

Under a climate of growing water scarcity, access to clean, safe drinking water is a top priority. Forest and wetland PAs provide cheap, clean drinking water to countless rural and urban populations, including a third of the world's most populated cities (Dudley et al. 2010). Well-managed natural forests almost always provide higher quality water, with less sediment and fewer pollutants than water from other catchments (Aylward 2000). Research has shown that about a third (33 out of 105) of the world's largest cities obtain a significant portion of their drinking water directly from PAs (Dudley et al. 2010). This is evident in the LAC region (Table 10.9).

Latin America, as a whole, has one of the highest per capita volumes of fresh water in the world — about 3,000 m^3/person/year. The destruction of water sources, combined with inequitable access, has left most Latin Americans "water poor," in the current BAU scenario. Millions live without access to clean water at all. While the region's available resources could provide each person with close to 3,000 m^3 of water every year, the average resident has access to only 28.6 m^3 /year. This compares to North America's annual average of 118 m^3 and Europe's 64 m^3 (Barlow and Clarke 2004).

Watershed conservation can greatly improve water quality and quantity, reducing water treatment costs. Tangible evidence is provided by the Chingaza National Park in Colombia, where the Bogota Water and

Table 10.9. Examples of Cities / Metropolitan Regions in LAC Depending on Water from PAs

City	Protected Area
Bogota, Colombia	Chingaza National Park (50,374 ha)
Cali, Colombia	Farallones de Cali National Park (150,000 ha)
Medellin, Colombia	Alto de San Miguel Recreational Park & Wildlife Refuge (721 ha)
Belo Horizonte, Brazil	Mutuca, Fechos, Rola-Moça & 7 other small PAs (17,000 ha)
Brasilia, Brazil	Brasília National Park (28,000 ha)
Rio de Janeiro, Brazil	Tijuca National Park (3,200 ha) & 3 other parks in metropolitan area
Sao Paulo, Brazil	Cantareira State Park (7,900 ha) & 4 other state parks
Salvador, Brazil	Lago de Pedra do Cavalo & Joanes/Ipitinga Environmental PAs
Santo Domingo, Dominican Republic	Madre de las Aguas Conservation Area with five PAs
Quito, Ecuador	Bioreserve El Cóndor (4 PAs): Cayambe-Coca Reserve, Antisana Ecological Reserve, Cotopaxi National Park, and Los Illinizas Reserve
Caracas, Venezuela	Guatopo (122,464 ha), Macarao (15,000 ha), Avila (85,192 ha) National Park
Maracaibo, Venezuela	Perija National Park (295,288 ha)

Aqueduct Company saved more than $15 million in treatment costs in 2004 by investing in watershed improvement. **Colombia**'s capital, Bogotá, gets up to 70% of its water from the Chingaza system, 50 km east of the city. Water from the Guatiquía, Blanco, and Teusacá rivers collect in two large reservoirs: the Chuza and San Rafael dams. The integrity and quality of this system largely depends on conservation of the watersheds of Chingaza National Park. Examples of how PA ecosystems provide fresh water for human consumption in Honduras, Venezuela, Ecuador, Brazil, Bolivia, and Chile are noted next.

In **Honduras**, the cloud forests of La Tigra National Park (23,871 ha) provide over 40% of the annual water supply to the 850,000 people of Tegucigalpa (WWF-running pure).

Most of **Venezuela**'s fresh water comes from superficial sources (MINAMB/Fundambiente 2006). Cartaya and Pabón (2009) note that 33 of 43 National Parks protect important water sources that regulate soils and water run-off. Guatopo National Park supplies water to Caracas. Parks in the central western region provide water to agro-industry in the high western Llanos and the Valley of Quibor, in addition to supplying water to Barquisimeto and other cities nearby. Furthermore, in the Guayana region, national parks protect the sources of large rivers such as the Orinoco, Caura, and Caroní, which provide fresh water to cities such as Guayana and Bolívar. Andean PAs protect the rivers that supply drinking water to the region's main towns, as well as water for irrigation of Venezuela's largest horticultural production area.

Conservation of mountain-forest ecosystems can be the cheapest way of maintaining high quality water (the SEM scenario). The 1.5 million inhabitants of **Ecuador**'s capital, Quito, derive 100% of their water from Andean creeks and rivers originating in the Condor Bioreserve; 80% is derived from two PAs. The Bioreserve is a mosaic of PAs, farms, and indigenous territories, encompassing cloud forests, high altitude grasslands, rainforests, and innumerable creeks, lagoons, and rivers. To safeguard the fresh water that Quito depends on, the price of water service was reviewed to include the cost of watershed conservation (SEM). The FONAG water fund is being capitalized through a percentage of the water fees. It now produces $1 million yearly for conservation and community development projects in the watersheds (TNC 2008).

In **Brazil**, an interesting concept for pricing water has been developed by the Conservation Strategy Fund (CSF) in the Guapi-Macacu watershed (State Park Três Picos) near Rio de Janeiro.[61] The study estimates the protection costs of water resources in the park at about $318,000 — including land tenure disputes, guard salaries, a mix of training, equipment, fuel, and administrative costs, and other selected infrastructure needs. The cost of park protection adds only 1.18%, on average, to the rates currently paid. The average annual cost / person for headwaters protection is around 35 cents (US). Thus, if political will is available to move to sustainable water fees (the SEM scenario), at almost negligible individual costs, water users can secure their water supply, while simultaneously protect the ecological integrity of the TPSP (Strobel el al. 2007).

Water from PAs in **Bolivia** is an important ecosystem service. Prime examples are the Piraí River from the Amboró National Park, and the Tolomosa and Victoria rivers from the Sama Reserve and the Tunari National Park. The Piraí River receives 50% of its flow from Amboró and supports agro-industry in the middle watershed valued at $500 million per year. In Sama, 50% of the drinking water for the city of Tarija is provided by ecosystems of the Sama Reserve, which also provides 80% of the water supply for the San Jacinto system, which generates 25% of the electricity consumed in Tarija. Without adequate protection of the ecosystems of Sama, a decrease in water supply for the hydroelectric system under the BAU scenario may result in an annual loss on the order of $230,000. The forest ecosystems of the Tunari National Park supply fresh water to over a million people, most in the nearby city of Cochabamba. However, in all these PAs mentioned, management is below basic needs; this con-

61 The Strobel et al. (2007) study covers 5 key aspects: (1) estimating the cost of guaranteeing the hydrological protection afforded by the park, (2) estimating the park's contribution to water used by the main consumer, (3) defining the economic criteria relevant to the allocation of protection costs among consumers, (4) posing a proposal of three alternative pricing scenarios, and (5) developing a description of an institutional arrangement to govern the payment system.

dition can be considered to be BAU. All three PAs have large financial deficits; the resources provided by the government hardly cover 30% of the cost to adequately manage them. The PROMETA study notes that SEM is achievable in Sama, if for instance, the inhabitants of Tarija contribute $15/year, with an in-kind labor contribution by the rural population in the area (Escobar et al. 2009).

In **Chile**, a recent study (Figueroa 2008) notes that the fresh water service provided by the Valdivia forest (a defined Biodiversity Hotspot) consisting of 2,418,361 hectares was estimated at $16.4 m. It was also estimated that Valdivia's forest has a potential to benefit over 7 million people (1,984,280 families) in the area, including the population of the city of Valdivia and other communities settled in a ratio of 40 km around the PA. The study used $8.2 willingness value (Nunez 2006 in Figueroa 2009). Assuming that the Valdivia Protected Area is in SEM (depending on funding, level of threats, and management), the protected area is safeguarding ecosystems that represent a significant value to the local and national economy of Chile.

DISASTER MITIGATION AND PREVENTION

PA ecosystems retard run-off, slow flooding, reduce landslides, mitigate climate change, and help control pest outbreaks. Evidence regarding the potential avoided cost of infrastructure reconstruction or safety net rehabilitation resulting from the establishment, expansion, or consolidation of PAs is unavailable. Nevertheless, this strategic service is being recognized. For example, in Mexico, PAs have been established in four of the five regions most vulnerable to climate change effects (Bezaury 2009).

HYDROPOWER

Sedimentation and lack of water for hydropower is becoming a problem worldwide; PAs managed under SEM are part of the response to such threats, which also affect irrigated agriculture and potable water supplies. Water scarcity is now evident in the Andes, the Himalayas, and the Alps. Neither the economic effect of water shortages on hydropower output, nor its potential reversibility as BAU practices give way to SEM, have been quantified. Nevertheless, the transition from BAU to SEM, including PA management, is part of the solution; the transition makes sense in economic, social, and environmental terms. This point about PAs and hydropower is illustrated with examples from Peru, Venezuela, Mexico, and Costa Rica.

In **Peru**, approximately 61% of hydroelectricity is produced in eight plants using water from as many PAs, such as the Junin Reserve, which provides water to the Interconnected Hydroelectric Systems of Mantaro. All together, these eight PAs, currently under BAU, enable the production of 10.6 GW/hour with an estimated annual value of about $320.5 million (León 2007).

Cartaya and Pabón (2009) note that **Venezuela**'s hydropower potential is equivalent to the energy of 2.5 million barrels of oil per day (MPD 2005). About 73% of electricity generated in 2007 came from hydropower plants with catchments in national parks (EDELCA 2008). Maintaining BAU practices will eventually result in more significant water shortages and loss of hydropower. The government may potentially lose the estimated annual savings of $15 billion, the equivalent of 23% of the 2007 budget, excluding the cost of environmental impact prevention measures (Ministry of Energy and Oil 2009). The most important case is the Guri Dam at the Caroní River, the largest hydropower system in Venezuela, with an estimated potential of 25 GW. According to EDELCA (2004), the Caroní River that is part of National Park Canaima provides one third of the water of the Guri Dam. Without the protection afforded by this park, the value of hydropower production and the useful life of the dam would be significantly reduced.

In **Mexico**, a recent multi-sector estimate of the value of water from PAs commissioned by CONAGUA (National Commission for Water) assessed the economic value of water in relation to PAs. The study clarified the value of additional water provision from PAs for irrigation, hydropower, and municipal (domestic) use. It estimated the total value of additional water for municipal supply, irrigation, and hydropower is $293 million, shown in Table 10.10.

In terms of BAU and SEM, this study concluded that municipalities with relatively well-funded and well-managed PAs (SEM) have a significant advantage compared to those without PAs (BAU). Municipalities with PAs are 6.8% above the average water availability in aquifers, 7% above the average water availability for different municipal uses, and 5% above the average water availability for hydropower generation. Based on the current low water prices (BAU price), the annual value of the additional water provided by PAs to Mexican economy represents about $293 million.

Finally, in **Costa Rica**, transitions from BAU to SEM have resulted in more forest conservation and declining hydropower costs. Hydroelectric utilities are funding reforestation upstream of their plants to maintain regularity and quality of water supply (SEM). PES are made by power companies to villagers to maintain forest through an NGO, with additional funds coming from the government (World Bank/WWF 2003).

10.5 IMPORTANCE OF PROTECTED AREAS TO EQUITY AND POVERTY REDUCTION

PAs, primarily set up to conserve biodiversity, are now increasingly under pressure to deliver benefits to people and contribute to sustainable development by helping to improve equity and reduce pov-

Table 10.10. Values of Selected Water Uses in Mexico

Selected Water Uses in Mexico	Total Value (Million of Mex$)	PA Related Value (Million of Mex$)	PA Related Value (Million of US$, Exchange Rate 13:1)
Additional water, municipal public supply[1]	22,890	2,034	151
Additional water for irrigation agriculture[2]	12,711	889	66
Additional water for hydropower3	20,648	1,032	76
Total	56,249	3,955	293

Source: Bezaury and Pabón 2009.
Note: Municipal water consumption (2006) and electricity (2007), 2009 Mex$.
1 National Water Commission - CONAGUA. 2007. Water Statistics in Mexico. Mexico City. 260 pp. + 1 CD.
2 Galindo L. M. In prep. The Economics of Climate Change in Mexico. Consultancy Report, SHCP, SEMARNAT, and British Embassy. Internal document.
3 Department of Energy. 2008. Basic information 1995-2008: Commodities on electricity internal sales. http://www.energia.gob.mx/webSener/portal/index.jsp?id=71

erty. According to the CBD, "much of the evidence illustrating the association between poverty reduction and PAs remains anecdotal … there are many instances where the right types of PAs, when combined with the appropriate governance systems, have contributed — sometimes considerably — to the well being of the people who live in and around them (Secretariat of the Convention on Biological Diversity 2008).

In this report and chapter, equity is understood as the degree to which all people have access to economic, social, and political opportunities, and specifically to the distribution of costs and benefits between rich and poor. PAs may contribute to economic, political, and social equity. However, this desired condition is not always the case (see Box 10.4).

The influence of PAs on equity and poverty alleviation comes on two levels: locally, in the communities within or near to PAs, and, broadly, in the society at large. Engagement of nearby communities and other stakeholders is essential under SEM to assure that externalities are taken into account and that all affected parties are integrated into the planning and implementation process that can ensure a sustainable outcome. The integrated, participatory approaches typical of SEM are structured to develop equitable solutions; actions conducive to poverty alleviation generally emerge.

Assessing the effects of PAs on poverty is complex, requiring attention to a range of factors related to rural populations like income, livelihood security, access to infrastructure and markets, education, empowerment, gender, health, and access to natural resources. These factors exceed the scope of this section, which will focus on benefits from compensation for forest conservation (a kind of PES scheme), reduction of deforestation and degradation (REDD and REDD+), NTFP, and transfers from taxes. Income and job creation from tourism in PAs are discussed in Section 3.4. Selected evidence is presented on potential negative impacts on equity of limited or unequal distribution of benefits and costs of PAs.

Economic Benefits

PAs provide a range of services that increase access by local people to income-generating opportunities. This is particularly true of multi-use reserves primarily designed to protect people's access rights to resources and representing approximately 90% of terrestrial Pas (WCS 2007). There is limited evidence on actual outcomes in terms of attaining equity, conservation, and development goals. Two examples follow.

Payments for environmental services (PES): The Bolsa Floresta program in **Brazil**, conceived in the context of "Deep Amazon" populations, compensates indigenous people for conserving the forest. There are four components: (1) the Bolsa Floresta Familiar provides monthly payments of $22 to female-headed households that reside in PAs and commit to stop deforesting, (2) the Bolsa Floresta Asso-

BOX 10.4. PAs and Poverty Reduction

Adam el al. (2010) assessed the effect of PA systems on poverty in Costa Rica and Thailand (both shifting to SEM). In 2000, average poverty rates were higher near PAs in both countries, suggesting that PAs may have exacerbated poverty. However, analysis using methods to control for confounding factors indicated that despite the differences in Costa Rica's and Thailand's institutions, economic development trends, and PA system histories, there was no evidence that their PA systems have exacerbated poverty on balance in neighboring communities.

This conclusion does not imply that all segments, sub-districts, or poor households experienced poverty alleviation from PAs. The study measured the impact of PAs over decades; thus short-term effects vary. The poverty measures used do not represent all dimensions of social welfare. The study did not assess the ways in which PAs may have helped reduce poverty. Finally, Costa Rica and Thailand are not representative of all developing nations since both have experienced rapid economic growth, enjoy stable political systems, make substantial investments in their PA systems, and have strong eco-tourism.

ciação strengthens community associations within State PAs, funded at 10% of the amounts dedicated to female headed families, (3) the Bolsa Floresta Renda, which provides on average US $1,740/ community/ year (communities average 11 families), and (4) the Bolsa Floresta Social, which grants an average of US $1,740/community/year to cover improvements in education, health, communications, and transportation, as well as basic support for local forest guards. Bolsa Floresta began in 2008 with 4,244 families registered, of which 2,702 were eligible for the Bolsa Floresta Familiar (Viana 2008). This program is thought to increase equity by channeling PES funds to the neediest communities and households, but no evaluation of outcomes is yet available.

Table 10.11. Examples of NTFP in the LAC Region

Country	NTFP
Peru	In Manglares de Tumbes, NFTP generate $2.7 million / year to the local economy. NTFP in the tropical lowlands in the Peruvian Amazon are valued at $13/ha as contribution to the local economy. The total value of NTFP in the entire Peruvian Amazon has been estimated at $698 / ha.
Ecuador	Average annual value of wild species use in the Ecuadorian Amazon is estimated at $120/ha. Net value of the extraction of NFTP in Northern Napo is estimated at $1,250 to 2,580 / family / year.
Venezuela	Annual value of wild foods consumed in Venezuelan Amazon ranges from $1,902-$4,696 / family.
Panama	The estimated annual value of diverse NFTP harvests in the Coiba National Park is $1,480,000.

Source: León 2007

Non-timber forest products (NTFP): Though often overlooked, NTFP are a dependable source of food and income in rural areas that can have substantial economic value and foreign exchange earnings. International trade in some NTFP generates large returns for resource harvesters as well as others within the commodity chain. While difficult to establish firmly, the global value of international trade from NTFP has been estimated at $11 billion/year (FAO 2007). But, this benefit is seldom equitably distributed; rural communities in LAC usually receive only marginal benefits (yet, important to them). Examples of NTFP are widespread in LAC. However, with few exceptions, such as natural rubber in Brazil, and brazil nut in Bolivia and Brazil, benefits are low and, in many cases, based on short-term projects funded by international donors. This situation can be explained partly by limited domestic investment in NTFP and the resulting absence of national-level strategies to address opportunities and develop markets.

In the LAC region, PAs commonly overlap with indigenous and settler communities. In such cases, they can contribute not only to protection of forest that otherwise would be depleted, but also to income- generating programs based on sustainable NTFP use. The following examples illustrate the benefits from NTFP in PAs (adopting SEM practices) to local communities in Peru, Bolivia, and Brazil.

In **Peru**, the average value of harvested NFTP per household in rural Amazon communities was $1,658/year, some 57% of household income. Agricultural income averaged $1,169 (Gram et al. 2001).

In **Bolivia**, PAs generate an estimated total economic value of $387,228 (excluding tourism) in 19 NTFP projects in several municipalities (Escobar et al. 2009). The PA projects included farmed caiman skin in TIPNIS and Madidi; brazil nuts in Manuripi; organic honey in Tariquía, Amboro, and Pilón Lajas; and organic coffee in Madidi and Pilón Lajas. All these PAs are home to indigenous peoples. At least nine of the projects reviewed in this study involve and benefit 2,500 households, which include approximately 100 rural communities in PAs. In-depth studies of regional socio-economic outcomes have yet to be done.

In **Brazil**, extractive reserves have been seen as a controversial alternative to deforestation since their creation. By 2002, there were 16 extractive reserves encompassing 3.4 million ha with a population of 28,000. By 2010, the number of extractive reserves had almost doubled. NTFP in the Amazon generate 10% to 20% of regional income. Rubber[62] is still the leading NTFP in extractive reserves; 65% of the NTFP are subsistence components.[63] In general, NTFP contribute to economic equity around PAs, since most producers and beneficiaries are rural settlers and indigenous peoples on the low end of the socio-economic spectrum. Further examples of the value of NTFPs appear in Table 10.11; additional information on income-related benefits from PAs in LAC, compiled by the WWF, is found in Annex 10.4.

Transfers from taxes: PAs can generate, in some cases, important revenue for local governments from tax transfers. Such income can be directed to pro-poor investments and PA transitions from BAU to SEM. In **Brazil**, the Constitution mandates transfer of 25% of the revenue from the ICMS sales tax from State to local governments. Paraná State introduced an ecological criterion for the ICMS in 1992, later followed by 13 other States (half of the total). A new ICMS distribution system earmarked 2.5% of the total ICMS for allocation to municipal governments with watershed PAs and a similar amount for those with other PAs. These provisions act as incentives to create PAs and fund pro-poor programs (Grieg-Gran 2000).

Evidence from Rondônia and Minas Gerais provided by Grieg-Gran

62 Natural rubber extraction is still subsidized by the government with minimum prices above the market. Planted natural rubber is much cheaper. UNDP Brazil is currently launching a program to establish minimum prices for extracted products.

63 Deforestation Alternative: Extractive Reserves & NTFP. Presentation by Caitlin Everett and Tamara Mitchell et al. (2002).

(2000) indicates that the Ecological ICMS has potential to create incentives for conservation in counties with low average levels of value added and primary production. For example, in eleven counties in Rondônia, the value added and primary production of an area of land of 1,000 hectares would have to be at least 50 times greater than the current average, to generate more ICMS revenue by other mechanisms than establishing a PA. However, PA creation may not be financially attractive for all countries and states, particularly those that are economically better off, due to trade-offs among the different ways of accessing ICMS allocations (Grieg-Gran 2000). The Ecological ICMS works as an incentive to create PAs and increase revenue, but the transition from BAU to SEM can be accelerated if part of the ICMS transfers is used to improve management of existing PAs.

BOX 10.5. Empowerment

The Galapagos Co-management Institution consists of a tripartite arrangement uniting a local Participatory Management Board (PMB), an Inter-institutional Management Authority (IMA), and the Galapagos National Park (GNP). The PMB is made up of the primary local stakeholders while the IMA represents Ministers and local stakeholders.

PMB members present specific management proposals (e.g., concerning fisheries and tourism regulation), which are analyzed, negotiated, and decided by consensus. The consensus-based proposals are channeled for approval to the IMA and then to the GNP for implementation and control.

Political and Social Benefits

PAs can be associated with the empowerment of some of the most vulnerable members of society, in particular rural women, indigenous peoples, and marginalized rural communities. Involving stakeholders from all socio-economic levels makes for much more sustainable PA funding, governance, and management than do purely top-down arrangements.

Across LAC, women's participation in local organizations and projects has improved since PAs were established and community organizations involved in PA co-management. This situation can be beneficial to the individual, her household, and the community as a whole; employment of women, in comparison to employment of men alone, has tended to contribute more to economic and social development.

There is evidence across the region that as a result of participation in PA-related activities, women have better access to cash, jobs, property, and freedom of movement, as a result of PAs being established. This can lead to a positive impact because girls are more likely to be sent to school, women can work outside the home, wages are more similar to those of men, and, thus, women are less economically dependent. Also, they are more likely to take part in decision making within and outside the household. Indigenous peoples can be similarly empowered. Marginalized rural communities are often involved. These effects can be seen in cases from Bolivia and Ecuador.

Bolivia is a good example. After the establishment of Madidi National Park (NPM), with support of park authorities and international NGOs, various levels of community organizations emerged to participate in park management, and in several integrated conservation and sustainable development projects in the park and its buffer zone. In the eastern part of the park, these organizations were the NPM Management Committee, water management associations, local women's associations, and NTFP producer associations. These groups worked with 21 communities settled in the park's eastern buffer zone near the towns of Rurrenabaque, San Buenaventura, Tumupasa, and Ixiamas, promoting active participation of local women and youth. In addition, establishing the park promoted the strengthening and active participation of existing indigenous communities (e.g., Tacana people from Tumupasa) and many settler communities in decision making on natural resources management. These better-organized local entities were able to dialogue more effectively with local government regarding allocation of funds for 1997-99. During this period, the NPM was severely under-funded. Park employees barely managed to get paid, with months' delay. If sufficient funding had been available, the effects of the park's community-strengthening programs would have been much broader.[64] Nevertheless, the Indigenous Council of the Tacana People (CIPTA) raised its capacity to negotiate and improve projects with international donors operating in the area (e.g., GTZ and SNV) and to access funding administered by the local governments under the new Popular Participation Law.

In **Ecuador**, co-management of Galapagos National Park is another example. The park contains remarkable terrestrial and marine ecosystems and became, some years ago, the site of complex — at times — violent multi-stakeholder conflicts. Rapid economic and demographic change, the presence of unregulated industrial fishing, the emergence of high-value fisheries for Asian markets, state-imposed policy and regulations, and general non-compliance with the management plan of the Marine Reserve were all factors fueling those conflicts (BAU practices). In 1998, Ecuador passed legislation that introduced migration control within the country, created one of the world's largest marine reserves (130,000 km^2), prohibited industrial fishing, and established an institutional framework for participatory management. The creation of the Galapagos Marine Reserve was the fruit of a participatory planning process that produced the Park's management plan (Borrini-Feyerabend 2004 adapted from Heylings and Bravo

64 Experience of the Manager of the Madidi Conservation and Development Program, funded and implemented by CARE Denmark/Bolivia, 1977-1999. Flores, M, 2009.

2001). However, the participatory management plan has not been able to eliminate the violent stakeholder conflicts that persist to date, reflecting powerful economic and political interests (see Box 10.5).

Are PA Objectives Compatible with Poverty Reduction?

Many consider that the contribution of PAs to improve income in rural communities is an important element of poverty alleviation. Sustainable income generating opportunities with PES, NBT, and access to NTFP are among the mechanisms. But, comprehensive, in-depth assessment of the overall effects of PAs on income generation and distribution is lacking; the more limited studies available are promising but may comprose a favorably biasedsample.

In a recent global study of the contribution of PAs to poverty reduction, Dudley et al. (2008) reviewed different levels of linkage between PAs and the rural poor (WWF 2008). No linkage refers to protection as the core aspect; people are viewed as a threat. This scenario can be considered BAU. Indirect linkage takes into account the socio-economic development of people living around PAs. In direct linkage, people's livelihoods are recognized as being dependent on conservation. The direct linkage case can be considered SEM (indirect linkage would have to be seen case-by-case). Despite difficulty in showing that conservation and poverty reduction can be achieved simultaneously in specific PAs (direct linkage), the study provides clear evidence of the role of PAs in improving income, livelihoods, and, thus, well being. However, the study also notes that, in some cases, the creation of PAs has deepened poverty. The authors note that, while PAs are not a tool *per se*, they can deliver economic benefits under certain circumstances (Dudley et al. 2008).

Payments for ecosystem services (PES) may reduce poverty by making payments to rural poor populations, often those in upper watersheds. The extent of this poverty reduction depends on how many PES participants are, in fact, poor. Further, poverty reduction through PES relies also on poor people's ability to participate and on the amounts paid. Although PES programs are not designed for poverty reduction, there can be important synergies when program design is well thought out and local conditions are favorable. Possible adverse effects can occur where property rights are insecure or if PES programs encourage non labor-intensive practices (Pagiola et al. 2005).

The impact of PES programs is not necessarily positive, however. Two main concerns have been expressed. Landell-Mills and Porras (2002) warn that by increasing the value of currently marginal land, PES programs could increase the incentive for powerful groups to take control of these lands. This land grab might exacerbate conflict in situations where tenure is insecure and exclude the most vulnerable from the benefits of PES. A different concern is voiced by Kerr (2002): livelihoods of the landless poor — women, herders, and others who are non-participants in PES programs and who often depend on gathering NTFP from forests — may be harmed if PES conditions limit their access to forested land.

Tourism in PAs can generate or reinforce inequality in distribution of benefits, partly due to BAU practices. In **Belize**, the economic value and benefits of the multi-use Gladden Spit and Silk Cays Marine reserve (GSSCMR) were unknown. Besides tourists (international and domestic), a range of stakeholders benefit: communities, local fishers, and tour operators, all of whom enjoy increased income from employment and business opportunities. A recent study measured the net value (NV) of the benefits accruing to each group and provided an aggregate net annual value and a 25-year projection: $1.3 million and $13 million-$29 million, respectively (depending on the scenario and discount rate). The inclusion of non-use values increased the NV to $41 million-$93 million. In terms of distribution of economic benefits, it was estimated that international tour operators receive 71% and international hotel owners 5%, while Belizeans in local communities receive 24% of the total value measured (15.5% to the residents and 8.5% to fishers from the north of the country). This is a relative low percentage, especially since it is shared by a large number of people: 1,200 are estimated to split these benefits even though many communities are excluded from the benefit pool. It is assumed that local governments in the region enjoy significant tax revenue from income tax, sales tax (VAT), property tax, licensing, and concessions fees (Hargreaves-Allen 2009).

The evidence of localized PA-based ES presented in the previous sections — e.g., water, fisheries, NTFP, NBT — supports the assertion that the contribution of PAs to improve income in rural communities is an important element of poverty alleviation. However, in terms of opportunity costs — people may benefit from conservation, but do they give up more to get those benefits? — the question remains open. The examples reviewed by Papageougiou (2008) and Balmford (2002, 2004), Pet-Soede, Portela, Adam and others suggest not. Other studies are less encouraging about a positive connection between PAs and poverty reduction.

A different perspective is offered by Quintero et al. (2009), in a study of Andean watersheds at Moyobamba (Peru); this work serves to examine the effects of introducing PES schemes and PAs on conservation and poverty reduction. The town of Moyobamba (40,000 people) gets drinking water from the Rumiyacu and Mishquiyacu micro-watersheds; 61% of the area is still covered with native forest. Yet, the annual deforestation rate in the area is a staggering 4.2%. Most farm land is untitled and 42% of farmers cultivate coffee; productivity is low. The replacement of native vegetation by other land uses led to a 20% rise in drinking-water treatment costs. As a result, the Municipality declared the watersheds a Conservation Area. Switching to shade-grown coffee would significantly increase farmer economic benefits: introducing shade-grown coffee would require large initial investments, but could increase net present value (NPV) by 91%, compared to the traditional slash-and-burn practice. This high initial investment may be provided by urban water-users of Moyobamba. In contrast, tree plantations and living fences would reduce NPV by 62% and 11%, respectively, if farmers are not compensated.

This case makes clear that the question of whether PAs and poverty reduction are compatible depends on the way each component is carried forth. If poverty reduction includes protecting the income of farmers in BAU enterprises on lands they do not own via PES payments sufficient to support conversion to shade-grown coffee; then, yes, PAs and poverty reduction can be compatible. The issue, thus, is fundamentally a political one — whether to end BAU externalized costs, by what means, and at the expense of whom? In LAC, under BAU, solutions have most often been reached at the expense of the less prosperous, more disenfranchised communities of people.

Thus, in a few places where benefits and costs are thoroughly reviewed and addressed, it appears that PAs can make a contribution to poverty alleviation, in at least some cases, if political will to do so is incorporated into their governance and management. Whether the relatively localized evidence on this would hold for cases in other LAC countries remains an open question.

10.6 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Despite gaps in the data, the existing evidence on the economic value of the ecosystems services (ES) provided by PAs is compelling. Overall, PAs raise productivity in agriculture, fisheries, forestry, hydropower, and nature-based tourism (NBT), among other sectors. Further sector-based research is needed to quantify the economic benefits derived from PAs, including job creation, income, local and national tax revenues, and the role of PAs as drivers of foreign exchange earnings and investment —and on how these benefits are distributed. Meanwhile, on a general level, the evidence reviewed permits a number of conclusions.

THE TRANSITION FROM BAU TO SEM IS FEASIBLE.

Transitioning from BAU to SEM in PA management is affordable. BAU approaches have hidden costs in many of the reviewed cases (e.g., cases where BAU land use resulted in erosion in PAs and ultimately burdened downstream water users with high costs of sediment removal). Based on a broader conception of costs and benefits, SEM approaches can often be self-sustaining (as when funds saved from water treatment are used to prevent sedimentation). Thus, the shift from BAU to SEM practices can make economic sense. Some of the conclusions that follow illustrate the higher costs of BAU that justify accelerating the transition to SEM, though that transition process will require that appropriate, permanent resources be allocated to PAs to cover financial gaps (Section 1.2). This condition can be achieved if there is political will to increase PA budgets, diversify income sources, provide financial autonomy, and to introduce PA-oriented fiscal reform. Even so, SEM approaches will require that PA management entities address their capacity gaps related to cost efficiency, transparency, and accountability.

BARRIERS TO THE TRANSITION FROM BAU TO SEM FOR PAS ARE SIGNIFICANT.

Politicians, in the past, have seldom opposed creation of PAs in remote places where opportunity costs are low, especially when supported by international seed money. Creation of new PAs, however, is becoming more difficult as pressure increases on governments to deliver tangible economic and social benefits. Transferring funds from development to conservation becomes unattractive for policy makers in LAC countries.

Resource degradation under BAU, typically, offers immediate returns in the form of marketable products, tax revenues, or subsistence goods, among others. With its long-term perspective, SEM is often less easily exploited in the short term. The impact of ecosystem wear and tear under BAU practices may not be visible in the short run; for instance, extinction of species is the result of decades of accumulated neglect. Those actors focused on short-term gains can often "get away" with not addressing critical SEM priorities, despite damage to ecosystem functions.

There is often a play of interests around the tighter regulation of natural resource exploitation under SEM, as some BAU stakeholders see their access eroded (e.g, loggers) and others, better adapted to work under sustainable conditions, gain influence and access (e.g., sustainable tour operators). Limited participation of the private sector in SEM for PAs is a critical barrier that may require attention.

Lack of reliable financial and economic data to assess the economic benefits of PAs in most countries is another barrier. This information is indispensable in establishing effective dialogue with decision makers.

Forested PAs provide opportunities, though sustainable forest management (a SEM approach), to generate income from concessions, fees and taxes, and PES.

Concessions for controlled harvesting of timber or NTFP or for attending tourism; and collection of user fees and taxes on enterprise earnings; and generating income flows from PES for watershed protection, carbon sequestration, and other ES: these activities could make many PAs into self-sustaining revenue centers. Gaps in the legal and regulatory frameworks, obsolete fee and tax systems, and lack of integrated management under BAU means that these potential revenue streams remains largely untapped, representing a sizeable opportunity cost.

GROWING BIODIVERSITY AND ECOSYSTEMS MARKETS CAN PROVIDE SIGNIFICANT BENEFITS TO BUSINESS.

PAs supply ES that promote economic growth. The review work to develop this chapter found no data to suggest that investing in PAs (shift to SEM) is not a sound economic choice. PAs managed under BAU and SEM approaches contribute directly to economic growth and equity in the sectors covered: agriculture, fisheries, forests, hydrological resources, and NBT — as among other economic sectors. PAs contribute to productivity, jobs, tax revenues, and foreign exchange amounts. Healthy ecosystems and biodiversity in PAs help reduce operating costs in critical sectors such as water supply and hydropower, and help avoid the cost of disasters.

NBT businesses have been flourishing in conjunction with PAs. The Caribbean, Costa Rica, Guatemala, Panama, Peru, Ecuador, and Bolivia are good examples of countries where important economic benefits come from NBT. For instance, PAs in Peru generated an estimated $146 million of tourism-related economic activity in 2005. NBT is particularly beneficial to small business, including those in the informal service sector.

Agriculture and forestry have benefited from PAs. Many PAs, globally, are closely linked to agriculture. For example, a Cambodian rice project received a certification to market wildlife-friendly "Ibis Rice" (www.wcscambodia.org/conservation-challenges/communities-and-livelihoods/wildlife-friendly-products.html, accessed July 2010). The project provides communities with an incentive to engage in conservation by offering farmers a premium price for their rice if they agree to use wildlife-friendly farming techniques. These conservation agreements protect the rare water birds and other species that use the areas where the rice is grown.

LAC coffee plantations benefit from pollination services from forests in Costa Rica, Guatemala, Colombia, and other countries in the region. In Brazil, FONAs — a type of PA where forestry is permitted under appropriate management conditions — also illustrate the timber-based business potential of PAs. Likewise, water quality and water tariffs that include the cost of watershed protection are growing markets and business opportunities.

To date, biodiversity conservation is still seen, by many business, as a risk or liability. Traditionally, company business plans have focused on keeping the company in business (and barely complying with environmental standards), rather than focusing on developing and incorporating ecosystem-friendly business models that can increase revenue. In the past decade, as a result of the climate change debate and the global financial crisis, more firms are exploring biodiversity and ecosystem-friendly operational models. The success of the initial modest investments in SEM-based ventures will lead to continued growth, surpassing the market average, as has been seen in the renewable energy and ecotourism fields.

PAS DRIVE FOREIGN EXCHANGE EARNINGS AND LOCAL EMPLOYMENT, ESPECIALLY VIA TOURISM.

The role of PAs in NBT and in the tourism sector as a whole is now well established. Studies in Costa Rica, Venezuela, Ecuador, Peru, and Chile provide solid evidence of the link between PAs and the economic benefits of tourism. PAs provide continuous habitats with viewscapes, biota, exotic foods, fresh air and water, and cultural services, without which NBT would scarcely be possible.

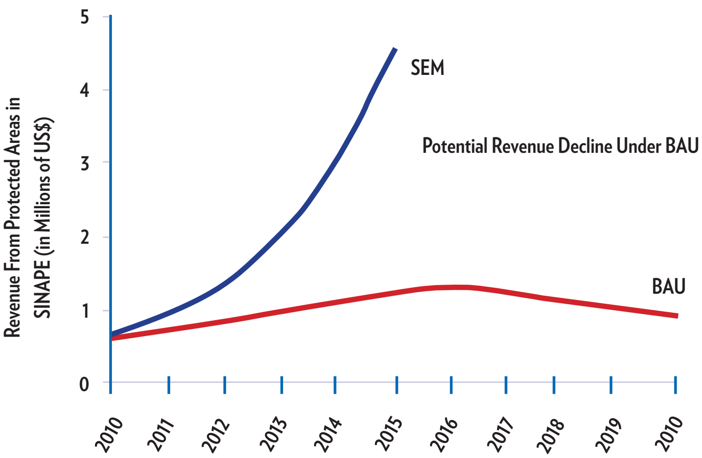
Tourism is a principle foreign exchange earner for LAC countries. This economic boon is more visible on small islands where there is a solid base of NBT. In Jamaica, Barbados, and the Bahamas, tourism accounts for 18%-35% of GDP and 37%-60% of exports. A recent study of 138 Caribbean PAs found that marine PAs (MPA) increase diving tourism in the region. In larger countries with more diversified economies, the contribution of NBT is lower but significant. In Bolivia, a total of 82,770 foreigners visited PAs (16% of foreign visitors) in 2007, when tourism netted about $292 million in foreign exchange.

Section 3.4 shows the creation of local job and business opportunities by NBT in and around PAs. In many places, NBT jobs have transformed economic backwaters into vibrant local economies. However, these service sector jobs can be low paid, seasonal, and localized, especially under BAU approaches to tourism.

With few exceptions, tourism in PAs is still poorly managed in the LAC region. This is alarming because BAU practices can seriously harm major tourism-rich PAs. For example, in Ecuador's Galapagos National Park, tourist numbers have expanded from 40,000 visitors in 1990 to 140,000 in 2006, putting great pressure on the natural resources. UNESCO and IUCN have formally declared the Galapagos National Park to be "in danger" from this tourism volume-based threat. The private tourism industry in the park contributes little to finance park management and has resisted implementation of a consensus master plan.

Studies show that introduction of sustainable tourism management in PAs can boost in revenues. For example, four national parks in Peru (Huascarán, Paracas, Tambopata, and Titicaca), currently under BAU practices, generate some $600,000 annually. If there is no shift to SEM, that figure may rise to $1.2 million, with a high potential to decline due to wear and tear. With a shift to SEM, however, revenue could increase to $4.3 million annually in five years (León 2010). This is illustrated in Figure 10.4.

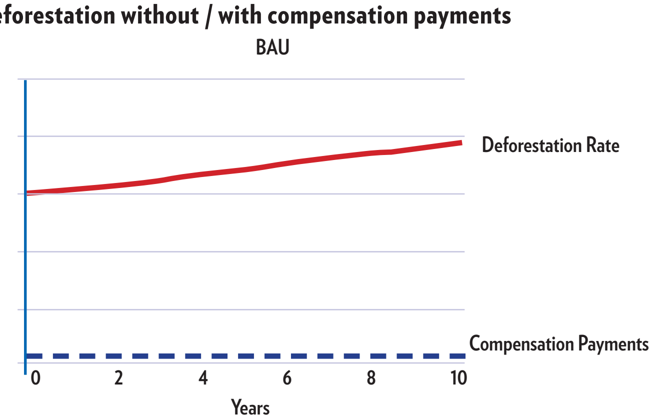
Figure 10.4. Potential growth of tourism revenue from PAs under BAU and SEM in Peru.



THE BENEFITS OF PAS ARE NOT EQUALLY DISTRIBUTED.

PAs under SEM can facilitate more sustainable and equitable natural resource management, as in the case of indigenous PAs in Brazil. Indigenous and rural people living in and around PAs have often been isolated or only partly incorporated into economic activities. These populations have low incomes and limited access to basic services. PA creation under BAU may exacerbate poverty as a result of opportunity costs (at local government and individual levels) and partial loss of access to natural resources (e.g., firewood, game, building materials). In the case of PA systems in transition to SEM, a study of their impact on poverty in Costa Rica and Thailand concluded that there was no evidence that they had exacerbated poverty in neighboring communities (Adam et al. 2010). Furthermore, no evidence has been found of human settlements in and around PAs having experienced major loss of access to natural resources; nor did this study find evidence that creation of PAs increases marginalization and poverty of rural communities on balance, though some individuals or groups may lose, while others gain.

Figure 10.5. BAU vs SEM: deforestation without / with compensation payments



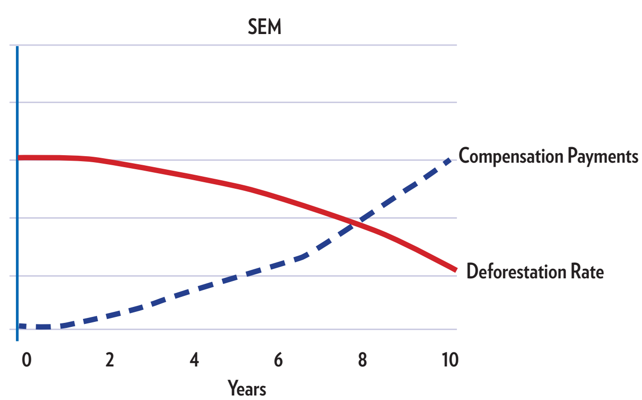
Much evidence shows that PAs generate benefits to local people, particularly when they are able to access mechanisms to receive PA benefits like participation in programs related to sustainable use of biodiversity resources, PA management (patrolling), or NBT. However, in some cases, PA benefits have not been evenly available to local residents. Thus, there are winners and losers. The losers, whose economic situation may worsen after the establishment of PAs, lack access to mechanisms by which PAs deliver benefits. Some national or local governments have failed to undertake compensating measures to avoid the potential negative effects of establishing PAs (e.g., training, subsidies, etc.). These are essentially political questions — who shall bear the costs — hidden under BAU, which need to be worked out transparently and accountably under SEM? In general, PA stakeholder involvement, empowerment of local actors, and transparency are keys to success in SEM, especially in transitioning toward this pro-ecosystem approach.

PAS UNDER SEM CAN CONTRIBUTE TO EQUITY AND POVERTY ALLEVIATION.

Local people, typically, access training and employment in the PA (e.g., guarding, mapping, boundary marking, upgrading infrastructure, outreach). They may also become involved in income-generating opportunities with regard to the PA and its visitors (as guides, ecotourism service providers, and as purveyors of food, crafts, souvenirs, and other items). They may also work exploiting concessions for timber, NTFP, visitor services, and other opportunities. Still, more people may be involved via tourism enterprises.

There are many examples of PAs contributing to the well being and improved equity of rural peoples by providing job opportunities and increasing seasonal income, particularly in NBT and through NTFP (like rubber and brazil nut in the Amazon). In addition, there are innovative PES mechanisms like Brazil's Bolsa Floresta program that pays indigenous households and hamlets to conserve the Amazon forest. This program began in 2008 with 2.702 families eligible to

Figure 6 SEM: Deforestation decrease as a result of compensation payments



receive "Bolsa Floresta Familiar" subsidies of $22 per month to female-headed households who reside in conservation units and commit to stop deforesting. Villages receive support for forest guards and other aspects. It is expected that in time, these PES will reduce or eliminate both deforestation and endemic poverty. The contrasting BAU and SEM scenarios are illustrated in Figures 10.5 and 10.6.

Establishing PAs can generate short-term negative impacts when potential social, economic, and environmental effects have not been fully assessed. This was the case of St Lucia's Sufriere MPA (ICRAN et al. 2005), where introduction of no-catch zones required that 35% of the fishing grounds be placed off limits, thereby allowing fisheries to rebound and attain higher sustainable yield levels. This action imposed a transitory cost on local fishers in the form of reduced catch and additional fuel cost to reach new catching areas. Transitional support policies to mitigate the losses incurred by the most vulnerable participants during the switch from BAU to SEM need to be part of any transition plan.

The creation of PAs, depending on the category, may result in losses to local communities who find their historical access to resources becomes limited. This is one of the externalized costs that characterize BAU. Conflict with such mistreated communities can be costly down the line, or even lead to the failure of the PA.

ECONOMIC BENEFITS FROM PAS AND COST REDUCTIONS FROM SEM JUSTIFY INCLUDING EXTERNALITIES.

Negative externalities may result from many activities in PAs under BAU; in other cases, PAs may be favored by externalities, which may become the basis for PES. In the context of the transition to SEM, the assumption of externalities and their valuation is a critical step. For example, for hydropower generation in river basins from PAs, the externality factor might be downstream siltation from visitor use or overuse of the PA. The cost of correcting this at the power plant could be specified in units of a 1000th of a dollar per kWh. If such a small unit is applied to large hydropower market and the revenues partly allocated to watershed protection in the PAs, this policy would generate a substantial flow of PES funding. Under SEM, with better control of soil disturbance in the PA, the amounts required would decline.

SEM SECURES HIGH QUALITY AND QUANTITY OF WATER RESOURCES FROM PAS, INDISPENSABLE TO MAINTAINING PRODUCTION LEVELS AND SAVINGS IN IRRIGATED AGRICULTURE, HYDROPOWER, AND POTABLE WATER.

Perhaps the most quantifiable contribution from ecosystems in PAs is high-quality fresh water supplies, low in sediments that clog infrastructure. SEM management of PAs is essential to sustain productivity and generate millions of dollars in savings by avoiding sediment removal costs.

Irrigation: The cases of Colombia, Peru, and Venezuela show that PA ecosystems are important to irrigated agriculture. For example, the Colombian National Park System feeds four of the six most important water systems in the country; 12 major agricultural districts use water from the parks to irrigate some 200,000 ha. Water supply in the Córdoba and Tolima districts depend on sources from Paramillo and Las Hermosas natural parks. These districts account for 37% of Colombia's rice production (FAO 2010), valued at $193 million in 2000. In Peru, the annual value of agricultural production in irrigation districts linked to PAs has been estimated at $514 million. In Venezuela, around 20% of the area under irrigation (450,000 ha) depends on national parks.

HYDROPOWER: SEM CAN SECURE SUFFICIENT WATER FLOW AND SAVINGS (AVOIDED REPLACEMENT COSTS) IN HYDROPOWER DAM OPERATIONS.

There is solid evidence from Venezuela, among other countries, where about 73% of electricity generated in 2007 came from hydropower plants with catchments in several national parks. The impact of maintaining PAs under BAU practices may be significant: the government may lose the current savings (compared to thermal generation), estimated at $15.2 billion annually, equivalent to 23% of the country's 2007 budget — and that excludes the cost of environmental impact prevention measures.

The Guri Dam at the Caroní River basin, the largest hydropower system in Venezuela, is a case in point. In the 1990s, the benefit derived from watershed protection for the Caroní River basin's hydroelectric production was assessed in a detailed cost-benefit analysis (Gutman 2002). Studies showed that power generation by this hydroelectric system would be reduced by about 10%-15% by silting, if moderate deforestation occurred. The hydroelectric system has an expected life of 60 years, and the loss of power generation would occur by the dam's midlife. The cost of recovering the capacity lost in this (BAU) scenario is illustrated in Figure 10.7. The replacement investment would need to be built between year 25 and 29 to be ready in year 30, at an estimated cost of $90 million to $134 million.

Water consumption: Water supply to millions of people in large cities in the region comes from PAs, for example, the capitals of Colombia, Brazil, the Dominican Republic, Ecuador, Venezuela, and Costa Rica. Under SEM, users could secure their supply at near-negligible individual cost, while simultaneously protecting the watershed — if political will is available to move to sustainable water fees. However, this ecosystem-based water benefit is at risk. In Venezuela, for instance, national parks sustain production of 530 m^3/sec, covering the water needs of over 19 million people in urban centers and small towns. However, under current BAU practices, water from the parks may decrease by 10% to 30% over the next 20 years (Figure 10.8).

Caracas water sources, for example, lose capacity at an estimated 0.5% annually, a reduction of 0.135 m^3/sec. At current marginal costs, Caracas will need to invest, on average, $13.5 million yearly in new water sources just to keep up with the loss in supply under BAU. Shifting to SEM would be cheaper.

Further evidence is provided by the case of water supply from the Chingaza National Park in Colombia, where the Bogota Water and Aqueduct Company (EAAB) will soon reap the benefits of investing in watershed protection (SEM). A four-year conservation effort by EAAB will pay off by saving part of the $4.5 million annual sediment removal cost incurred under previous BAU practices (GEF 2010). Without SEM, costs of sediment removal would continue to escalate. Figure 10.9 illustrates the BAU and SEM scenarios.

A great deal of work has been done on the value of water resources in terms of human consumption. Data from Chile, for instance, indicate that the fresh water service provided by the 24,000 km^2 Valdivia forest (a designated Biodiversity Hotspot) is worth $16.4 million yearly. This PA has potential to benefit 7 million people. In Brazil, the Guapi-Macacu Watershed, partly within the Três Picos State Park, supplies half of the region's 1.7 million residents, with an average annual cost of $0.35/person for headwaters protection.

MARINE AND FRESHWATER PROTECTED AREAS CONTRIBUTE TO GROWTH THROUGH BIODIVERSITY CONSERVATION.

Marine reserves contribute to increases in biodiversity and renovation of depleted fisheries that are associated with large increases in fisheries productivity. This SEM approach has increased income and jobs to local populations, as well as to industrial fishing fleets. In Brazil, an important fresh water fishery for the currently endangered pirarucu has led to establishing extractive reserves to implement community-based fishery management.

Recommendations

RESEARCH AND INFORMATION MANAGEMENT

- Assess (1) investments required to achieve SEM, including definition of SEM targets for PA systems, (2) priority areas for investment in PAs that could lead to cost-savings in other sectors, (3) existing subsidies to BAU practices that are perverse and develop strategies to progressively phase them out, and (4) the feasibility of developing new PAs to improve ecological representation on a national or regional scale. Stakeholders should be engaged at all levels.

Figure 10.7. Cost of maintaining hydroelectric power capacity (BAU)

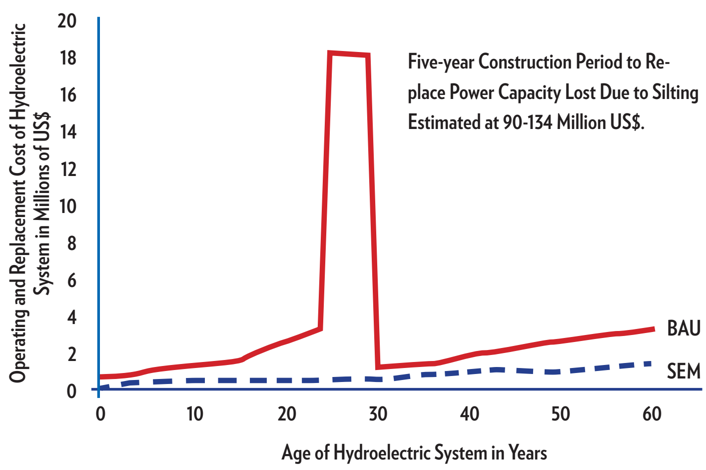


Figure 10.8. Potential decline in water supply from PAs under BAU in Venezuela.

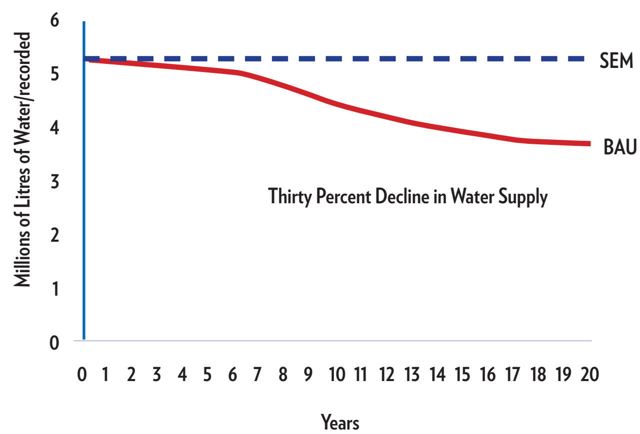
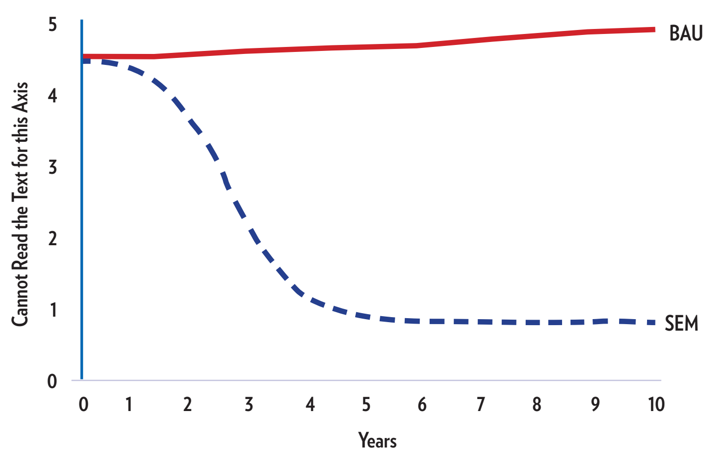


Figure 10.9. Potential decline in water supply from PAs under BAU in Venezuela.



- Determine the options for environmental fiscal reform and innovative PES financing to close the financial gaps of PA systems.

- Introduce more systematic and socio-economically rigorous valuation of PA benefits and costs, including stakeholder participation; introduce a focus on the marginal benefit of moving from BAU to SEM, and consider opportunity cost and distribution issues.

- Establish a SEM Information Management System for PA systems to provide a timely flow of sector-level information to decision makers (public and private) on matters such as ecosystem health, progress toward SEM targets, and the economic impact of PAs under SEM. Link these findings to a regional economic and sustainable development platform, such as the UN Economic Commission for Latin America and the Caribbean (ECLAC) to facilitate information sharing, regional coordination, and decision making.

PA POLICY AND FINANCE

Based on the assessments described here,

- Identify needs for consolidation of existing PAs and creation of new ones; this effort should result in a proposal that considers ecological representativity, opportunity costs (including positive externalities such as carbon, water, genetic resources, and visitation), distribution of benefits, and PA management costs and finance mechanisms.

- Provide for stakeholder participation in PA planning, implementation, and monitoring. Above all, PA systems should include those PAs that provide critical ES to support both national economic growth and local development.

- Adopt policies, consultation procedures, and investment programs to minimize the potential negative impact of new and existing PAs. Such policies will provide, for example, involvement of national and local stakeholder groups, temporary income compensation when establishing seasonal bans and no-take areas, resettlement compensation where required, and transparent mechanisms to access PA benefits. Addressing such distribution issues will, in turn, directly affect local and national support for conservation, with implications for those ES that provide national benefits.

- Introduce systems to include the benefits and costs associated with natural capital in the national accounts system.

- At the national level, introduce a results-oriented financial management policy for PAs, addressing three areas: (1) making clear the links between PAs and economic growth, (2) ensuring and increasing diversified funding streams, and (3) building capacity to adequately manage funds. It is essential that PAs work to define realistic financial needs, based on results-oriented programs that link costs with both biodiversity conservation and economic growth goals.

- Implement a phased, multi-sector national strategy on environmental fiscal reform (EFR), including opportunities to end externalities, based on the findings of the assessments outlined earlier. EFR will require strong commitment from public and private sectors, and will address, in a balanced manner, the financial needs of local governments, communities in and around PAs, and PA funding. The multi-sector strategy would target various sectors simultaneously (e.g., water supply, energy, and mining) and will be introduced in an incremental manner, to avoid shocks and to distribute responsibility and financial contributions widely. Examples of such policies include improved water and energy pricing, ecological taxes, pollution fees, carbon caps, and forestry royalties.

INSTITUTIONAL (PUBLIC AND PRIVATE)

- Establish a ministerial-level coordination mechanism to advance the introduction of a new ecosystem-based PA management policy with strong involvement of the private sector and other stakeholders. This mechanism will link with the creation of an Intergovernmental Platform on Biodiversity and Ecosystem Services, called for in the Joint Statement of the G8/G20 Summit in Canada in June 2010.

- Assess needs for national institutional and administrative reform. To be sustainable, SEM will require a strengthened institutional environment. The durability of SEM depends on shared public and private sector commitment, and on shared accountability for maintaining healthy ecosystems and biodiversity. PA agencies could benefit from multi-sector shared responsibility for PA management costs. Co-managed and co-funded operations would involve key areas, among them environment, tourism, industry, fisheries, agriculture, energy, water and sanitation, and employment. Under BAU, sectors that use ES, such as tourism, agriculture, energy, water, fisheries, and industry, are sharing neither responsibilities nor costs.

- Continue to formulate PA system financial strategies and business plans with private sector support, to facilitate implementation of EFR, and the use of portfolios of diversified revenue mechanisms; and, also, to introduce business development units in PA agencies to be responsible for assessing and communicating the value of the contribution of PAs to these financial strategies and business plans. Peru's MINAM has taken initial steps in this direction by establishing the Directorate for PA Economic Valuation in 2009.

ANNEXES

Annex 10.1. Threats to Freshwater Ecosystems and the Possibility of Prevention by Protected Areas

Threat to fresh-water ecosystem	Description/Cause	Origin: Local	Origin: Catchment	Origin: Extra-catchment	Place-based solution for pro-active protection?
Direct habitat alteration	Degradation and loss	X	X		Local-to-catchment management
	Fragmentation by dams and inhospitable habitat segments	X			Protected rivers or river reaches
Flow alteration	Alteration by dams	X	X		Protected rivers or river reaches
	Alteration by land-use change		X		Catchment management
	Alteration by water abstraction	X	X		Abstraction prohibited or managed for priority systems
Overharvest	Commercial, subsistence, recreational, and poaching	X	X		Fishery reserves
Contaminants	Agricultural runoff (nutrients, sediments, and pesticides)		X		Catchment management
	Toxic chemicals including metals, organic compounds, and endocrine disruptors	X	X		Catchment management; local prohibitions against point-source discharges
	Acidification due to atmospheric deposition and mining			X	None
Invasive species	Altered species interactions and habitat conditions resulting from accidental and purposeful introductions	X	X		Preventing introductions to systems with natural or constructed barriers to invasion
Climate change	Results in changes to hydrologic cycle and adjacent vegetation; affects species ranges and system productivity			X	None (except maintaining dispersal opportunities and thermal refugia)

In nearly all cases where both local and catchments origins are listed, local stresses are transferred downstream to become catchment impacts elsewhere.
Sources: Information drawn from Brinson and Malvarez 2002; Bronmark and Hansson 2002; Malmqvist and Rundle 2002; and Tockner and Stanford 2002

Annex 10.2. PAs and Crop Genetic Diversity in Selected LAC countries

Country	Protected area	Link to crop wild relative (CWR) and landscapes
Argentina	Nahuel Huapi National Park, IUCN Category II, 475,650 ha	The oldest (established in 1934) national park in Patagonia, the reserve contains potato CWR (Solanum brevidens and S. tuberosum)
Bolivia	Madidi National Park, IUCN Category II, 1,895,750 ha	The Pampas del Heath in northern Bolivia and south-eastern Peru is the largest remaining undisturbed Amazonian grassland plain. Approximately two-thirds of the Bolivian pampas is located within this park. A wild pineapple (Ananas sp.), which may be the ancestor of the cultivated pineapple, is common in the Pampas. Bolivian National Parks have also been surveyed for in situ conservation of CWR, including potato and peanut (Arachis spp.) species
Costa Rica	Corcovado National Park, IUCN Category II, 47,563 ha	This park in the south of the country is a genetic reserve for avocado (Persea americana), "nance" (Byrsonima crassifolia) and "sonzapote" (Licania platypus)
	Volcán Irazú National Park, IUCN Category II, 2,309 ha	Located in the central highlands of Cartago province, plant species include populations of wild avocados and avocado near relatives P.schiedeana
Ecuador	Galápagos Islands World Heritage Site, 766,514 ha (terrestrial area)	The Galápagos Islands are likely to contain important genetic resources, but, in general, these species have yet to be investigated. One notable exception is the endemic tomato (Lycopersicon cheesmanii) which has contributed significantly to commercial tomato cultivation by improving survival during long-distance transport. In a survey of tomato populations in the Galápagos Islands, several populations of L. cheesmanii reported 30–50 years earlier had disappeared, mostly as a consequence of human activity, highlighting the need for active conservation of CWR at this site
	Sangay National Park, IUCN Category II, 517,725 ha	This park in central Ecuador is considered "an enormous genetic reserve, and surely a source for wild relatives of crops and potentially valuable medicines"
Guatemala	Mario Dary Rivera Protected Biotope, IUCN Category III, 1,022 ha	After more than 50 years, the rare pepper, Capsicum lanceolatum, was rediscovered in a virgin remnant of the Guatemala cloud forest, preserved as habitat for the resplendent quetzal (Pharomachrus mocinmo).
	Sierra de las Minas Biosphere Reserve, IUCN Category VI, 94,796 ha	This mountain range in eastern Guatemala contains several species of Solanaceae that "represent potential germplasm resources of food plants, including local varieties of tomatoes"
Mexico	Sierra de Manantlan Biosphere Reserve, not categorised on WDPA, 139,577 ha	The existence of Z. diploperennis and other CWR is likely to be due to the traditional agricultural practices of slash-and-burn cultivation (coamil) and cattle-ranching
	Sierra Norte de Oaxaca Community Protected Natural Areas, not on WDPA	WWF has helped create community PAs in Mesoamerican pine-oak forest in Sierra Norte of Oaxaca, a known centre of potato diversity. Ixtlán de Juárez protects 9,000 ha of pine-oak, cloud, and tropical forests; Santa Catarina Ixtepeji protects 4,225 ha of pine-oak forest; Santa María Yavesía protects 7,000 ha of pine-oak forest; and four communities of the Union of Zapotec and Chinantec Indigenous Communities (UZACHI) protect 12,819 ha of pine-oak, cloud, and tropical forests. The area protected is expanding rapidly. During the past two years, an additional 18,970 ha of community PAs have been established in San Francisco La Reforma I (670 ha), Santa Sociedad Río Grande Teponaxtla (3200), San Francisco la Reforma II (2500) Cruz Tepetotutla (4600), San Antonio del Barrio (2200), San Pedro Tlatepusco (2300), and Nopalera del Rosario (3500)
	Montes Azules Biosphere Reserve, IUCN Category VI,331,200 ha	Montes Azules is located in the state of Chiapas in southeast Mexico. It is one of the largest areas of humid tropical forest in Mexico and Central America, containing some 500 species of trees, including wild avocados
	Pico de Orizaba National Park, IUCN Category II, 19,750 ha	Pico de Orizaba includes populations of the wild avocado (P.americana)
Paraguay	Mbaracayú Reserve, IUCN Category IV, 1,356 ha	A USDA/Paraguay project is researching herbarium and museum records and other species inventories to determine geographical locations of CWR in Paraguay and especially in its PAs. The objective is to use the data to create or revise management plans within existing PAs and recommend sites for new PAs in CWR "hotspots"
Peru	Bahuaja Sonene National Park, IUCN Category II, 1,091,416 ha	Bahuaja Sonene protects the Peruvian area of Pampas del Heath. The park home to Peru's largest population of Brazil nut (Bertholletia excelsa) trees, over 30,000 ha, and protects a number of native fruits, including wild pineapple and guava (Psidium sp.)
	Manú National Park, IUCN Category II, 1,716,295 ha	The lowland floodplain forests of the Manú River harbor a number of commercially important or potentially important fruit trees like cacao (Theobroma cacao) and "sapote" (Quararibea cordata); It has been suggested that the forests of Manú "probably include a disproportionate number of the general region's economically important plants, and they are exceptionally important to maintain germplasm for future programs of genetic improvement"

Source: Stolton et al. 2006

Annex 10.3. IUCN Protected Area Management Categories

CATEGORY Ia. Strict Nature Reserve: protected area managed mainly for science. Definition: Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.

CATEGORY Ib. Wilderness Area: protected area managed mainly for wilderness protection. Definition: Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.

CATEGORY II. National Park: protected area managed mainly for ecosystem protection and recreation. Definition: Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

CATEGORY III. Natural Monument: protected area managed mainly for conservation of specific natural features. Definition: Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.

CATEGORY IV. Habitat/Species Management Area: protected area managed mainly for conservation through management intervention. Definition: Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.

CATEGORY V. Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation. Definition: Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

CATEGORY VI. Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems. Definition: Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

Annex 10.4. Examples of Economic Contributions of Protected Areas to Poverty Reduction in the LAC Region

Country, HDI ranking & GDP/capita*	Name of protected area and details**	Contribution to economic dimension of poverty reduction
Guatemala HDI rank:118 GDP/cap: $4,313	Maya Biosphere Reserve (2,112,940 ha, MAB, 1990), including the Tikal National Park and World Heritage Area, Laguna del Tigre National Park and Cerro Cahuí Protected Biotope.	The Maya Biosphere Reserve provides employment for over 7,000 people in the Petén region of Guatemala and generates an annual income of approximately $47 million. The reserve is credited with close to doubling local family incomes. 5% of net earnings from ecotourism goes to local people and is invested in community projects such as handicraft production and local schools. Women are an important target group for these projects.
Bolivia HDI rank: 115 GDP/cap: $2,720	Kaa Iya del Gran Chaco National Park and Integrated Management Natural Area (3,441,115 ha Category IV, established 1995).	A $3.7 million program that included a $1 million trust fund, has been created to support the national park. $300,000 is earmarked for strengthening indigenous organizations, about $700,000 for pilot sustainable production activities and $1.5 million to support land titling for indigenous territorial claims by the Guaraní-Izoceños, the Chiquitanos and the Ayoreodes.
	Eduardo Avaroa Reserve (714,845 ha, Category IV, established 1973).	About 25% of the park revenue should go to the local Quetena communities, although in reality it would seem that less than that amount is actually transferred.
Ecuador HDI rank: 83 GDP/cap: $3,963	Awa Indigenous Protected Area (101,000 ha, Category VI, established 1988).	There are 4,500 Awa living in 21 communities. They manage their protected area for sustainable timber. While timber intermediaries paid $60/m3 for sawn “chanul,” the Awa Forestry Programme sells its product for $240/m3 (anticipating production of 200 m3/year, therefore a total of $48,000/year). Of the $240, $60 goes to external costs, $60 goes to community members who worked on the extraction and the remaining $120 is a stumpage fee to the community (or family).
	Cuyabeno Reserve (603,380 ha, Category VI, established 1979).	For five communities in the reserve, per capita annual income from ecotourism has been estimated at between $80 and $175. In Playas (which is situated inside the reserve) the wage for permanent employment at the Flotel Hotel is about double the average for local daily wage.
	Galápagos Marine Reserve (13.3 M ha, Category VI, established 1996), includes the Galápagos National Park (799,540 ha, Category II, est. 1959).	The area was also designated as a World Heritage Site in 1978; some 16,000 people inhabit five of the Galápagos islands, and because of better economic opportunities population growth continues by immigration from the mainland. Annual revenues from tourism which supports 80% of the islands’ residents amount to $60 million.
Peru HDI rank: 82 GDP/cap: $5,678	Manu National Park (1.5 million ha, Category II, established 1973).	Accommodation for ecotourists provides an estimated $500,000 per annum to the local indigenous communities living in and around the park.
Brazil HDI rank: 69 GDP/cap: $8,195	Mamirauá State Ecological Station, 1,124,000 ha, Category Ia, established 1990).	An Economic Alternatives Programme started in 1998 targeted 10,000 people living in five villages in the area. Subsequently incomes have increased by 50% and in some areas by 99%. Infant mortality has declined by 53% with better health education and water quality.
Trinidad & Tobago HDI rank: 57 GDP/cap: $12,182	Matura (8,200 ha, Category II, established 1990. Designation unclear).	It is estimated that income generated from turtle-viewing in Matura averages $28,572 per season, between March and August. This income is managed by the community.
Mexico HDI rank: 53 GDP/cap: $9,803	El Triunfo Biosphere Reserve (119,177 ha, Category VI, declared a Man and Biosphere Reserve in 1990)	Household income has increased by between 50-125% thanks largely to agroforestry activities.
Costa Rica HDI rank: 48 GDP/cap: $9,481	Tortuguero National Park (18,946 ha, Category II, established 1975)	In 2003, direct income to the Gandoca community (situated 125km from the Park) was about $92,300; 6.8 times more than the potential income from selling turtle eggs on the black market. Each local tour guide in Tortuguero earned on average $1,755-$3,510 in a five month period; this is two to four times the minimum wage. Overall, about 359 jobs have been generated by ecotourism. In addition, a local high school, clinic, and improved water and waste treatment were set up due to revenue from the park.

* All GDP figures are taken from UNDP 2006

** All protected area data are taken from UNEP WCMC World Database on Protected Areas unless stated otherwise.