CHAPTER 8.
FORESTRY

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8.1. INTRODUCTION: FOREST RESOURCES, DEVELOPMENT, AND SUSTAINABILITY

The Latin America and Caribbean region (LAC) is home to the world's largest rainforest the most biodiverse biome on earth. There are also many other kinds of tropical forests, temperate forests, savannas, and semi-arid biomes, each critical for biodiversity conservation. This ecologically rich set of forests has extraordinary potential to provide ongoing ecosystem services (ES) of economic significance, including water, food, wood, fiber, carbon sequestration, non-timber forest products (NTFP), and tourism destinations, as well as erosion control, flood mitigation, water purification, pollination, waste assimilation, and disease regulation.

Box 8.1. Sustainable Forest Management

"Sustainable forest management … aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations. It is characterized by seven elements: (i) extent of forest resources; (ii) forest biological diversity; (iii) forest health and vitality; (iv) productive functions of forest resources; (v) protective functions of forest resources; (vi) socio-economic functions of forests; and (vii) the legal, policy and institutional framework."

Source: UN 2008

Despite the many links between forests and human welfare, current patterns of forest use are largely unsustainable. Extraction rates exceed the capacity of these forests to regenerate. Conversion of forest lands to other uses frequently involves lands that cannot sustain those uses and are soon abandoned, reverting to degraded forest. These approaches do not realize the long-term potential of forest-based ES to support income generation, development, and social equity, through the potential of the forests to sustain themselves.

The loss of forests is clearly visible and staggering. However, its far-reaching impacts have yet to be fully acknowledged. There is a direct correlation between loss of forests and reduction of critical ES. If current degradation trends continue, the decline of ES availability for the following decades will affect a higher proportion of low income rural communities (MA 2005). These communities, isolated from cities and markets, are directly dependent on biodiversity and other forestry resources for their wellbeing. Growing populations will raise the demand for forest products in LAC countries. Existing natural areas will continue to be threatened, further reducing options for those economic activities dependent on forests.

Traditionally, extraction of forest resources has occurred in unsustainable forms, primarily for rapid monetary gain. Due to concerns by environmental groups and buyers of forest products, forest management has been evolving to address ongoing depletion of natural forests and loss of ES. Alternatives to traditional forest management can balance conservation with local development, while

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still providing revenues to forestry firms and the region. Sustainable forestry (see Box 8.1) is dependent on management approaches that consider environmental sustainability and social responsibility, as well as continued economic returns. Examples include sustainable forest certification and adoption of improved harvesting practices such as reduced impact logging (RIL).

As natural resources are depleted, the value of biodiversity and ES increases, fostering innovative business models for NTFP, carbon markets, and payments for environmental services (PES). These business models combine natural resource conservation with economic and social development, engaging many stakeholders, from local communities to private and public entities.

This chapter will compare the costs and benefits of using forests under current Business-As-Usual (BAU) approaches, with those from a Sustainable Ecosystem Management (SEM) approach. [23] BAU is characterized by unsustainable forest exploitation, leading to natural resource depletion and deterioration of local economies. This type of resource use is often followed by land-use change, for example to "slash and burn" agriculture and extensive cattle ranching. Negative impacts of forest resource use are externalized.

In contrast, Sustainable Ecosystem Management (SEM) refers to forestry practices that take into account all the effects of resource use and pursue positive overall results on all sides. This SEM approach includes sustainability of the resource use, respect for the rights of people living inside or close to forests, and fair distribution of benefits from the use of public resources.

BAU practices are not inherently negative but, rather, evolved in response to earlier conditions with a relative abundance of resources. These practices have met with success: the current size of the forestry sector and its importance to each LAC country economy has been achieved primarily by BAU practices. However, with that growth, BAU has tended to create the conditions for its own demise: growing scar-

Table 8.1. Intensity Levels of Forest Management in LAC

Forest Management Intensity	Type of Forest	Type of Use and Products	Forest Species Diversity	Type of User	Level of Mechanization	Level of Investment	Natural Resource Conservation	Profitability	Inclusion of Sustainability Criteria	Social Costs of Productive Practices
Low Impact	Native forest, Agroforestry	Subsistence use NTFP & fuel wood gathering	High diversity	Individual farmers Rural communities	Low, Artisanal	Low	High	Important to livelihoods & additional rural income	Low to medium Certification for some NTFP (certification expensive for smallholders)	Low
Medium Impact	Managed native forest Native or mixed species plantations	Low input selective logging High value native & exotic timber. NTFP production	Medium to high diversity	Forest concessions; Small to large landholders	Medium to high; RIL logging	Medium	High to medium	Medium to High	Medium to low Some FSC & PECF certification	Low to medium
High Impact	Heavily intervened native forest Exotic tree monocultures	High input selective logging; High value native & exotic timber. Heavy NTFP extraction	Low diversity or monoculture	Small to large timber & reforestation firms	Medium to high; RIL logging	High	Low	High	Low under BAU High under SEM: FSC & PECF certification	Medium to high
Very High Impact	Forest conversion	Clearcutting; Land use change	Low diversity	Smallholders to big firms	Variable; CL logging	Variable	Very low	Variable; short term high; long term low	None	High

23 The term Sustainable Forest Management (SFM) is widely accepted in forestry; Sustainable Ecosystem Management (SEM) is used here for consistency with the other chapters.

city of key resources, large externalized impacts, and narrowly focused benefits, as well as a more prosperous society now more concerned with lasting, equitably distributed costs and benefits. SEM is a response to those new conditions, building on the BAU platform to improve sustainability, equity, and overall efficiency of forest resource use.

To frame the analysis of this chapter, three intensities of forest management ranging from low to high impact are characterized, using several variables to differentiate them (Table 8.1). The chapter will explore how, by adopting SEM practices, the forestry sector can continue to be a dynamic pole of rural economic growth, while playing a role in the development of sustainable livelihoods for forest communities and preserving the natural environment. For each level of forest management intensity in Table 8.1, the information will show which SEM practices produce better social and economic returns for forest users, and regional and national growth, if adopted successfully. These best practices should encourage sustainable long-term revenues of the public and private sector, and support the economic growth of LAC nations.

To make the comparison between BAU and SEM forestry approaches, the chapter will rely primarily on case studies to highlight the economic and social results of BAU, and to portray the benefits of moving toward SEM. These real world examples will do so by focusing attention on the indicators depicted in Figure 8.1, where information was available, and by highlighting the interrelations between natural forests, plantations, and ES, and the related benefits for society. A series of concrete policy recommendations will be highlighted to guide the appropriate engagement of governments and institutions in the transition from BAU to SEM.

KEY FINDINGS

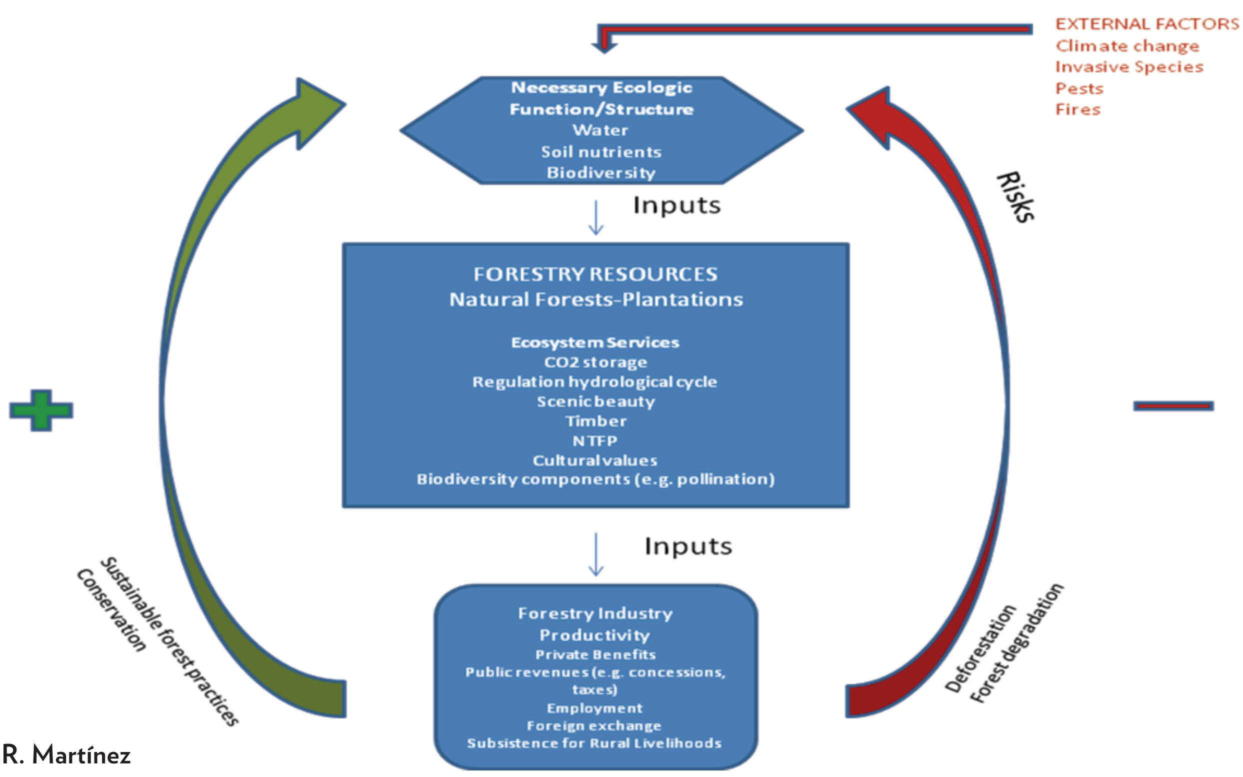
- Forestry production in LAC depends heavily on biodiversity and ES; decisions to convert remaining forests — most of them on slopes and otherwise fragile environments — to other land uses or to mine this natural resource seldom consider long-run economic costs of deforestation and forest degradation.

- SEM practices can lead to reduced costs, avoid over-capitalization, and realize higher profitability for community enterprises and private firms, while also improving fiscal revenues.

- Succesful market-based drivers of SEM currently being explored include PES, certification of sustainable production, and certification of carbon sequestration and avoided CO2 emissions through REDD+ schemes. Programs to certify sustainable management are essential to formalize the sector, improve governance, gain access to training, opt for sustainable approaches to forest resources, and open previously inexistent markets for value-added products.

- SEM can serve as a framework to promote social and gender equity by emphasizing vulnerable communities, the rural poor,

Figure 8.1. Interrelation of Ecosystem Services and Forestry Resources



Source: R. Martínez

and supporting the role of women — for example, in adding processing value to NTFP.

- Data on key forest-based economic processes and their relation to ecosystem functioning needs improvement, if the sector is to harness sustained future benefits from forest resources and ES.

- Forest use, if not planned, implemented, monitored, and controlled adequately by SEM principles, may not be able to compete with alternative land uses such as agriculture.

- Climate change will pose an additional threat to current pressure on forests. Resilience to some adverse effects of climate change will come from adopting SEM practices.

8.2. FORESTRY IN LAC

EXISTING FOREST RESOURCES IN LAC

LAC contains the world's largest block of rainforests, as well as extensive temperate forests, totaling about 22% of the world's forest. Within the region, 90% of the forested area is located in South America, 9% in Central America and Mexico, and 0.4% in the Caribbean. The countries with the most forest cover are Brazil (475 million ha), Peru (68 million), Mexico (63 million), Colombia (60 million), Bolivia (59 million), and Venezuela (50 million): a total of 775 million ha or 84% of the total forest area in LAC (see Table 8.2). In the Amazon basin alone, 25% of about 675 million ha of natural forest are considered to be production forests (CATIE 2008).

South America also holds 86% of planted forests in LAC, notably in Brazil, Chile, and Argentina (Table 8.2). Central America has 10% and the Caribbean 3% of the region's plantations. The species most used are pines, eucalypts, and Paraná pine (*Araucaria angustifolia*). In 2000, the 13M ha of plantations were only 1.4% of LAC's total forest area but represented 9.4% of planted forests worldwide (FAO 2006a; Del Lungo et al. 2006b).

Of tropical forests in LAC, according to the International Tropical Timber Organization (2006), 6.5 million ha (7.5%) of forests have management plans, with 4.2 million ha (4.9%) under certification. In comparison, Sustainable Ecosystem Management plans cover 15% of natural forests in Asia, with 5% certified.

FOREST COVER IN LAC

Forest cover has been in continuous decline in most LAC countries. The annual net loss for 2000-2005 amounted to 4.5 million ha, which was 61% of annual global net loss. Between 1990 and 2005, the region lost 64 million ha, 7% of its forested area (Table 8.3; FAO 2009). All South American countries registered a net forest loss between 2000 and 2005 except Chile and Uruguay, which had positive trends because of large-scale industrial plantation programs. All Central America countries, with the exception of Costa Rica, experienced forest loss greater than 1 percent per year between 1990 and 2005 (FAO 2006a).

In contrast, the Caribbean sub-region experienced a net increase of forest cover, with a larger forested area documented both in 2000 and 2005 than during the previous measurement (Table 8.3), with the majority of increase occurring in Cuba (FAO 2006a). This trend is the result of natural restoration in areas previously used for agriculture. In some parts of LAC, there is also an expectation that more protected natural areas will result from nature-based tourism including more forested areas (FAO 2009).

KEY STAKEHOLDERS

In most LAC countries, rural communities dependent upon forest resources and small- to medium-scale forest enterprises comprise the largest group of direct actors within the forestry industry.

In 2005, about 78% of South American forests were owned by the public sector, 20% by the private sector, and 2% by other types of owners (FAO 2010). Of private forest concessions in Latin America and the Caribbean, 30% are foreign-owned (Scherr et al. 2004). In terms of management rights, approximately 77% are held by public entities, 3% by corporations, 16% by communities, and 4% by other actors (FAO 2010). Mexico is a special case in that 80% of forest lands are managed by more than 3,000 ejidos and communities (Hayward 2010).

Despite the fact that the state is generally the main owner of the forests and –on paper– regulates and controls their use, limited financial and human resources make it difficult to enforce these regulations. Often, the state shares its responsibilities with the private sector, either through concessions, recognition of territorial user rights, or shared management schemes without ceding its rights (as in protected areas).

On the other hand, decentralization of forest management at the municipal level, when implemented successfully, has played an important role in the growth and distribution of benefits from forest resources. Decentralization has also served to enable better enforcement of regulations, control of illegal exploitation, and social auditing of forestry activities and actors. Table 8.4 describes some of the decentralization processes that countries in LAC have implemented. These processes correspond to institutional measures that strengthen SEM.

Table 8.2 Forest cover in LAC in 2000

Country/Subregion	Land Area (Thousand Hectares)	Natural forest Area (Thousand Hectares)	% Natural Forest	Plantations (Thousand Hectares)
Anguilla	8	0	0.0	-
Antigua y barbuda	44	0	0.0	-
Aruba	19	0	0.0	-
Bahamas	1,388	515	37.1	0
Barbados	43	2	4.7	-
Bermudas	5	0	0.0	-
British virgin islands	15	0	0.0	-
Caiman islands	26	0	0.0	-
Cuba	11,086	2,319	20.9	394
Dominica	75	46	61.3	n.s.
Dominican Republic	4,873	0	0.0	-
Granada	34	4	11.8	n.s.
Guadalupe	171	79	46.2	1
Haiti	2,775	81	2.9	24
Jamaica	1,099	325	29.6	14
Martinique	110	45	40.9	1
Montserrat	10	4	40.0	-
Netherlands antilles	80	0	0.0	-
Puerto rico	895	0	0.0	-
Saint kitts y nevis	36	0	0.0	-
Santa lucia	62	0	0.0	-
San vicente and the grenadines	39	10	25.6	n.s.
Trinidad y tobago	513	211	41.1	15
Turks y caicos	43	0	0.0	-
Virgin islands (us)	34	0	0.0	-
Total caribbean	23,482	3,641	15.5	449
Belize	2,296	1,653	72.0	-
Costa rica	5,110	2,387	46.7	4
El salvador	2,104	292	13.9	6
Guatemala	10,889	3,816	35.0	122
Honduras	11,209	4,618	41.2	30
México	195,820	63,180	32.3	1,058
Nicaragua	13,000	5,138	39.5	51
Panamá	7,552	4,233	56.1	61
Total Central America and México	247,980	85,317	34.4	1,332
Argentina	278,040	31,792	11.4	1 ,229
Bolivia	109,858	58,720	53.5	20
Brasil	851,488	475,314	55.5	5,384
Chile	75,663	13,460	17.8	2,661
Colombia	113,891	60,399	53.0	328
Ecuador	28,356	10,689	37.7	164
Malvinas	1,217	0	0.0	-
French Guiana	9,000	8,062	89.6	1
Guyana	21,497	15,103	70.3	-
Paraguay	40,675	18,432	45.3	43
Peru	128,522	67,988	52.9	754
South Georgia and Sandwich Is.	409	0	0.0	-
Suriname	16,327	14,769	90.5	7
Uruguay	17,622	740	4.2	766
Venezuela	91,205	50,0001	54.8	-
Total South America	1 ,783,770	825,468	46.3	11,357
Total Latin America and Caribbean	2,055,232	914,426	44.5	13,138

Table 8.3 Forest area: extent and change

Subregion	Area (1000 ha)			Annual change (1000 ha)		Annual change rate (%)	
	1990	2000	2005	1990-2000	2000-2005	1990-2000	2000-2005
Caribbean	5.350	5.706	5,074	36	54	0,65	0,92
Central America	27.369	23.837	22,411	-380	-285	-1,47	-1,23
South America	890.818	852.796	831,540	-3,802	-4,251	-0,44	-0,50
Total Latin America and the Caribbean	923.807	882,339	859,925	-4,147	-4,483	-0,46	-0,51
World	4,077.291	3,988,610	3,952,025	-8,868	-7,317	-0,22	-0,18

Source: FAO (2006a).
Note that areas for 2000 do not coincide with those in Table 8.2. In particular, Mexico is apparently not included here in Table 8.3, greatly lowering the total area for Central America (Table 8.2 lists Central America and Mexico together).

8.3. DEFINING BAU AND SEM FOR LAC FOREST

BUSINESS AS USUAL (BAU)

BAU economic and social gains in the forestry sector accumulated over centuries and helped found important trading centers and generate exportable surplus for much of LAC. The abundance of forest resources – until even a few decades ago – low population densities, and demand from growing economies made the BAU model effective for society. Areas being cleared for timber and pasture likely benefited the population more than would have leaving forest stands intact. This could still be true in some places; but, recent rates of deforestation, biodiversity loss, and global carbon emissions from deforestation (18% of the total of carbon emissions) made evident decades ago that BAU is unsustainable for most of LAC.

In general, BAU refers to maximizing short-term gains from the exploitation of forest resources without consideration of off-site or longer-term effects or of externalized costs. In LAC, BAU is characterized by:

1) Extensive, unregulated timber harvest, often with high-grading and environmental damage,

2) Little involvement of state agencies in forest management,

3) Large areas of forest being converted to grazing and agricultural land, often quickly depleted and abandoned,

4) Continuous uncontrolled settlement along rivers and roads, and

5) Marginalization of local populations and a lack of mechanisms to mitigate the impacts of land-use change and to adapt forest populations to this change.

Harvesting under BAU is typically done by conventional logging (CL), resulting in damage to residual stands, erosion and compaction of soils, and sedimentation of waterways. Land holders often contract with logging companies, seeking a low-cost route to short-term revenues and/or to land tenure via forest clearing. These logging operations tend to use older, inefficient machinery, lack planning and business skills, and have little control over impacts on the land or the concessions. CL practices are often highly destructive to forest ecosystems; heavy machinery can compact the soil and destroy saplings, while high-volume harvesting can foster erosion, reduce species diversity, and lessen regenerative capacity (CIFOR 1998). Forest products from rural and indigenous communities may be sold at prices below market, with the profits accruing mainly to large companies. BAU clear-cutting practices generate short-run income but are less financially attractive over the long run, with diminishing returns and higher net costs (CATIE 2008).

On the NTFP side, overharvesting is chronic under BAU, with products extracted at higher rates than of natural replacement. Rattan was one of the first documented examples of overharvesting (de Beer et al. 1989). Palm heart overharvesting has been shown to underlie the decline in palm heart production from forest-growing species observed over the last thirty years (CATIE 2008).

Forestry actors and institutional settings of BAU: Under BAU, government control over the forests in most places is weak, using a short-term perspective. In general, BAU situations are associated with lax regulation and frail institutional frameworks associated with

Table 8.4. Decentralization of Forest Management At The Municipal Level

Country	Period	Process	Benefits	Limitations
Bolivia	Mid-1990s[1]	Forest management decentralization that allows municipalities to control up to 20% of national forests within their jurisdiction.	Bolivia is one of the LAC countries with greatest decentralization at the municipal level. Municipal governments are able to award forest concessions or rights for forest exploitation for small-scale loggers and other traditional forest users. 25% of forest license fees goes to municipal governments.	Central government still remains powerful in terms of policy-making for the forestry sector.
Honduras	1990s	Decentralization of forest ownership & management to municipal level for 28% of forests.	Important economic benefits for municipalities when they became owners of significant extensions of forests.	The need of improvement in forest management and control skills at the local level.
Guatemala	n.d.	Decentralization of forest activities via technical assistance and technology transfer to municipalities, with funding mechanisms (PINFOR Forest Incentive Program).	The transfer of 50% of the tax revenue on concessions and timber licenses from the central to municipal governments, which control and oversee forest resources, support reforestation programs, implement forest plans, and collect local taxes.	Municipalities still lack of power to implement own forest policies
Nicaragua	Mid-1990s[2]	Municipal strengthening to develop, conserve and control the environment and natural resources at the local level.	Municipal roles: vetting logging contracts, receipt of 25% of fiscal revenues from forest contracts, establishment and management of natural parks; plus promotion of agroforestry and reforestation projects, granting domestic felling permits, developing land-use plans, collecting taxes and fines for legal and illegal logging, and management of forestry funds.	Low municipal budgets and insufficient transfers of resources from the central government, as well as legislation and practices that reinforce a centralized forest management.
Brazil	n.d.	While decentralization of environmental & natural resource competencies is not yet widespread in Brazil, local governments have big indirect impacts on forest resources by developing municipal infrastructure and managing credit funds.	Implementation of forest control programs, modernization of the timber industry, forestry and agroforestry promotion, as well as of forest certification, and support for NTFP extraction; support fron nongovernmental organizations and projects supported by the federal government.	Forest management lags, still highly centralized; the entity charged with forests has little clout, is unable to oversee forest management plans. Municipalities depend on state and federal transfers, reducing motivation to find forest-related alternative revenue sources.
Costa Rica	Mid-1990s[3]	One of LAC's more centralized models with regard to forest resources, relatively successful centralized tradition; population and economy concentrated around capital.	Despite the existence of several fund collection mechanisms for municipalities, they have not been able to exercise forest competencies due to political and legal obstacles.	Municipalities play only a minor role and have no direct effect on forest management. Some competencies were transferred to local governments without any technical and administrative training.

the agricultural frontier. Low taxes on agricultural income and fiscal incentives that favor pasture over forest tend to overvalue agriculture and rangeland, and to boost the profitability of forest conversion. Lack of understanding of the ES provided by forests further fosters forest conversion. Illegal extraction is often commonplace, sometimes depleting the more valuable species (CATIE 2008).

SUSTAINABLE ECOSYSTEM MANAGEMENT (SEM)

SEM is sustainable management of forest ecosystems. The SEM approach consists of practices to obtain sustainable benefits from forest resources, while conserving the biodiversity and ecological balance of the forest and maintaining provision of ecosystems services. Typically, SEM encourages creation of long-term jobs, gender and economic equity, and income-generating activities for local communities. (See Box 8.5 for an illustrative case study of SEM practices in forestry.)

Both in natural forests and plantations, the SEM approach is versatile and can be adapted to different forest types and socio-economic circumstances, with silvopastoral, agroforestry, and sustainable cultivation systems among the potential management options. SEM uses tools such as reduced impact logging (RIL) to help manage the forest for the long term. RIL systems use harvesting techniques that reduce damage to residual trees, limit soil disturbance and erosion, protect water quality, mitigate fire risk, maintain and encourage

Box 8.4: Forestry Management Sustainable Practices

- Mixed-species plantings are preferable to monocultures, due in part to their increased structural complexity;
- Different-aged stands in ecosystems that are not fire-dominated;
- Extending rotation length benefits biodiversity, particularly favoring diversity of soil biota and species associated with dead wood or leaf litter (Ferris et al. 2000; Magura et al. 2000),
- Maintaining snags, logs and other woody debris on site can also enhance habitat values for a range of species, from fungi to cavity-nesting birds; and
- Management practices that improve soils rather than degrade them. Practices such as spot cultivation, use of amendments, retention of harvest residues, and decreased disturbance during site preparation and harvest help maintain soil fertility and the diversity of soil organisms, essential for nutrient conservation and cy**cling.**

Source: Johnston et al. (2002).

natural regeneration, and protect biological diversity. RIL techniques and guidelines are not fixed prescriptions, but is an approach that adapts harvesting options to existing biophysical and economic conditions based on site-specific assessment and planning.

The FAO model code of forest harvesting (Dykstra et al. 1996) is the basis for RIL system design. This code, typically, includes many or all of the following activities, which imply substantial up-front costs, including preparation and coordination of personnel. Such costs are recovered from more efficient use of equipment and of harvesting options, as well as reduced loss of felled stems and better forest regrowth (see also Box 8.4.).

- pre-harvest inventory and mapping of trees,
- pre-harvest planning of roads and skidtrails,
- pre-harvest vine cutting,
- directional felling,
- cutting stumps low to the ground,
- efficient use of felled trunks,
- constructing roads and skid trails of optimum width,
- winching of logs to planned skid trails,
- constructing landings of optimal size, and
- minimizing ground disturbance and slash management.

Certification: In many cases, the social and ecological benefits of SEM are verified by certification. Besides ensuring sustainable extraction, forest certification assures civil society control of the process, and a focus on long-term gains that often favors value-added products. Certification also addresses labor conditions to ensure that these conditions meet international standards, thereby minimizing accidents and work-related illness. Certification schemes permit entry into market niches that exclude products from unsustainable sources. While some negative ecological effects may occur under SEM, this approach is subject to strict control, specific regulation, and institutional frameworks, so that long-term preservation of ES is enhanced.

Forestry actors and institutional settings of SEM: Under a SEM scenario, large companies manage private forests or concessions. Small- and medium-sized companies and communities have greater access to markets, financial services, and processing facilities, all fostering regional income, employment, and capital investment. Timber harvest in community-owned forests is done by communities and integrated within their land-use systems, complementing their income from low impact agriculture and other economic activities (CATIE 2008).

Under SEM, many successful NTFP can be cultivated in areas adjacent to communities, where they compete and rotate with other agricultural products adapted to local conditions. In these same areas, forest plantations will supply a growing part of the timber, paper, and pulp industry. Forest management will be adaptive, oriented at maintaining the resilience of the ecosystem in the face of climate change, ensuring regeneration of the harvested trees and avoiding situations that affect forest-based ES (CATIE 2008).

Transparent market information for SEM: Market information is openly accessible for all actors under SEM. Forest product markets have chain-of-custody mechanisms to track the origin of the products sold. Such transparency provisions are supported by certification standards, government regulations, and monitoring and enforcement measures. Systems also reward forest owners for the production and maintenance of ES, which generate funds from both market and non-market sources (see Section 8.7).

8.4 ROLE OF FORESTRY IN LAC NATIONAL ECONOMIES

Forestry plays a significant role in many countries of LAC. Forest-based products constitute an important part of primary economies and rural communities, and are essential to survival in many remote populations. Well-managed forests can generate long-term income and employment, especially in rural areas.

Box 8.5. Case Study Futuro Forestal Forestry Company

Futuro Forestal is a private German-Panamanian Reforestation and Investment Service Company that in the last 15 years has developed an innovative model for ecologically and socially sustainable reforestation in the tropics. The Company is currently managing 16 M trees in Nicaragua and Panama (eastern Darien and Cebaco Island). Futuro Forestal manages forest projects for large investors, taking into account high returns on forest investment and optimized growth performance, as well as nature preservation, enhanced biodiversity, and social responsibility.

The projects use a system of mixed plantations, planting teak (*Tectona grandis*) as the only introduced species, and six native species with high commercial value: amarillo (*Terminalia amazonia*), mahagony (*Swietenia macrophy*lla), spine eedar (*Bombacopsis quinatum*), almond (*Dipterix panamensis*), zapatero (*Hyeronima alchorneoides*), and rosewood (*Dalbergia retusas*). In addition, about 65 native species of lesser value are planted to increase system stability and biodiversity.

With Futuro Forestal, investors buy 1 ha parcels for $24,990 and receive direct title land ownership in Panama, Panamanian tax-free profits from the sale of the timber, and an annual IRR of 11% on a 25-year term from timber, seed, and carbon credit sales.[2]

Depending on species, after 20-30 years of growth and silvicultural management, Futuro Forestal expects to have about 400 crop trees/ha to harvest, with heights of 25-35 m. Most trees will reach heights of 20 m within their first 4-8 years and the first income will be generated with the different thinnings that occur at years 10, 15, 18, 22, and 25.

The lands chosen by the company for implementing reforestation projects are characterized by being previously deforested and used for agriculture or cattle. Futuro Forestal will transform those areas into forests again with native species in ratios and spacings that are adjusted to the conditions of each site. The forests created will come closer to a primary forest than do other plantations. 25 % of the land is reserved for natural regeneration.

These mixed species plantations emulating high biodiversity create a stable ecologic system in the forest that will result in low vulnerability to plagues. That stability increases growth and health of the forest, leading to bet**ter yields and higher quality timber. Areas are certifie**d by FSC (Forest Stewardship Council) through the SmartWood Program.

Futuro Forestal pays about average salaries with social security benefits and offers proactive training courses for its employees, such as literacy programs and computer courses. The project is now employing 50 full-time and 80 seasonal workers. The project has also helpsd farmers in the area learn about the benefits of reforestation.[3]

Futuro Forestal . Viewed online 1 Aug 2010. Published 19 May 2009 http://wiki.hardwood-investments.net/Futuro_Forestal .

2 Futuro Forestal. Balancing Nature and Business http://www.escapeartist.com/Futuro_Forestal/Futuro_Forestal.html, Viewed 1 Aug 2010.

3 Anderson, B. Timber Investments in Panama. Online http://www.nuwireinvestor.com/articles/timber-investments-in-panama-51311.aspx Published on: Monday, October 29, 2007. Viewed August 1, 2010

Logging is currently the main source of income in the forestry sector, but NTFP are also important sources of revenues for rural companies and for community forestry initiatives (Section 2.5).

GROSS DOMESTIC PRODUCT (GDP)

On average, logging activities in LAC contribute 2% to GDP (Figure 8.2). From 1990 to 2006, forestry's GDP share grew from $30 billion to $40 billion (2006 dollars), mostly from roundwood production (Figure 8.3). This amount refers only to commercial value and does not cover the potentially greater value of forest products and ES used directly or indirectly by rural populations (FAO 2008). The emerging focus on ES is significant enough to help motivate a switch from BAU to SEM in LAC, to make logging sustainable. The switch is still in progress: currently, most roundwood production is from plantations (Section 2.4).

EMPLOYMENT

The forestry sector plays an important social role in LAC by creation of jobs. According to FAO (2008), employment in roundwood, pulp and paper, and wood processing industries reached 1.5 million in 2006, 0.75% of the regional total (Figure 8.4). Counting all activities, formal and informal, in 2001 the forestry sector provided more than 8 million jobs, of which 2.7 million (32%) were formal (FAO 2006b). These figures provide an indication of the forestry sector's contribution to poverty alleviation, since forestry activities occur in rural areas, which are generally underprivileged in relation to other

Figure 8.2 Contriution of Forest Timber Products to GDP in LAC

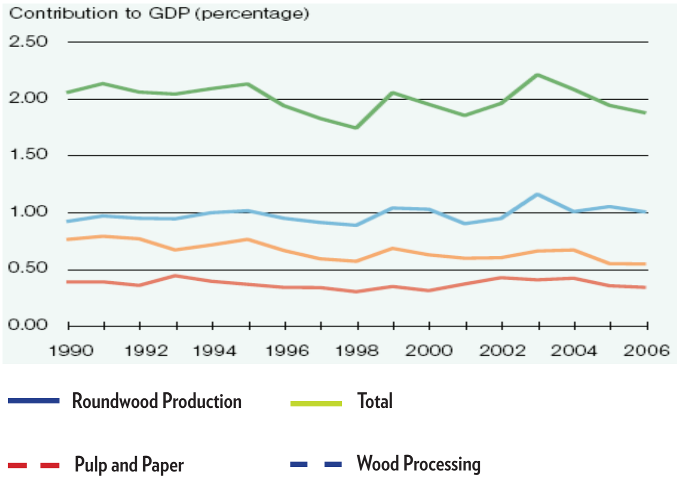
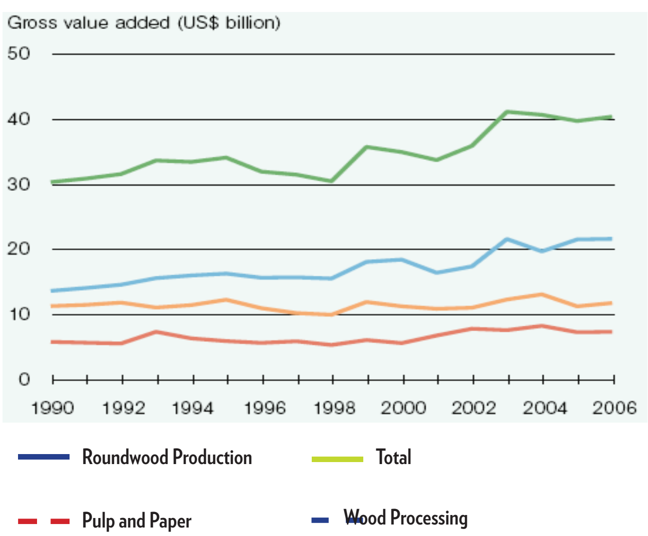


Figure 8.3 ForestryProduction in LAC 1990-2006



Source: FAO (2008).

areas (FAO 2006b). Since the majority of employment in forestry is outside the formal sector, forest work is probably more significant for rural livelihoods and national economies than the reported figures suggest (FAO 2010).

EMPLOYMENT

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CONTRIBUTION TO FOREIGN EXCHANGE EARNINGS AND PRODUCTION

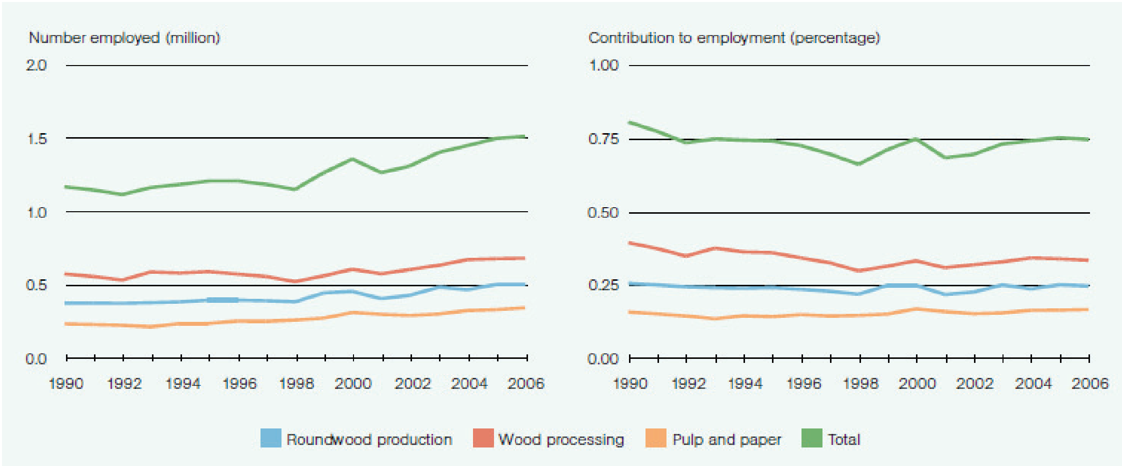
Exports of primary wood, secondary wood, and primary paper products in LAC increased from 1998 to 2005, reaching $7.5 billion dollars per year, with a decline of about 30% in 2006 (see Figure 8.5).

CURRENT STATUS OF WOOD PRODUCTION IN LAC

The total volume of roundwood production from LAC reached 134 million m3. This represents about one third of Asia-Pacific, Africa, and LAC combined, with 63% of this amount coming from plantations that have had an important effect in reducing extraction from natural forests in several countries of LAC (FAO 2009).

In natural forests, private long-term forest concessions manage the majority of the production. Bolivia, Guyana, and Surinam have the largest concessions, up to 200,000 ha. Guatemala, Peru, and Venezuela, in general, have medium-sized concessions; smaller scale concessions are found in Colombia, Ecuador, Honduras, and Trinidad and Tobago (ITTO 2006). In Brazil, forest products traditionally come from private land, but forest concessions have also been opened to logging in the Amazon as a strategy to avoid illegal occupation and to reduce logging pressure in conservation areas.

Figure 8.4 Employment Generated by Formal Sector Forest Industries in LAC, 1990-2006

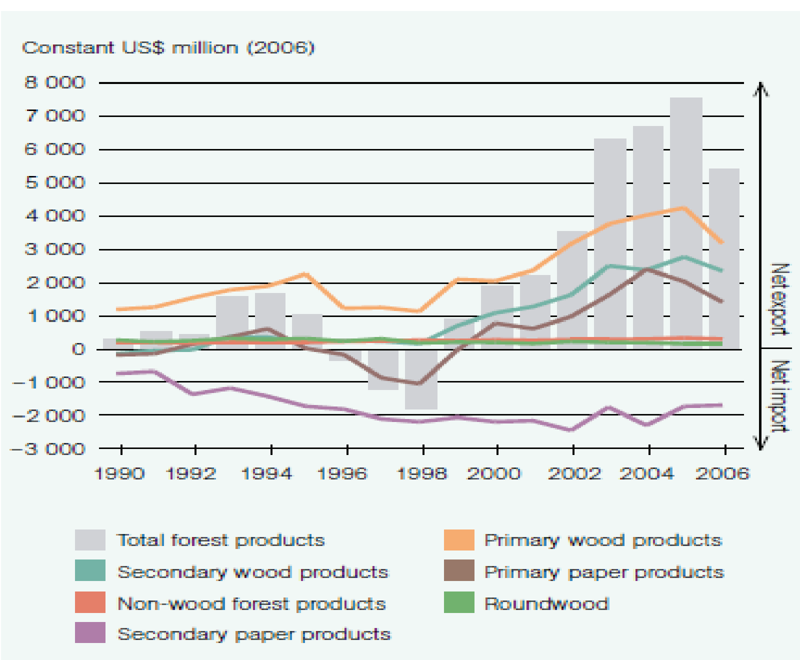


Source: FAO (2008).

NON-TIMBER FOREST PRODUCTS (NTFP)

Forests offer a wide range of NTFP, important both to industry and to rural residents. They include diverse fruits, nuts, seeds, oils, spices, resins, gums, fibers for construction, furniture, clothes, or utensils, and both plant and animal products for medicinal, cosmetic, or cultural purposes (UNEP-WCMC 2010).

Figure 8.5 Net Imports and Exports in the LAC Forestry Sector, 1990-2006



Sources: FAO (2008) and UN (2008e).

Food security, medicinal plants, and natural fibers: A large share of the world's poorest people depends on NTFP for survival and income. At least 40,000 species of plants and animals are used on a daily basis (CIFOR n.d.). NTFP can be extracted or produced directly from natural or planted forests. Examples of foods include Maya nuts (see Box 8.6.), Brazil nuts, cacao, palm heart, a variety of edible roots, and many kinds of fruits. Once an NTFP attains consistent demand and market importance, it may no longer be produced in natural forests. For example, Brazil nuts and palm hearts are now being produced in plantations.

Women from low income households often rely on NTFP for home use and income. Improved management of NTFP has helped villagers generate more income from forest materials, while protecting the forests. About 80% of the population in the developing world use NTFP for health, nutritional, and household needs. At least 150 NTFP are traded internationally (Etherington 2008). Demand for medicinal plants is growing at such rate that the natural stocks in the wild are being destroyed. Hundreds of species are overharvested and face extinction if they are not protected or cultivated (Lambert et al. 1997).

Local depletion of tripeperro, used to make crafts and bags in Quindio, Colombia, was studied with a group of 80 craftsmen and 25 gatherers who spent from one to four hours to reach a forest where the raw material is still available. The average effort was 8.5 hours per trip, eight times longer than 15 years ago due to depletion of the resource closer to town (Ramos 1997). The study reported then that, with current extraction systems, there would be a scarcity of tripeperro in the nearby and intermediate woods within five years. To meet the demand craftsmen would have to increase the average extraction effort by two hours, costing the group of artisans $8,500, or $82 apiece.

Box 8.6. Case Study: Maya Nut Program

Mainstreaming traditional rainforest food drives conservation, stimulates economies and improves health in rural Central American and Mexican communities[24].

Background

Maya nut (*Brosimum alicastrum*) is a delicious, nutritious fruit of an abundant neotropical rainforest tree that provided a staple food for pre-Columbian peoples. The nut is an excellent source of high quality protein, calcium, iron, folic acid, fiber, and B vitamins. In recent times, Maya nut has been critical to rural food security; thousands of villages in Mesoamerica have survived drought and famine by eating the nut when no other food was available. Unfortunately, knowledge about Maya nut has fallen to near zero as globalization, export crops, and deforestation negatively influence indigenous culture and the forests that sustain these people. Loss of this indigenous knowledge led local people to cut down Maya nut trees for firewood and construction, and to burn Maya Nut forests to plant crops. The tree is in danger of extinction in much of its range, which threatens the food security of both human and animal populations.[25]

Maya nut is an ideal staple and famine food due to its abundance, ease of harvest and processing, and good storage, nutritional, and culinary qualities. Each tree produces 50 to 300 kg of food yearly, which can be easily and quickly harvested from the ground during the two-month fruiting season. The nut tolerates drought and rocky shallow soils, making it apt for reforestation in degraded sites and in areas predicted to experience climate change-induced drought. Once established, plantations require little care and no inputs. A ten-year old plantation can give 23 tons of food/ha/year. When dried, the nut can be stored for five years, making it an excellent option for food-insecure families. Maya nut forests provide four-six times more calories, ten times more protein, and 100 times more micronutrients per hectare than corn. The nut provides a complete protein, similar to that of meat, making it a good food for low-income rural families.

The Healthy Kids, Healthy Forests campaign promotes local production and consumption of Maya nut to help solve malnutrition and economic crises in Mesoamerica and the Caribbean, where nearly 50% of rural children under five years old are chronically malnourished and under 10% of rural women work outside the home. Healthy Kids, Healthy Forests integrates rural economies, rainforest conservation, and health by focusing on women as caretakers of the family and the environment. Since 2002, 14,000 women from 800 villages have been trained on Maya nut for food and income generation; 6,000 children from 45 villages have been consuming the nut as part of a novel school lunch program.

BAU vs SEM

The current agro-economic paradigm in rural Central America, the Caribbean, and parts of Mexico does not seek to provide high-quality, locally produced food for people. The BAU model values input-intensive crops for export such as bananas, sugar, and coffee. This BAU model benefits established, elite landowners and market intermediaries, but exacerbates rural poverty, malnutrition, and socio-economic disenfranchisement by paying low wages, excluding producers from decision-making and free market opportunities, and usurping prime land for non-food crops.

One example is sugar production in Guatemala, where 200,000 ha of Maya nut forests on the south coast have been cleared to plant cane. Most sugar produced in Guatemala is exported (Suarez 1996), yet, workers earn only $50/week. In comparison, if sugar fields in Guatemala were restored to Maya nut forests, within eight years they would yield 295,000 t/year of high-quality food, with a local value of $535 million (at $1,76/kg for dry Maya nut seed).

In the same vein, the BAU situation of school lunches in Guatemala also threatens food security, rural economies, and health. A typical school lunch in a rural Guatemalan school costs $0.11/day/child and may include, boxed juice or milk, soup, rice and beans. Most of these items are purchased from large national or multinational corporations that import them. Conventional school lunch programs do little to stimulate the local economy.

The SEM approach of Healthy Kids, Healthy Forests seeks to create social and economic value for Maya nut by educating policy makers, private firms, communities, and families about the nutritional, economic, and environmental advantages of Maya nut compared to conventional crops. The Maya nut school lunch costs a bit more than the conventional model at $0.15/day/child (Vohman 2010), but has the advantage of being produced locally by rural women, ensuring that every penny spent is also an investment in community enterprise.

COSTS OF TRANSITION FROM BAU TO SEM

Maya nut trees require several years to become productive. A cost-benefit analysis of Maya nut reforestation in Central America (Equilibirum Fund 2010) showed that the cost to establish the first hectare of trees is $3,277 and $1,696 for each additional hectare. If this forest is managed by a family or community to produce Maya nut flour, the forest will pay off the initial investment in reforestation and processing equipment purchase, yielding a net income of $5,804 in the seventh year. By year 10, if managed for flour production, the forest will generate $25,417/ha/yr.

24 Prepared by Erika Vohman (2010), Director of The Equilibrium Fund.

25 Many Mesoamerican wildlife species use Maya nut for food.

NTFP Markets

In the Amazon basin alone, formal trade in NTFP is valued at US$200 million per year; this is less than 1% of the total forestry sector's value (CATIE 2008). The NTFP share of exports from the region is likewise very low compared to primary and secondary wood, and paper products (Figure 8.5). However, the total NTFP contribution to the forestry sector is unclear since NTFP processing industries are treated as manufacturing sector activities, rather than in the forestry sector. Markets have been largely informal, with little control by national and local authorities. (See Box 8.7 on financing biotrade.) Data on NTFP production and trade is scarce and, at times, imprecise, except for the few large-scale products (CATIE 2008).

In 2005, sale of NTFP in Peru generated over $14 million, including products such as algarrobo (6.5 million kg/yr), cat's claws (0.5 million kg/yr), tara (3.9 million kg/yr), sangregado (1.1 million units/yr), palmheart (0.2 million kg/yr), and a large number of medicinal and aromatic plants (CATIE 2008). One of the emerging products is camu-camu, promoted for its high vitamin C content; camu-camu is now grown in plantations, the latest example of domestication of highly successful NTFP, in addition to rattan, palm heart, and rubber. (See Box 8.6 on biotrade; See Box 8.7 on medicinal plants and producer associations.)

In Brazil, Bolivia, and Peru the brazil nut value chain provides direct employment to 15,000 people (FAO 2009). In Bolivia, brazil nuts constitute 45% of the country's forest-related exports, contributing $70 million/year (CIFOR 2008a). The main Amazon NTFP in volume traded, value, and involvement of local actors are brazil nut in Bolivia, and palm heart in Brazil and Peru (ITTO 2006). In Costa Rica and Cuba, large amounts of honey are made in mangrove forests (Hernández et al. 2000).

NTFP Role in Poverty and Rural Livelihoods

Internationally traded NTFP are important to some sectors of LAC society. However, these products do not have the potential to easily transform local economies or social and cultural institutions and practices in positive ways. Commercially traded NTFP can generate real benefits for local groups, and, as discussed, may lead indirectly to species and forest conservation, but the greatest value for local groups is often found in subsistence use and local trade of NTFP (Laird, Wynberg, and McLain 2009).

In two villages (116 households) south of Iquitos in the Peruvian Amazon, Gram et al. (2001) studied the average value of products extracted per household from natural floodplain forest over a year (Table 8.5). Goods consumed by the households were distinguished from those sold.

These values were compared to the income generated from agricultural activities such as domestic animals and products from cultivated land after slash and burn practices (see Table 8.6). Domestic use was again separated from commercial sale.

Box 8.7. Providing Local Access to Finance: The BioTrade Fund in Colombia

According to the Humboldt Institute, in Colombia, biotrade products generate approximately $25 million/year. Medicinal plants generate more than $10 million/year in Colombia and natural ingredients used by the pharmaceutical industry represent $8 million to $10 million/year, having experienced a 50% growth rate in the last three years. Demand for biotrade products is expected to continue growing in the near future; this presents an opportunity to generate economic growth in Colombian rural communities.

Biodiversity-based companies need to access financial resources. This is a challenge for biotrade initiatives. The "Fondo Biocomercio" was created in December 2005 by the Colombian BioTrade Program (managed by the Alexander von Humboldt Institute). The program was launched as a non-profit that "aims to contribute to implementing the CBD objectives by providing financial services to enhance development of biotrade in Colombia." The BT Fund provides financial services to companies committed to complying with BioTrade Principles. Products and services financed include NTFP (medicinals, cosmetics, and foods), ecotourism, agricultural systems (e.g., farm products, agro-ecological practices, wildlife breeding), and timber products (wild timber species). Financial support has been received from the GEF via the World Bank and from the Netherlands Embassy. Since 2007, BioTrade Fund beneficiaries have improved by 40% and 50% on their environmental and social performance, respectively. From 2007 to 2009, 59 companies benefited from the BioTrade Fund. The total turnover by beneficiaries in 2008 was $57.6 million. A total of 19,252 ha with over 300 species are currently under BioTrade practices; 707 jobs have been generated for communities and minorities; and 3,206 families benefit.

Source: Jaramillo 2010.

Box 8.8: "Jambi Kiwa" Medicinal Plant Producers' Association, Ecuador

In Ecuador's Andean Chimborazo province, one of the poorest in the country, 20 women started a pilot project in 1998 to improve their quality of life, foster gender equality, guarantee sustainable use of the surrounding natural resources, and capture the market potential of medicinal plants. The project was created during the crisis that led to dollarization of the economy. Despite difficulties related to the instability of the local currency, prices and costs, the initiative evolved into a community business (a SME) named Jambi Kiwa in 2001. A cooperative to grow, process, and market medicinal and aromatic plants, Jambi Kiwa involves more than 600 families (80% women with high levels of illiteracy; 75% indigenous Puruhá). Its success was fostered by mobilization of a wide range of community assets that were, in turn, used to lever considerable outside resources. With the support of the Sustainable BioTrade Programme in Ecuador, a three year project (2004-2008) was implemented in partnership with the Organization of American States (OAS).

The project promoted the economic development of minority groups by strengthening the institutional, business, and productive capacities of Jambi Kiwa, and by consolidating its participation in national and international markets. Jambi Kiwa has accessed niche markets by differentiating its products through eco-certification schemes, quality certification, and biotrade practices. Recognized as a supplier of high-quality medicinal and aromatic plants to markets in Ecuador, Latin and North America, and Europe, Jambi-Kiwa has created a sustainable economic development model for localities that allows them to compete in national and international markets through the differentiation of their products. This differentiation was the result of a well-tailored strategy that aims to improve quality and product range, enhances processing capacities, and is supported by a solid communications and marketing plan.

The model led to the elimination of intermediaries, which allowed Jambi Kiwa to raise the price paid to producers for fresh plants from 8 cents/kg in 2001 to 20 cents/kg in 2003; the development of skills for identifying, collecting, growing, and harvesting medicinal and aromatic plants; and the certification of 420 producers in 38 communities.

Sources: Jaramillo (2010) and Coady International Institute (2004).

Total value of extracted products in the two villages was $164,142 per year on 13,108 hectares. The average value of products extracted per hectare was $13, and on average 113 hectares per household in the two communities was available. Viewed as an integrated system, NTFP extraction and agriculture together gave a value of $21 /ha/year (Gram et al. 2001).

Torras (1999) and Saraiva et al. (2007) reviewed the literature on the value of selected NTFP/ha/year (Table 8.7). These findings reflect the generally modest but stable income levels that a farmer with several hectares can generate. A more complex but well-analyzed example is the case of xate palm frond harvesting in Guatemala (Box 8.9).

Table 8.5. Average value of NTFP / Household in Two Villages in Peru

Type of product	Used locally[1]	Sold	Total
Game	70	20	90
Animal by-products[2]	6	4	10
Fish for food	678	222	900
Aquarium fish	1	122	123
Fruit	17	120	137
Timber and leaves[3]	143	16	159
Crafts[4]	32	19	51
Medicinal parts[5]	23	7	30
Other plant products[6]	4	9	13
Firewood	145	0	145
Total	1.119	39	1.658

[1] Including local exchange of products.
[2] Eggs, smaller animals, et.
[3] Materials for construction, e.g. timber for canoes and palm leaves for roofs.
[4] For example, baskets. bows and ceramics.
[5] Including plants not used in connection with illness but which are supposed to be benificial for health
[6] For example, honey and palm heart.

Table 8.6. Income Generated from Natural Forest vs. Agriculture in Two Peruvian Amazon Villages

Origin of product/income	Used locally	Sold	Total
Natural forest	1.119	539	1.658
Agriculture[1]	616	553	1.169
Other inome[2]	–	–	68
Total	1.735	1.092	2.895

[1] Slash-and-burn farming including products from fallow and from domestic animals. Costs are deducted.
[2] Mainly wages and gifts, e.g. clothes from relatives in towns and food aid from religious organizations. the gifts counted here do not include traditional systems of exchange of local products.

NTFP and Biodiversity for Pharmaceutical, Cosmetic, and Personal Care Industries

NTFP are also valued in the pharmaceutical, cosmetic, and personal care industry, where stakeholders include individual gatherers and traders, rural communities, small and medium producers and processors of raw material, and medium and large corporate buyers. Globally, these sectors are very large, producing $735 billion annually (SCBD 2008 in TEEB 2009). The proportion following SEM practices is unknown.

Despite the importance of NTFP and biodiversity resources for those markets, the lack of clear legal frameworks to access the genetic resources through bio-prospecting agreements has been a disincentive for companies to invest in screening natural compounds found in forests and other ecosystems. The bio-prospecting market is still evolving, and has not yet generated significant direct investment or payments to local people. A recent global survey found 72 cases of biodiversity markets in 33 countries worldwide, of which 63 were in 28 tropical countries; 70% of the markets were international (Scherr 2004).

Both Costa Rica and Brazil have benefited from bio-prospecting agreements. Costa Rica has entered into agreements with over 30 pharmaceutical and agricultural research companies (Tamayo et al. 2004). The most well-known agreement involved Merck in 1991; under this bio-prospecting agreement, a variety of biodiversity resources were screened for new pharmaceutical compounds. The agreement stated that 50% of the benefits from the drug discovery and development phases would be divided with the National Biodiversity Institute (INBio) and the Ministry of Environment and Energy (MINAE). Shared profits, joint property rights, and development and training of Costa Rican scientists were also covered (Tamayo et al. 2004). No product coming from this agreement has reached the market, but 27 patents have been registered by Merck (Medaglia 2007). The cost of INBio bio-prospecting activities has been about $0.5 million per year (Eberlee 2000).

In 2000, the Swiss multinational Novartis (1996 merger of Merck and Sandoz) entered an agreement with the Brazilian Association for the Sustainable Use of the Biodiversity of Amazonia (Bioamazonia). Novartis agreed to pay $4 million for the ability to gather 10,000 samples/year for three years, and to pay more to Bioamazonia upon clinical testing, patent registration, and launch of any successful drug. They also agreed to give Bioamazonia 1% of royalties during the 10 years that Novartis retains exclusive rights (Peña-Neira et al. 2002). One weaknesses of this agreement is the lack of a requirement to use funds for biodiversity preservation, and for transfer of technology through engagement of Brazilian scientists.

The most important aspect of these agreements is the potential for building scientific, technical, and institutional capacity. Costa Rica benefited by developing its own research capacity to investigate diseases such as malaria and others that attack agriculture, and by better knowledge of the taxonomy, distribution, and natural history of Costa Rican species. However, in Brazil this benefit was less clear and the results are more in terms of the payments done to Bioamazonia (McClelland 2004).

Table 8.7. Value of NTFP Production in Different LAC Forests

Author	Region	Type of NTFP	Values
Peters et al. 1989	Mishana region of the Peruvian Amazon	Food: data given on trees/ha, annual fruit production, and net price for each species	US$ 400 / ha / year
		Raw Materials: Latex	US$ 22 / ha/year
Grimes et al. 1994	Ecuadorian Amazon	Subset of available food & non-food raw materials & medicinal benefits	US$ 46 / ha/year
		Supply of Protium, a ceramic resin	US$ 61 / ha/year
Anderson et al. 1991	Brazilian Amazon	Value to estimates only from the babassu palm tree	US$ 59 / ha / year
Godoy et al. 1993	Mexican forests	Different uses of the Mexican te'lom forest, timber and coffee	US$ 116 / ha / year
Saraiva and Sawyer 2007	Brazil	Various NTFP extracted	R$ 174 / ha / year

Box 8.9. *Xate* Palm use in Uaxactun, Guatemala

Villagers from the community of Uaxactún in the Maya Biosphere Reserve (MBR) subsist primarily on income earned from selling NTFP such as fruits, gum, resin, and ornamental flowers, particularly *xate* palm fronds. Over-extraction typical of successfully marketed NTFP, combined with an absence of standards and management practices, resulted in serious challenges to the sustainability of the plant and of the income that its extraction generates.

A communal forest concession signed in June 2009 in this subtropical rainforest community is the first of its kind. Conservation International and the Wildlife Conservation Society (WCS) supported the design of the agreement with the Uaxactún community in close coordination with Guatemala's National Council on Protected Areas (CONAP).

Under this agreement, the community has pledged to conserve 84,000 ha of forest, halt deforestation and cattle farming, protect key species like the jaguar, control fires, use zoning to limit agricultural expansion, abide by transparent business practices, and work with supervision of CONAP. The agreement fosters sustainable use of *xate* with financial and technical support for a nursery to restock forests with *xate*, and with a price premium for sale of the plants.

The government sees the agreement as a potential model for safeguarding the country's natural resources while improving the quality of life for its people. Based on the Uaxactún experience, CONAP is exploring replication of the agreement to implement the National Strategy of Communal Lands, recently approved.

Rainforest Alliance supported villagers in establishing sustainability standards and certification of Uaxactún for sustainable forest harvesting in 2005. Thirty million fronds are delivered worldwide each year for household and church decorations (especially Palm Sunday). The shipments earn more than $100,000 per year for the community, of which over half goes directly to the 1,300 *xate* collectors. *Xate* exports contribute $1 million yearly to Guatemala's economy.

8.5 ROLE OF BIODIVERSITY AND ECOSYSTEM SERVICES IN THE FOREST SECTOR

Forest products and services depend on maintenance of biodiversity and ES, while, in turn, these systems support human livelihoods, economic growth, and security. Besides timber and non-timber products, forests provide a wide range of services. For example, they regulate water flows, protect human settlements against landslides and floods, and buffer against climate change.

ECOSYSTEM SERVICES FOR THE FORESTRY INDUSTRY

Most forest-based economic processes require growth of timber and NTFP. These dependencies, in turn, depend on ES inputs, among them water as precipitation and soil moisture, nutrient cycling, soil fertility, pollination and seed distribution, and pest control. Other ES, essential at the ecosystem level, include genetic diversity, waste assimilation, and storm mitigation. Few of these ES can be replaced easily; if degraded, forests may change in character, lose productivity, or be lost. Forests not only use ES but provide many of the same ES for downstream uses. For example, forests not only receive and use water as rain, runoff, groundwater, and vapor, but store and recycle water, providing many essential water-related ES. The same can be said of many other ES: those related to soil fertility, pollination and seed dispersal, microclimate, growth and carbon storage, and biodiversity maintenance are all sustained by healthy forests. These self-operating natural systems are vulnerable to disturbance and degradation, if forests are not sustainably managed.

The Millennium Ecosystems Assessment (MA 2006) offers a framework to analyze types of ES used.

Provisioning Services

Economic benefits from ES in natural and planted forests come mostly from supply of raw materials: timber, fuelwood, and diverse NTFP (ITTO 2007). The provisioning ES that "grow" these materials are exploited by forestry enterprises of varied types and sizes. The raw materials supplied depend, in turn, on provisioning of the plants and animals that produce them with water, nutrients, CO2, or O2, and so forth.

Regulating Services

Forest ES are important not only for provision of a variety of inputs to economic processes, but also for regulation of the conditions in which they are provided: micro climate, forest health (vulnerability to fire and to attack from insects and pathogens), and others (ITTO/UICN 2009). Around 330 million hectares of forests worldwide are designated for conservation, avalanche control, sand dune stabili-

Box 8.10. Natura and the Iratapuru, Brazil

Surrounding the Iratapuru State Sustainable Development Reserve, in the Amazon forest in the state of Amapá, the remote Iratapuru community is an exemplary case of Natura's learning from traditional and local communities. The communities had lived off collecting brazil nut for generations, using extraction methods that changed very little. In 2002, major changes were made after an agreement with Natura for the provision of brazil nut oil for the Ekos line.

Composed of 30 families, the Mixed Extraction Cooperative of the Iratapuru River sells crude brazil nut oil to Cognis, a processing company that refines the oil and delivers it to Natura, which in turn uses the oil to manufacture shampoos, conditioners, and bar soap. The community is paid twice, in the beginning of the productive chain, as a provision and for oil sale; and at the end, as a percentage of Natura product sales. To set a fair price for these payments, community meetings were held with participation of family leaders, Natura professionals, and Cognis employees.

All stakeholders presented their needs and expectations, and debated costs, prices, and profit margins. The government of the state of Amapá, NGO Amigos da Terra (Friends of the Earth), and local academic community representatives supported and participated in the negotiations.

Over the course of four years, resources derived from the agreements and from investments made in the community by Natura allowed the construction of an oil extraction plant that the community itself operates. Natura financed the hiring of Imaflora, the Forest Stewardship Council (FSC) representative in Brazil, which certified the plant's nut production with the "FSC green seal" in 2004.

To prevent the community from becoming dependent on the company and to avoid the appearance of a "handout" relationship, part of the value received for the sale of products was allotted to the creation of a Sustainable Development Fund. Its purpose is to foster other economic initiatives by the community to reinforce its technical and commercial management capacity. The community will be in charge of setting its own development goals without the oversight of Natura.

Source: Arnt (2008).

zation, desertification control, coastal protection and production of water, and, soil and water conservation (FAO 2010).

Water and wind regulation: Forests provide clean water by protecting soils against erosion, and recharging streams and groundwater. Forested floodplains act as water storage areas to significantly reduce the level of floods and flood velocities downstream (Anderson and Masters 1993). Healthy riparian areas also act like sponges. When flood waters are slowed, these areas allow more of the excess water to percolate underground. Slow release of stored water from riparian zones helps maintain stream flow between storms. Vegetation slows wave action and roots of trees help bind and stabilize the soil (Anderson and Masters 1993); thus, maintaining forests in high risk areas can buffer against flood and storm damage in coastal and montane sites.

Forests also act as wind barriers, protecting trees and soils and creating appropriate microclimates for tree growth and agriculture. Coastal and others forests buffer against hurricanes and other wind storms.

Pollination and seed dispersion: Many forest plants are dependent on insect pollination in order to fruit and set seed, and, then, on other animals to disperse the seed. In forests, as on agricultural landscapes, hundreds of species used by humans are pollinated by insects, birds, bats, and other animals (Hill 1998). Animals play an equally fundamental role in seed dispersal; for instance, of 172 timber trees in Guyana's Iwokrama forest, 51% are dispersed by mammals and 21% by birds (ITTO/UICN 2009). Maintenance of pollinating and dispersing organisms is part of the regulatory ES of forests.

Such ES can come from small patches of natural forest in human-dominated agricultural landscapes. In Costa Rica, for instance, the oil palm industry is highly dependent on weevils from nearby forests as pollinators (Hill 1998). Despite the clear relation between forests and their own pollinators and dispersal agents, as well as with pollinators of nearby crops, more data is needed to properly gauge the role of this ES in ecosystem functioning, sustainability, and forest productivity, and to identify those ES most at risk.

Biodiversity and genetic resources: Biodiversity is critical to the health of natural and managed forests and plantations. A multitude of different kinds of plants, animals, and microorganisms is essential to maintain healthy, functioning forest ecosystems (Hill 1998). Fragmentation of forests into patches, common on BAU landscapes, undermines biodiversity, with effects ranging from gene pool simplification to loss of species and of ES. Degradation can be lessened by connecting the patches via biodiversity corridors, as by maintaining forests along waterways that connect patches. Fragments are more prone to fires, invasion of weedy species, and habitat degradation (ITTO/UICN 2009). Fragmented forests also lead to increased harvesting costs, because small, scattered stands require more moves by the logger, using more fuel and time.

Forest plantations benefit from biodiversity but also contribute to fauna and flora preservation. Enhancing biodiversity in plantations can be done by increasing variability when plantations are established (Hartley 2002). An obvious way is to use mixed-species plantations rather than monocultures. Random species assemblages are unlikely to be successful; care is needed to design mixtures that are stable and productive (FAO 1992; Montagnini et al. 1995; Lamb 1998). The type and number of species will also be affected by costs. In LAC, a number of native trees have been successfully tested for use in plantations (PROFOR 2010; CATIE 2008), but technical knowledge and seed sources have not been widely available. An economic advantage of building diversity into plantations is that it provides insurance against future changes in biological factors (climate, pests, disease) and in market values (Carnus et al. 2003).

Supporting Services

Soil moisture and fertility are two important aspects of site quality that ecosystems provide to natural forests and plantations. Soil fertility on many rural landscapes in the world is affected by BAU practices and mismanagement of soils. Soils that have been dramatically depleted need costly investments in fertilizers and other amendments to bring them back to productive levels. But, deposition of excess nutrients from plantations may produce acidification and eutrophication, reducing productivity.

Plantation soil fertility under BAU and SEM: Generally speaking, plantation management is associated with significant nutrient losses. In East Kalimantan, Indonesia, Mackensen and Folster (1999) found that on poor Alisols/Acrisols or Ferralsols soils (typical in tropical forests in South America as well), *Acacia mangium* plantations with a harvest volume of 200 m3/ha lost 18% to 30% of the available Ca and K supplies after one rotation. The costs of replacing the expected nutrient losses on intensively managed timber plantations of different species range from 9% to 40% of the plantation's total costs, depending on the species, site management, and type of fertilizer (Mackensen and Fölster 1999).

An average nutrient loss of 20% per cycle would mean that the available supplies of the elements may become limiting in under five rotations. If the area is managed conventionally (using tractors, harvesters, etc. and burning the logging debris), the total loss of nutrients on typical sites after one rotation amounts to 21-62% of the system's pools of K, 9-32% of Ca and 5-20% of Mg, depending on the tree. The losses of P amount to a maximum of 17% and of N (for *Eucalyptus deglupta* only) to a maximum of 53%. The continuous output of nutrients under BAU practices leads to site degradation and decreased productivity.

Using a form of management that preserves the land by not burning the slash and by using methods that preserve the soil (light-weight machines, high-lead cable car systems) and other SEM practices, nutrient losses that occur in each rotation can be reduced by about 50% (Mackensen and Fölster 1999).

The internal rate of return calculated in accordance with government stipulations was 17.7%. If fertility management is geared toward replacing nutrient losses and the plantation's costs, therefore, increase by 13% (replacing nutrients removed with the harvest), the IRR drops to 11%. Investment calculations for plantations, thus, need to consider site-specific effects on nutrient budgets. Managing large, uniform areas conventionally is economically less efficient (Mackensen and Fölster 1999).

Cultural Services

Ingrained appreciation for forest ecosystems and for biodiversity in its many forms is a cultural facet shared by traditional peoples across LAC — and some modern groups too, such as those that support forested watersheds and certified wood products. Certain agroforestry practices traditionally used by indigenous communities in natural forests enhance biodiversity. The clearance of small patches of forest by Mayan families (for example) to cultivate food and fiber, the enrichment plantings of fruit and nut trees, and the harvest and regeneration cycles — all support the growth of more diverse sets of species.

Climate Change Regulation

Climate change will affect the menu of ES available to forest resource users — forest industries, rural communities, and nearby or downstream agricultural operations. Changes in temperature and precipitation patterns will affect distributions of species and ecosystems; increasing storm frequency and intensity will bring greater uncertainty and risk to the users and the forests. Blow-downs, drought, and fires may multiply. Change in fire frequency may affect forest structure, carbon sinks, and air quality. Trees stressed by such factors may be rendered more susceptible to insect attack and/or disease.

The services provided by biodiversity may contribute to long-run profitability of natural and planted forests by providing greater resilience to climate change, as is expected from forest and non-forest ecosystems characterized by varied species and genetic diversity within species. Thus, biodiversity can provide ES in the form of resilience, contributing to maintenance of other ES from forests.

8.6 COSTS OF BUSINESS-AS-USUAL (BAU)

Forest conversion via slash and burn, then planting open land with high-value monocultures have been constant strategies throughout LAC to bring employment to rural areas. Declining crop productivity on newly-cleared rainforest lands is seen as normal, with ongoing abandonment of old lands and deforestation of new ones to renew revenue streams. Conversion of forests to pasture and cropland, as well as fires associated with the widespread slash-and-burn practices, makes forest loss permanent, with significant reductions in the biodiversity and ES needed by the forestry industry and society.

The Eliasch (2008) Review, commissioned by the UK Prime Minister, found that deforestation worldwide has resulted in a financial loss between $1.8 trillion to $4.2 trillion; some researchers put the net present value of forests as high as $25,000/ha (McKinsey & Company 2008). This section relates the economic losses of forest conversion to the direct and indirect drivers of forest loss and degradation, including subsidies and fiscal incentives, and the impacts on economic and social conditions.

Loss of Soil Productivity

Declining soil fertility of tropical forests, together with unsustainable production practices, soil compaction, erosion, pests, weeds, and pathogens often rapidly diminish the carrying capacity of plantations, pastures, and crops, eventually affecting returns for forest companies and farmers.

BAU farming in the Amazon involves extensive, shifting cultivation of annual crops like rice, corn, and cassava. A piece of forest is logged and burned, then put into annual crops for a couple of years. Burning provides a nutrient-rich, relatively pest-free environment that gives high yields for one-four years. Yields then decline rapidly; copious amounts of fertilizer are required for further crops. That is because in tropical forests, most of the essential nutrients are locked up in the living vegetation, dead wood, and decaying leaves. As organic material decays, it is recycled quickly by the web of living rootlets and their fungal symbionts; few nutrients ever enter the soil, leaving the soil impoverished. On cutting the forest, this nutrient cycling capacity is disrupted, and the nutrients stored in the living tissues are released and lost.

Degradation and abandonment of land was documented in Brazil from 1960 to 1985. By 1985, 14% of Amazonia was converted to agricultural land. Of this, 63% was pasture, 7% annual crops, and 2% perennial crops and planted forest. The rest (28%) was fallow due partly to soil degradation (Andersen 1997).

In contrast, Brazilian states that have promoted agroforestry systems (a SEM practice) on their landscapes have seen productivity raised by as many as three times more cattle/ha compared to BAU-cleared pastures (Brack 2000). Economic analyses (Hecht 1986; Hecht, Norgard, and Possio 1988; Almeida and Uhl 1995) show that ranching in the Amazon had a very low or even negative productivity — if the gains from land speculation were not taken into account — due partly to nutrient loss after a few years. Soil degradation and weeds in Brazil typically reduce cattle stocking rates from two head/ha during a pasture's first four years to only 0.3 head/ha a few years later (White et al. 2001). This six-fold loss in productivity reflects the costs of BAU forest resource utilization, but only in part.

Revenue Loss

Conventional logging, cattle ranching, and agriculture established after forest conversion under BAU, typically, generate few tax revenues or none, since logging fees and other levies are seldom collected. Low tax collection in some countries is a policy to subsidize wood consumption (e.g., as fuel) for social reasons (Fernagut 2008). Illegal logging implies revenue loss from uncollected taxes and royalties in countries that regulate harvesting activities. Loss of timber revenue globally is $5 billion/year (Fernagut 2008).

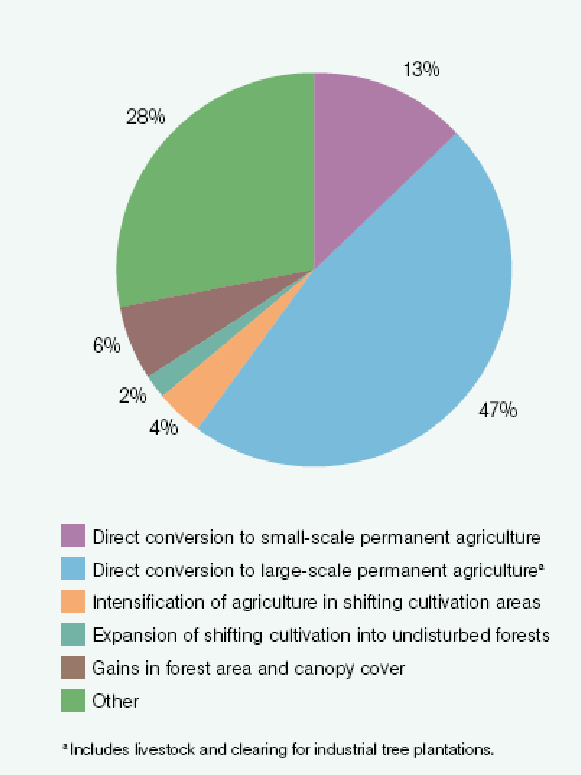
LAND CONVERSION/DEFORESTATION

Depletion of forests in LAC countries is occurring at an alarming rate. This affects the natural resource base on which the livelihoods of rural communities depend. Rural economies remain stagnant. Without investment, the only way to increase revenues is to continue expanding the agricultural frontier, which has led to further stagnation in the past. Land conversion leads to loss of biodiversity and of livelihoods for forest-dependent people, raises greenhouse gas emissions, changes local hydrological patterns (precipitation, flooding, drought), and increases sedimentation and soil degradation (Kanninen et al. 2007).

The main driver of land conversion has been large-scale permanent agriculture, followed by small- scale permanent agriculture (Figure 8.6). Chomitz (2007) summarizes factors that influence deforestation rates:

- The suitability of land for agriculture (flat, fertile, good rainfall, and well drained,.
- Availability of tax credits,
- Accessibility, as by road,

Figure 8.6. Causes of Forest Area Loss in Tropical Latin America, 1990-2000



Source: FAO (2001).

- Fertilizer prices (increased prices bring pressure on forests),
- Demand for agricultural products, farm gate price levels, and
- Situations where land clearing facilitates obtaining property rights, fueling land speculation.

Fire and Land Degradation

Fire is a traditional tool to open up new land to agriculture, by clearing it, killing many pests, and putting the ashes into the soil to enhance its nutrient content. This technique works for a few years but leads to erosion and land degradation because of loss of the soil-retaining and nutrient cycling capacity of tree root systems. Loss of canopy shade leads to an additional degradation factor: heating the soil surface, hardening the surface, and decreased soil moisture.

The risk of forest fires in Latin America is high, particularly in periods of increased drought, like those caused by El Nino in Central America in 1998, when losses in the region were in the range of $10 billion-$15 billion (Cochrane 2001). In South America, the incidence of agricultural burning as a cause of forest fires has held steady over decades. Chile is an exception: burning as a cause of forest fires has fallen over 25 years from 41% (1976-1980) to 12% (1991-2000). Key to this was adoption of SEM practices (Alvear 2004).

BAU land conversion methods focus on the short-term economic advantage of burning, while ignoring long-term costs and off-site impacts like nutrient washing, sedimentation, fire risk, and air pollution.

Subsidies

Financial returns from planted and natural forests are a primary factor driving forest management, conservation, and investments throughout the world. The economic activities that exploit natural forests and replace them with other land uses often receive considerable financial support from the public sector. Governments have created a diversity of mechanisms to support forest conversion: direct subsidies, subsidized credit, fiscal incentives, and other forms of transfers. Subsidization of land acquisition also contributes to forest conversion via its influence on land prices (Cubbage et al. 2007).

A large percentage of the world's planted forests have been established with a subsidy of one sort or another at some time, either directly or indirectly (Bull et al. 2006). Direct subsidies in South America, generally, covered about half the establishment costs (Cubbage et al. 2007). Over 75% of establishment costs may be covered when additional subsidies for land, maintenance, and many other costs are considered (Bull et al. 2006). Subsidies generally increase rates of return by 2% to 3% (Cubbage et al. 2007). Subsidies have undoubtedly been key drivers in the rapid growth of plantations.

Subsidies for natural forest exploitation differ from those for plantations. The main subsidy policy tools to promote forestry investment in natural forests are the annual property taxes (Cubbage et al. 2007).

Negative impacts of forestry subsidies: Tax and credit incentives to agriculture and ranching have been fundamental to the expansion of deforestation in LAC (Browder 1985; Mahar 1988; Binswanger 1989). Subsidized credit remains a common incentive for cattle ranching and agriculture (White et al. 2001).

In the Atlantic Zone of Costa Rica, investment in productive land is distorted upward by interest rate subsidies, leading to land speculation, inflated rates of investment in land, larger farm sizes, and higher deforestation rates in agrarian frontier areas. This process is further promoted by subsidized livestock credit and other forms of agricultural subsidy that increase the marginal value of land (Roebelinga et al. 2010).

Examination of planting subsidies in Costa Rica and Nicaragua showed only moderate success in promoting establishment tree of plantations, the success of which was significantly diluted by allegations of inequity, inefficiency, and negative environmental effects. Fewer hectares were successfully established than those for which subsidies had been paid: in Costa Rica, only 50% and in Nicaragua, 27% (Bull et al. 2006).

Subsidies also play a significant role in environmental deterioration; on a global scale, subsidies may now be its primary cause (Taylor 1998). A report on perverse incentives to the Earth Council concluded that when prices do not reflect the full costs and benefits of production and consumption, information on scarce resources and environmental values is not properly conveyed, and people act according to erroneous information (De Moor 1997). In forestry, as in other sectors, a non-market price and incentive structure leads to over-investment, over-supply, or overuse and can cause environmental degradation.

There may be circumstances in which subsidies are acceptable: to obtain environmental benefits such as replanting degraded land, providing buffer zones around reserves, and stabilizing watersheds. The circumstances under which such subsidies may be acceptable are likely to be site-specific (Bass et al. 1996). Plantations can provide additional ES such as enhancing biodiversity, reducing salinity, and sequestering carbon. Such benefits should be considered in analyzing subsidization (Pagiola and Bishop 2002).

Mangrove Forest Conversion

Marine and estuarine fauna such as crab, shellfish, shrimp, and fish found in mangrove forests provide income and protein to coastal communities. Mangroves provide timber and fuel, as well as many NTFP and ES, such as storm protection, drainage and filtration, wind breaks, and fresh water (Gammage 1997).

Mangroves in the Caribbean are critical to mitigate the effects of tropical storms, acting as natural barriers to winds, storm surge, and other coastal weather hazards. In areas prone to storms, mangrove disappearance increases impacts on coastlines, and the cost of recovery, reconstruction, and relocation of people.

Mangroves are essential to the shrimp industry; deforestation and agrochemical run-off directly impact shrimp breeding grounds, slowing productivity and lowering yields (see Box 8.11). In El Salvador, this industry adds about 3.8% to yearly export revenues. Some 112,000 families depend on 26,772 ha of mangrove and brackish forests (MIPLAN 1993; Paredes et al. 1991; Foer 1991 in Gammage 1997).

8.7 NET ECONOMIC BENEFITS OF SEM

This section analyzes the economic benefits of SEM in areas related to forest resources production and certification, return on investment, and economic benefits of mixed plantations vs. monocultures.
Different types of forest resource users (listed in Table 8.1, earlier) have distinct costs of transition from BAU to SEM. Smallholders who occasionally sell timber or NTFP in low volumes, may find shifting to certified SEM practices costly and the net economic benefits unclear. For medium-sized operations, market access and new revenue-generating options may be an incentive to engage in SEM practices, particularly if several producers get together to make SEM certification affordable. Large-sized operations will find SEM practices requisite for market access; certification costs will be low due to economies of scale.

REVENUES FROM SEM PRACTICES

Revenue from sustainable activities related to forest management and recovery in the northwestern Amazon may have reached $123 million, as early as the decade 1982-1991 (Arias 1994). GTZ's Project Gesoren in Ecuador's Amazon estimated the benefits from avoided costs of deforestation at $3 million, while the costs of forestry control were $112,000/year (Hexagon Consultores 2007).

Avoided costs from protected areas and SEM practices can also be calculated by valuing the ES from forested areas. In Peru, the economic value of carbon sequestration on 2.4 million ha, 92% forested, was $1.25 billion in 2000 with a projected value of $2.47 billion in 2010 (Chambi 2002). The total economic value of the biodiversity hosted by the area was found to be $1.85 billion in 2000. This figure includes associated benefits such as fishing, NTFP, timber, agriculture, ecotourism, gold, and carbon sequestration, together with option and existence values.

In Peru, sustainably-managed timber concessions were shown to be profitable by analyzing net present values and internal rates of return from six concessions (Table 8.8). IRRs ran 24%-74% (González 2005).

SEM, Certification, and Market Access

New trends in market response to the status of natural forests require that forestry industries in LAC adapt adeptly. For example, origin denomination in agricultural products such as "bird friendly coffee from

Table 8. Profitability in selected Sustainable Managed Timber Concessions in Ucavali Peru

Timber Concessions	MPV	IRR
Concessionaire 1	37,904	24%
Concessionaire 2	108,894	34%
Concessionaire 3	518,410	74%
Concessionaire 4	461,085	56%
Concessionaire 5	289,148	42%
Concessionaire 6	264,157	35%

Source: González 2005

Box 8.11. Impact of Logging in Mangrove Forest in Barra de Tecoanapa, Mexico

Degradation of mangroves threatens livelihoods of coastal populations in several LAC countries. In Mexico, urban development, agriculture and ranching, aquaculture, and pollution are pushing fisheries that depend on healthy mangroves to the brink of collapse. Mangrove felling continues, reducing productivity and impacting fisheries.

A study undertaken in Barra de Tecoanapa on the Guerrero coast measures how much economic harm (loss in net benefits), via environmental damage and degradation of ES, was caused by deforestation of 3.5 ha of mangrove forest to plant maize in a community along the Quetzala river from June to November 1992 (Hernandez et al. 2000).

Litterfall production: Before deforestation, 14.2 ton/ha/year of litterfall (dry weight) was deposited on the forest floor. In terms of units of organic carbon, an estimated 7.8 ton C/year, previously deposited in the 3.5 ha, was lost to the system. Part of the organic matter produced by mangroves is exported to the sea where it goes into the trophic chain; 10%-15% of this is transformed into fish, crustacea, molluscs, polychaetes, and isopod tissue. Of that fraction, no less than 20% is caught in commercial fisheries (Odum 1970 in Hernández et al. 2000). Thus 1.9 tons of live tissue of a variety of organisms would have been obtained from the lost carbon, and 380 kg of fish, crustaceans, and mollusks were not caught at sea the following year. At an average of $1.26/kg, the fishery's value shrunk by $480.

Recorded environmental changes: On the study site, accelerated salinization occurred in December 1992, together with an increase in temperature. Interstitial salinity in the soil went from an average of 12 psu (practical salinity units) in the forest to 30 psu in the deforested area. Lack of plant cover caused temperatures to rise by up to 13°C in soil and 11°C in the air (Hernández et al. 2000). These variations induced changes in soil color, permeability, and density. Permeability rose via lixiviation and decomposition of organic matter, increasing the portion of sand from 43% to 63%. Strong changes in atmospheric and soil humidity were observed.

Economic losses: After deforestation, maize was planted from June to November 1992 yielding an average of 529 kg/ha valued at $0.45 cents/kg, which left farmers with a total of $68, net of expenses (labor, planting, and weed and pest control). In 1993, the site was planted again, but the yield decreased to 190 kg/ha of maize, at a market price of $0.60 cents/kg leaving a net income to farmers of $20. In 1994, the site was abandoned.

Felling 3.5 ha of mangrove forest produced a loss to the community of wood for construction and firewood, with an estimated cost of $80/ha/year. Between 1993-94, a 33% reduction in estuarine fisheries occurred, primarily because of the destruction of the refuge, reproduction sites, and fishery areas for species along 200 m of the felled river margin. The loss of the mangroves also caused silting of the deepest part of the river (2.5-4 m), used as a refuge by commercial fishing species. This was particularly critical in 1993. The fishery yield of 1991-1993 was averaged, and the average for each species was multiplied by the price of the kilogram of fresh product in the market and compared to the 1994 yield. Losses for the community were recorded as volume and income for the years 1993 and 1994. While other factors may have affected catch size, records show a decrease from 5,305 kg to 4,244 kg of fresh product for 1993-94, worth $1,758 and $2,030. Catches recovered by 15% and 17% in 1995 and 1996, except for snook, but never reached the 1991-92 yield.

Other benefits such as harvesting honey and wildlife were also analyzed; net costs were included in the table below. It is estimated that the costs incurred by felling this site were 32 times higher than the benefits obtained by the farmers.

COST-BENEFIT data expressed in $

Products and services	Costs (USD)	Benefits (kg of maize)		Income USD
Extraction of wood and firewood	136.0	1992 cycle...1850		67.6
Estuarine fisheries	1895.0	1993 cycle....665		20.4
Marine fishery component	480.0			
Wild fauna	133.0			
Honey	162.0			
Total	2805.0 USD	Harvest	2515 kg	88.0 USD
Costs after 5 years+55%[1]	21 741USD			

[1] Costs for the five years during which the site recovered by only 30%, plus the average inflation recorded during the same period.

Costa Rica" is gaining more acceptance in international markets. The same applies to certain types of timber and NTFP products.

There is growing concern by consumers about the state of forests and how purchasing patterns may affect forest conditions. Certification by FSC or Programme for the Endorsement of Forest Certification (PEFC) can contribute widely to SEM and has become an increasingly important tool for accessing or assuring markets. Certification emerges as a way to counteract market, institutional, and governance failures, opening the door to new market niches for certified forest products.

In Guatemala, FSC-certified community concessions increased their revenues by 209% to $5.8 million. Improved sawmilling efficiency, higher grades of mahogany, better prices for FSC-certified mahogany, and the addition of an FSC-certified NTFP made higher revenues possible. In addition, employment for women in associations increased, by working on value-added NTFP business (PROFOR 2010).

In Honduras, cooperatives banded together to provide semi-processed mahogany for export to certified markets by changing their production chain and adopting SEM practices. With only a 19% increase in volume harvested, their revenues increased by 128% to $579,375 after accessing certified markets. Production costs rose 40% due to increased costs of forest management and taxes, as well as the extra care needed to produce quality mahogany grades (PROFOR 2010).

Despite the potential of certification to expand forestry businesses and to support SEM, its adoption has lagged. By 2007, only 1.2% of the forest area in LAC was certified, up from 0.4% in 2002. The region's share of certified area was only about 4% of the world's total (ITTO 2008). According to FSC, certification in 19 countries of LAC accounted for 11.7 million ha in 679 operations (Table 8.9).

Three main factors have hampered growth of certified forest management programs (Durst et al. 2006): (1) an absence of premium prices for certified wood in some markets, (2) a wide gap between existing management standards and certification requirements, and (3) a weak ability to formulate appropriate forest sector policies and ensure effective implementation. Additional barriers are insufficient capacity to implement SEM at the unit level, to develop standards and delivery mechanisms, and to resolve land tenure issues.

Table 8.9. Number of FSC Certifications and Area Under Forest Management in LAC

	Number of Certified Operations				Area (ha) in Certified Projects		
	COC	FM	FM/COC	CW/FM	FM	FM/COC	CW/FM
Argentina	**18**		**14**	**1**		**256,331**	**120,560**
Belize	1						
Brazil	252		64			5,474,587	
Bolívia	28		18	1		2,093,158	
Chile	32		13			313,590	
Colombia	4		2			20,361	
Costa Rica	11	2	17		1,060	66,880	
Dominican Republic	0		1			1,000	
Ecuador	0		4			24,537	
Guatemala	8		10			481,967	
Guyana	3		1			371,681	
Honduras	6		4			16,175	
México	21	1	36		965	717,446	
Panamá	3		7			13,715	
Paraguay	3		2			15,974	
Peru	19		8			628,359	
Puerto Rico	3						
Uruguay	25		33			916,690	
Venezuela	**2**		**1**			**139,650**	
Total	**439**	**3**	**235**	**2**	**2,025**	**11,552,101**	**120,560**

Similar interest in certification standards and sustainability criteria is expected to arise in economic activities that can compete with forests for land, such as biofuels, beef, and cereals. Examples of this are the Roundtables on Responsible Soy Association, Sustainable Palm Oil, and Sustainable Biofuels, with active involvement of several countries in the LAC region. These organizations include all players on the custody chain and use social, economic, and environmental criteria to guide production activities. Certification for sustainable management, conservation of biodiversity, and social welfare is being used by actors in these value chains as a strategy to gain market access and as a way to enhance competitiveness.

Trade bans and other import restrictions tend to be used against products that become associated with unsustainable extraction. For instance, the European Union (EU) launched an action plan to restrict the illegal timber entering the EU, raising the import requirements on tropical timber (E.C. Commision 2003).

A recent trend among sustainable forestry certifiers is to actively approach small- and medium- forest enterprises (SMEs) in developing countries. They account for as much as 80%-90% of businesses and many large-scale forestry companies are already certified. This can help formalize forestry practices in community and other small forestry initiatives, modernizing the sector at that level. Accounting for 50% of forest-related jobs and offering a greater leverage to reduce poverty than large-scale operations, SMEs are a model for new forms of rural institutions, such as community enterprises (Rainforest Alliance n.d.).

Native Species and Mixed Plantations

By using native species, it is possible to replicate the high quality of timber found in original rainforests, serve local markets with familiar woods, and, often, improve growth rates (PROFOR 2010). Native biodiversity is supported and it is possible to create natural corridors between forest patches (Erskine et al. 2005). Erosion risk is reduced and nutrient use increased because of the complementary root architecture and soil use strategies of distinct species (Ewel and Putz 2004). Increased growth of mixed plantations is due to lower levels of intra-specific competition in mixed plots. Mixed plantations have proved to be more resilient to pests, diseases, and climatic variations. Selection of appropriate species is important to design more productive mixes (Piotto et al. 2009). Alien species, if not threatening to surrounding ecosystems, can be used to good advantage, if they provide essential ecological or socioeconomic services. By speeding restoration or making it more effective, non-native species can provide economic and ecological payoffs (Ewel and Putz 2004). Mixed plantations better accommodate the immediate economic necessity of many smallholders who need to begin harvests prior to completion of the rotation. Mixed plantations may often be a preferred system for reforestation, either for timber production or carbon storage because a mix is more economically viable and productive than single species antings (Piotto et al. 2009).

Return on Investment – Mixed Plantations vs. Monoculture

Studies in Australia and Costa Rica show the economic benefits of reforestation using a mix of native species instead of monoculture. Mixed plantations yielded more timber per hectare with a Net Present Value (NPV) of $1,124 to $8,155/ha and Internal Rate of Return (IRR) of 7.7%-15.6%, depending on the species mixture (Lamb et al. 2005). Mixed plantations also performed better for all growth variables considered, including height, diameter, volume, and aboveground biomass (Piotto et al. 2009).

REDUCED IMPACT LOGGING (RIL) VS. CONVENTIONAL LOGGING (CL)

RIL has been shown to be more competitive than CL in financial returns to initial harvest entries. CL operations refer to unplanned, selective harvesting where salable stems are identified by a skilled timber cruiser, felled by a sawyer, then later searched for by tractors or skidders, and extracted on impromptu skid trails to log decks or roadsides, generating considerable environmental impacts (Boltz et al. 2003).

RIL requires investment in inventory, planning, vine cutting, and infrastructure up to a year before logging, equal to 2%-18% of total CL harvest costs. The pre-harvest costs of RIL are a disincentive to its adoption. However, RIL direct costs are usually lower than or competitive with those of CL due to gains in efficiency and reduced wood waste (see Box 8.13). Lower indirect costs were obtained under RIL due to gains in efficiency that brought lower support, maintenance, and overhead expenses relative to CL.

RIL methodology defines the pattern and intensity of harvesting, and the resulting opportunity costs relative to CL. When RIL is designed to mimic CL harvesting in terms of harvest level, species, size classes, and spatial distribution, gains in operational efficiency and waste reduction makes RIL environmentally and economically superior to CL, as shown by comparative studies on CL and RIL in Brazil, Guyana, and Ecuador (Boltz et al. 2003). Direct and indirect costs of RIL vs. CL in the examples studied reflect the potential for adopting RIL practices (Figure 8.7). These costs are not adjusted for waste, therefore, the relative costs of RIL may be even lower and the comparison with CL even more favorable (Boltz et al. 2003).

Despite the overall benefits and profitability of RIL, an obstacle to its wider adoption is the uncertainty concerning the marginal benefits of RIL in relation to the more familiar, known profitability of CL (Boltz et al. 2003). CL firms face few incentives to alter their operations unless dramatic changes in market signals appear. Current stumpage and timber prices may not provide incentive to adopt practices that appear more costly up front. If stumpage fees do not reflect the true value of the assets or if land and forest resources are treated as a “free good,” they will be over-utilized and RIL will be less competitive. This appears to be occurring in areas of South America currently under intensive timber exploitation (Boltz et al. 2003).

Box 8.12. case study: planting empowerment — private business model for local reforestation

Background

Planting Empowerment (PE) is a private firm committed to socially responsible activities, addressing environmental, social, and economic means to attain the goal of conserving rainforest in Panama's Darien Province. Its business model engages rainforest-dependent populations to create investment opportunities in sustainable forestry and increase conservation in fragile environmental areas. Darien province is recognized by Conservation International as a threatened biodiversity hotspot. After being logged, the land is typically used for agriculture or pasture, during which time the land loses fertility from overuse and poor management.

By leasing previously deforested land from low-income landowners in the Darien, PE reforests the area with a mix of predominantly native specie tropical hardwoods. After a 25-year cycle, the trees are harvested for investors (including local communities) and the surrounding biodiverse forest is left to continue attracting species and enriching the environment. US and European investors who desire a solid return, as well as a positive social and environmental impact, partner with PE. Incorporated in Panama in January 2007, PE has already planted 22,000 trees in mixed species plots on 20 ha of previously denuded and degraded land.

BAU

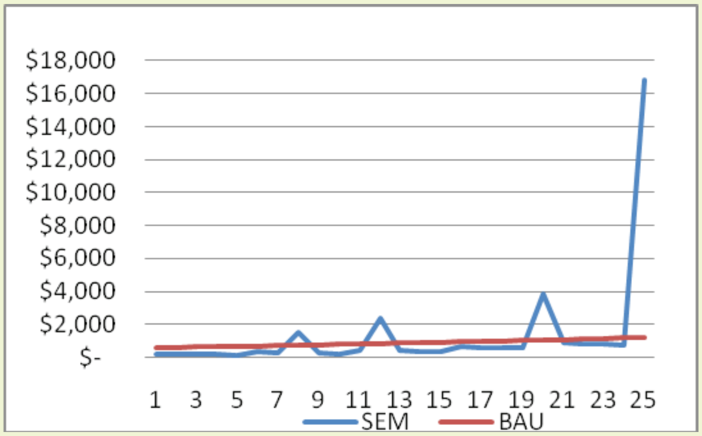
Nuevo Paraiso, one of PE's partner communities in the Rio Congo region of Darien settled in the 1980s by Latinos, now has a population above 20,000. The majority depend on exploiting natural resources (principally land) for a livelihood. Smallholders often obtain land by squatting on a parcel of rainforest, then logging and clearing the land to make room for subsistence agriculture and, later, cattle. According to FAO, Panama lost about 82,000 ha of rainforest between 1990 and 2005. Cleared land around the community sells for $200-$3000/ha depending on road access, power connection, and cleared vs. semi-cleared status. Landowners currently rent pasture at $14/month for 9-10 months/year. They can also plant corn or rice that yields $200/ha using slash-and-burn practices, but this practice requires crop rotation and resting the land at least five out of every ten years.

Taking into account the opportunity cost over 25 years, as well as the investment in the land, an IRR of 6.24% does not seem unreasonable for a landowner rate of return under BAU conditions. However, in addition, slash-and-burn and cattle raising practices cause erosion, soil compaction, and loss of fertility that further degrade the property, in effect, limiting the holder's future returns. Agriculture and ranching produce only sporadic income from harvests or sales of cattle. There is currently no incentive for smallholders to invest in conservation of natural resources.

SEM

The vision of the company is to (1) increase and smooth the income smallholders receive, and (2) do this by undertaking activities that promote regeneration and conservation. The company leases degraded land from locals for between $13.66 and $18/ha-month. This rate is set for the first five years and then scales each five years for the full 25 years, to match potential inflation. Thus, landowners receive a guaranteed increase in return of between 15%-80% plus income smoothing due to year-round lease payments (agriculture and renting of pasture stop during dry season). Finally, landowners receive 2%-4% of revenues generated from the plantations on their land (profit sharing). In both BAU and SEM cases, the land is valued as an initial investment of $12,500 ($2,500 x 5ha).

Figure 1. Individual Yearly Economic Return, SEM vs BAU



According to the PE SEM table, the profit-sharing lease payments after the initial investment over 25 years offers a SEM IRR of 11.24%, significantly higher than the BAU IRR of 6.24%. PE is partnered with two landowners in Nuevo Paraiso, each leasing 5 ha to the project. Binding contracts grant PE access to the land for 25 years. Monthly lease payments are made to partners through a savings cooperative an hour away. By making conservation more profitable than normal slash-and-burn activities, the company gives smallholders the incentive to maintain their natural resources (Figure 1)

Community and Landowners of Nuevo Paraiso

To better examine the benefits that PE's SEM offers over the BAU case, the community and landowners of Nuevo Paraiso offer an example. Table 1 lists the benefits to both parties from profit-sharing with PE.

Table 1. Benefits in Monoculture vs. SEM

	Monoculture	PE (SEM)	Comments
Daily Wage	$10	$10	Detail variety of local work for $10
Sale of Land to Project/ha	$2,000	$4,000	On average
Equity in plantation - individual	0	4%	Potential value of $4000/ ha over 25 years
Equity in plantation - community	0	2%	Potential value of $2000/ ha over 25 years

Scholarships, other community help (latrines, water systems, etc.)

Source: Planting Empowerment (2010).

Other benefits arrive with the increases in local labor employment. Although the initial increase in employment is minimal (structural change), larger benefits to the community will accelerate once small industry develops in the region, adding value to the timber produced from the plantations.

The last harvest at the end of the plantation's cycle provides most of the profit-sharing revenues (Figure 2).

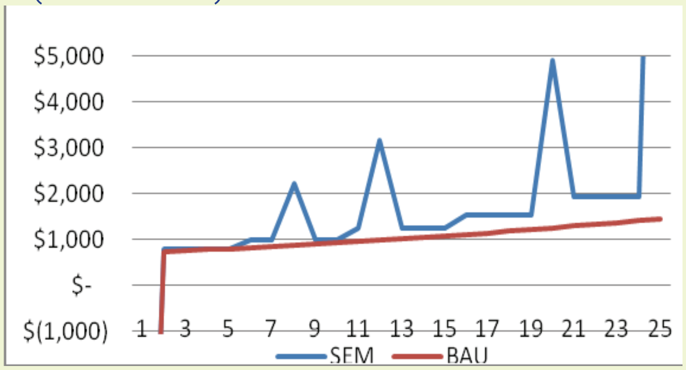
The company also pays a premium to its day laborers ($9/day vs. $8/day) compared to other wage opportunities in the area. The full-time foreman that PE employs receives a salary of $300/month plus benefits (health and pension). As the government sets the minimum salary at $200/month (without benefits), PE pays roughly a 50% premium (Table 2).

Table 2. Comparison of BAU with Cattle or Subsistence Farming - Individuals

	BAU	PE (SEM)		COMMENTS
Daily wage*	$8	$9		BAU wage is paid to work as manual laborer for 7 hours with machete
Salaried worker	$200	$300	$100	salary difference, plus benefits
Cattle ranching	14	$13.68 - $18/month		
Equity in plantation		0	2% - 4%	valued at $4000/ha over 25-years

Source: Planting Empowerment (2010).

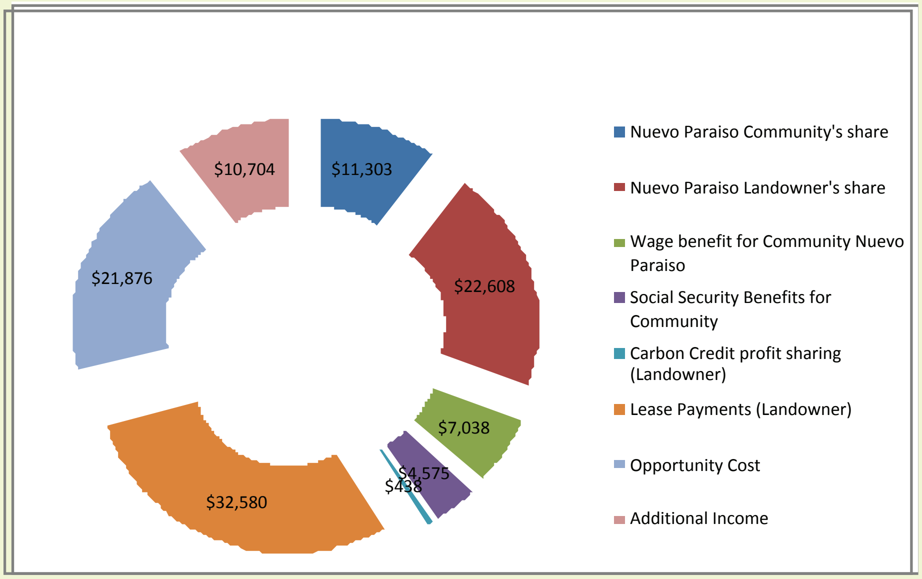
Figure 2. Net Present Value by Year, SEM (PE) vs. BAU (8% discount rate)



PE estimates that additional revenues will be generated through carbon credit profit-sharing with the landowners (Figure 3). At 6t/yr of storage, plantation forests are more efficient at sequestering carbon than natural forests.[26] Carbon credits in the voluntary market are at about $4/t in the US ($12/t in Europe), but are expected to rise as energy consumption increases and the US develops its carbon credit market.[27] One ha of PE's mixed species plantation will store 6t/yr of carbon, nearly enough to offset one American's yearly carbon emissions of 8t. A 20 ha plantation is expected to sequester roughly 3000 t of carbon over the 25 year investment span. In the table, a small yearly profit from the sale of these carbon credits will be realized by the landowner as well.

26 Potvin (2008) measures carbon sequestered by 1 ha of Teak at 350t/ha over 20 years. PE assumes under 50% of the 350t over 25-years, or 6t/ha/year.
27 http://www.chicagoclimatex.com/about/program.html

Figure 3. Community/Landowner Nuevo Paraiso Case (25-year Plantation)



To calculate the Net Present Value of the Individual Landowner, as well as the Social NPV for the community, the opportunity cost of the land (rental for cattle) is subtracted from the lease payments they would receive from PE in order to calculate the additional income generated from the SEM over the BAU case. Totaling all three categories, using an 8% discount rate (equal to local livestock financing interest rates), the NPVs are all positive totaling over $10,000 on 5 ha of land for the total and the community, as well as over $8,000 for the individual landowner.

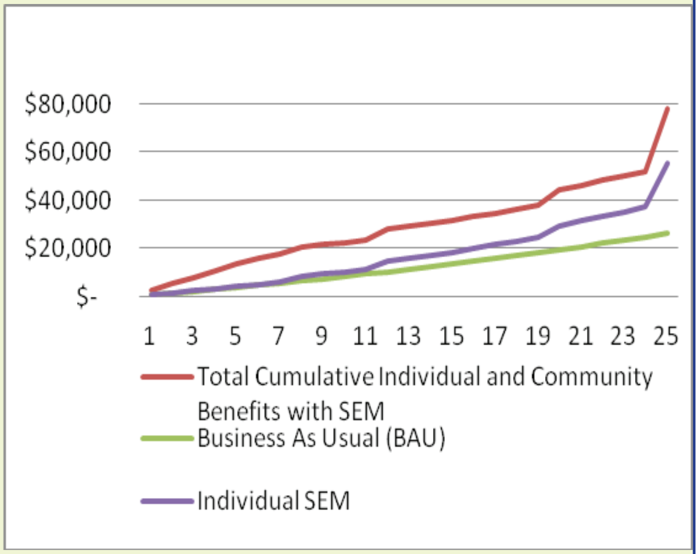
Other Benefits

Most of the population, including settlers and indigenous peoples, depend on the exploitation of natural resources for a livelihood. By exhausting the land's fertility, low-income settlers lose their chief source of income, pushing them into deeper poverty. Those who purchase new tracts of forest to work continue the cycle of slash-and-burn agriculture as a short-term answer to the lack of sustainable income. The PE solution to this is to lease — not buy — degraded portions of their land and pay them for the opportunity cost (cattle, subsistence agriculture) via lease payments. The landowner keeps the property, which appreciates, still has a portion of it to work, and receives a steady income.

Because PE plants approximately 70% native species, this culture choice will help ensure biodiversity maintenance and soil fertility. PE plantations include eight to ten different tree species, while leaving many non-commercial species, with the potential for many more if conditions permit. This mix of species attracts a healthy diversity of flora and fauna, providing forest corridors for species to travel between "islands" of jungle.

The tree plantations are helping to protect virgin rainforest in two ways. First, the PE does not displace low income landowners and, therefore, does not encourage them to venture farther into the jungle to clear new plots. Instead, the leasing model pays them monthly to stay on and conserve their land. The "normal" model employed by plantation companies is to purchase land from local communities/farmers. Often, these quick sales result in reinvestment in a larger tract of forested land, which would subsequently be logged and degraded. Second, as the plantations begin to produce timber, it will offset or decrease demand for old growth timber. The plantation timber will be FSC-certified, a feature that large purchasers like Home Depot and Ikea now require. The organization of plantations makes their future timber production easier to manage than that of an old growth forest, where low accessibility increases extraction costs and damage.

Figure 4. BAU vs. SEM Benefits in Dollars



Source: Planting Empowerment (2010).

REDUCED IMPACT LOGGING (RIL) VS. CONVENTIONAL LOGGING (CL)

RIL has been shown to be more competitive than CL in financial returns to initial harvest entries. CL operations refer to unplanned, selective harvesting where salable stems are identified by a skilled timber cruiser, felled by a sawyer, then later searched for by tractors or skidders, and extracted on impromptu skid trails to log decks or roadsides, generating considerable environmental impacts (Boltz et al. 2003).

RIL requires investment in inventory, planning, vine cutting, and infrastructure up to a year before logging, equal to 2%-18% of total CL harvest costs. The pre-harvest costs of RIL are a disincentive to its adoption. However, RIL direct costs are usually lower than or competitive with those of CL due to gains in efficiency and reduced wood waste (see Box 8.13). Lower indirect costs were obtained under RIL due to gains in efficiency that brought lower support, maintenance, and overhead expenses relative to CL.

RIL methodology defines the pattern and intensity of harvesting, and the resulting opportunity costs relative to CL. When RIL is designed to mimic CL harvesting in terms of harvest level, species, size classes, and spatial distribution, gains in operational efficiency and waste reduction makes RIL environmentally and economically superior to CL, as shown by comparative studies on CL and RIL in Brazil, Guyana, and Ecuador (Boltz et al. 2003). Direct and indirect costs of RIL vs. CL in the examples studied reflect the potential for adopting RIL practices (Figure 8.7). These costs are not adjusted for waste, therefore, the relative costs of RIL may be even lower and the comparison with CL even more favorable (Boltz et al. 2003).

Despite the overall benefits and profitability of RIL, an obstacle to its wider adoption is the uncertainty concerning the marginal benefits of RIL in relation to the more familiar, known profitability of CL (Boltz et al. 2003). CL firms face few incentives to alter their operations unless dramatic changes in market signals appear. Current stumpage and timber prices may not provide incentive to adopt practices that appear more costly up front. If stumpage fees do not reflect the true value of the assets or if land and forest resources are treated as a "free good," they will be over-utilized and RIL will be less competitive. This appears to be occurring in areas of South America currently under intensive timber exploitation (Boltz et al. 2003).

~~Box~~ 8.13. ROI from RIL: Return on Investment from Reduced Impact Logging

At Fazenda Cauaxi in Brazil's Amazon, a comparative analysis showed the benefits of RIL over CL. Pre- and post-harvest inventories showed RIL to be effective in reducing wood waste in the forest and on the log deck.

- Wood wasted in the CL operation was 24% of the initial harvest volume, compared to only 8% with RIL.

- More careful checking of logs under RIL increased recovered volume by 1.1 m3/ha relative to CL, and better coordination between felling and skidding crews in RIL increased recovered volume by 0.9 m3/ha.

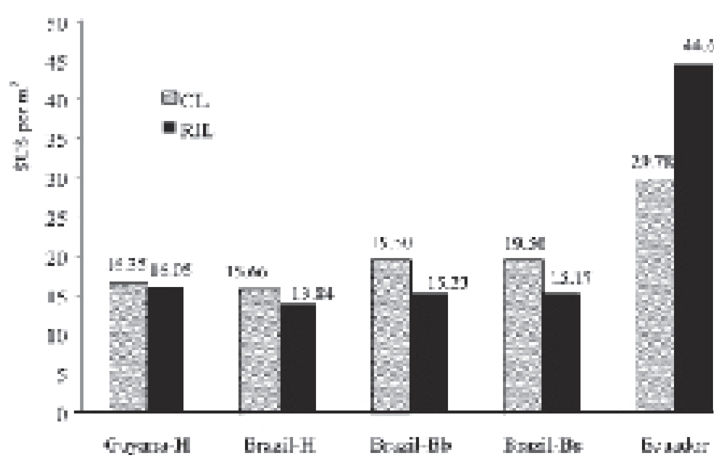
- More careful tree selection by RIL crews (in terms of size, species, and defects) resulted in a decrease of about 1.4 m3/ha in logs that were harvested but not used by the mill.

Logging damages the residual stand. In contrast to CL: by cutting vines, directionally felling trees, and planning the layout of roads and skid trails in RIL operations, damage to commercially-valuable residual trees can be greatly reduced.

RIL reduced fatal damage to residual trees: for every 100 trees felled on the CL block, 38 (commercial, greater than 35 cm dbh and with good form) were fatally damaged, compared to only 17 in the RIL block.

- Damaged future crop trees in the residual stand were recovering at nearly twice the rate on the RIL block.

Figure 8.7. Direct and Indirect Costs of CL and RIL



Source: Boltz et al. (2003).

In Central America, it is common to find forestry operations that are working with no net profit or at a loss, due to lack of information of the operators — mainly small scale, community enterprises — on the costs involved in the extraction. Certification standards that adopt RIL practices are able to solve this problem by incorporating registries, inventories, and both extraction processes and standards that help attain profitable margins (Butterfield 2010).

With no constraint on land availability, no clear signals of scarcity, and no effective regulatory framework, loggers will likely not be drawn to the marginal increments in efficiency to be gained under RIL. In a broader landscape without resource constraints, the opportunity costs of more careful RIL management, relative to maximizing forest turnover and timber processing by conventional means, may be too high and the benefits too uncertain for firms to change their logging behavior.

Forest Governance and Tax Revenues

Revenues from royalties, fees, and taxes from timber and forests remain very low in LAC (May et al. 2003; Richards et al. 2003). Governments, generally, spend more on forestry than they collect in revenue. This situation undercuts public finance and support for transitioning to SEM, and also reinforces treatment of forest resources as free goods, sending the wrong market signal and encouraging continued BAU practices. On the other hand, where taxes and fees are attractive, public agencies have an incentive to assure that logging and extraction activities are carried out in a sustainable way to maintain the revenue stream.

The average governance expenditure per hectare in South America was less than $1 compared to Asia at $20 (FAO 2010). In contrast, countries like Cameroon raise substantial revenues from timber auctions and taxes, with forestry providing up to 25% of the country's total tax revenues (Fernagut 2008).

The problem in LAC is worsened by the lack of governance in control of forest resources and the low prices associated with overexploitation of forest resources on the agricultural frontier. Often, the removal of commercially valuable trees is used to pay loggers for the cost of land clearing. In contrast, if taxes and charges on timber were set appropriately in a proper governance system, sustainable logging could become a pole of economic dynamism and SEM for natural forests would be more feasible.

Better forest governance will halt fiscal losses due to corruption, with uncollected taxes and royalties on legally-sanctioned timber harvests. If a fair level of tax on forest resources is achieved, this condition can lead to improved compliance with other environmental directives, raising revenues for environmental monitoring and enforcement, and benefiting equitable development initiatives (Fernagut 2008). Taxes can also be used as a disincentive to over-capacity in logging, thereby reducing over-investment in the forestry sector.

8.8 MARKET OPPORTUNITIES FOR SEM

Besides wood products and NTFP production, with certification to foster sustainability, there is also a huge potential for the region to capitalize on existing and emerging ES markets for PES including carbon sequestration, biodiversity, and watershed services markets.

PAYMENTS FOR ENVIRONMENTAL SERVICES

Payments for environmental services (PES) have mainly been used for watershed services. They are emerging as an alternative to command and control measures for forest management in several places. Globally, direct and indirect PES combined are about the same magnitude as total annual investment in forest conservation by governments, philanthropic organizations, and international organizations — somewhere between $2 billion and $2.5 billion/year (Scherr et al. 2004). Most LAC countries have legislative and regulatory frameworks for forestry, natural resources, or water to promote use of economic incentives for forest production and protection. By 2008, at least 22 countries had engaged in PES projects or in studies to implement one; payments for watershed services in LAC accounted for $555 million, conserving 8.9 million ha. Payments in LAC to farmers for carbon sequestration have totaled roughly $137 million, while conserving 1.08 million ha between 1993 and 2007 (OAS 2009).

A well known example is Costa Rica's PES scheme. Landowners who protect forest cover receive payments from the National Forestry Trust Fund, averaging $40/ha/year. Funding comes from a fuel sales tax, supplemented by "environmental credits" sold to businesses and other international sources (see Box 8.14).

Another PES example is Mexico's Program of Hydrological Environmental Services (PSAH). This program began in response to rapid depletion of aquifers, where two thirds of the 188 most important aquifers suffered from over-allotment of water resources. On average, extraction for human use was nearly double the natural recharge rates (Ruiz-Perez et al. 2005). The PSAH, which combines forest and water policy, provides incentives to avoid deforestation in areas with severe water shortages. With this program, the Mexican government pays forest owners for watershed protection and aquifer recharge in places where commercial forestry is not currently lucrative. Funded by $18 million in federal water fee revenues (Munoz-Pina et al. 2008), the program selects beneficiaries — landowners and populations — by criteria that include the value of water and the degree of poverty in the affected area. In 2004, 83% of payments went to marginalized population centers (Ruiz-Perez et al. 2005). PSAH payments have also been channeled to implement

Box 8.14. Case Study: Payments for Environmental Services: the PES Program's Impact in Costa Rica[28]

Costa Rica's PES program started in 1996, with origins in earlier attempts to incentivize forest conservation. Launched as Costa Rica's response to the agreements attained at Rio and in the Climate Change Conventions, the program is managed by the National Forestry Financing Fund to provide "financial recognition by Costa Rica's government to forest and plantation owners for the environmental services they provide and their impact on environmental protection and improvement" (FONAFIFO 2010). Current law allows people to apply for PES in seven categories: (i) forest protection, (ii) forest management, (iii) reforestation, (iv) established plantations, (v) agroforestry systems, (vi) natural regeneration with productive potential, and (vii) natural regeneration in pasture areas.

Scholars have undertaken to evaluate from different angles the impacts of Costa Rica's PES since it began. There is evidence on the motivations people have to enroll, as well as on the program's impacts in terms of deforestation rates and poverty reduction. While the goal is to incentivize forest protection and regeneration, the reasons given for participating are varied and do not always respond to conservation efforts.[29] However, the reasons to join the program are not that important, as long the goal is attained.

One main factor that prevented people from enrolling in the program is the low profitability of the payments compared to other alternatives, especially considering the application costs. Between 1996 and 2000, for instance, the average payment ranged between $22 and $42/ha but participants had to pay for a management plan that accounted for about 15% of the payment.

Table 1. Costa Rica: Summary of Findings on the Relation Between the PES Program and Deforestation Rates

Author	Region	Period	Positive Impact
Zbinden and Lee	Northern Zone	2005	PES recipients had 61% of the farm under forest, compared to 21% for non-recipients
Sierra and Russman	Osa Peninsula	2006	PES recipients had 92% of the farm under forest or bush, compared to 72% for non-recipients
Ortiz and others	NA	2003	36% of forests with PES contracts had previously been used for pasture
Tattenbach et al. in Tattenbach, Obando & Rodríguez	Cordillera Volcanica Central Conservation Area	2006 to 2006) 2000	in 2005, primary forest cover nationwide was about 10% greater than it would have (analyzes been without the PES program
NA	Sarapiqui	2006 (analyzes 1997 to 2000)	PSAs encouraged protection of mature native forest
Sanchez-Azofeifa et al.	Country	2007	Deforestation rates in areas not receiving payments were not significantly higher than areas that were enrolled in the PSA program
NA	Country	2007	PSA program had only minimal impact on deforestation in first phase

Source: Mayer not dated

Independent of the net effect of the PES program on deforestation rates, Costa Rica has indirectly achieved other important milestones related to increased competitiveness of the tourism sector and poverty alleviation. Some findings are summarized in Table 2

28 Prepared by Adriana Chacón-Cascante (2010), CATIE, Costa Rica.

29 The program has been highly evaluated, apart from the motivations participants might have to enroll. Among the reasons expressed by applicants as factors in their decision to join are lack of more profitable land-use options due to land characteristics (e.g., poor soil quality); legal restrictions on forest management on steep slopes or near streams and against land use-change; low returns of alternative activities such as cattle farming; earning extra income; and income for people with physical limitations that restrict their ability to work (Arriagada et al. 2009).

Table 2. Costa Rica: Summary of Research Findings on Other Indirect Impact of the PES Program

Author	Period	Positive Impact
Segura et al.; Rosa et al.	1997 1999	Job creation, particularly for women and local peoples, and better soil quality
Pagiola	2006	Tourism sector growth: Costa Rica established itself as a global leader on environ mental issues. Growth due in part to country's position as one of the world's most environmentally conscious countries; In 1995, tourism revenue was US$681 M and it increased to US$1.57 B in 2007
Ortiz	2003	Poverty alleviation: PES represented over 10% of total income for over 25% of the participants
Muñoz	2004	Poverty alleviation: Payments to PES participants under the poverty line moved about 50% of them above this edge

Source: Bennett and Henninger (2008).

Despite that, Costa Rica's PES program has proved to be successful in many ways. Carlos Manuel Ramirez, former Environment Minister, states that it "transformed conservation from charity into an economic tool capable of competing with any other export in the global marketplace…. We proved a developing country can succeed using conservation as an economic engine," and that "an acre of forest is worth more than a cow" (Tidwell 2006). Jorge Mario Rodriguez, FONAFIFO Director, declared that the PES program has "not only contributed to the socio-economic development of beneficiaries in the rural sector, but they have also had a visible environmental impact, which is reflected in a reduced deforestation rate and an increase in the country's forest cover." (Mayer XXX).

Since the program's inception, deforestation rates have dropped significantly. It is important, nonetheless, to consider other factors that might have pushed deforestation rates down. A few researchers concluded that many landowners had preserved their lands or had adopted more environmental friendly practices, whether or not they had received PES (Ortiz et al. 2003 and Miranda et al. 2003 in Mayer XXX). There is an ongoing debate on whether Costa Rica's PES program is actually a main determinant in slowing the pace of deforestation. Table 1 shows some findings from studies since early 2000. The question of how much impact on deforestation Costa Rica gained with its PES investment is still open.

agroforestry in seven Mexican states, with $4.8 million in 2008 to protect 86,385 ha. The success of the PSHA is such that, between 2003 and 2005, less than 0.1% of the nearly 300,000 ha covered was deforested (OAS 2009).

The PES approach is not without its limitations. A certain amount of capital needs to be invested up front to make PES projects feasible. For example, finances are need to set-up and maintain a network of permanent forest inventory and monitoring plots to provide information on changes within the forests protected. This should be done also on a larger scale, nationally and regionally. Only through the information gathered from such networks will it be possible to tell what ecological results come from SEM activities. Such a monitoring network needs to be set up in the main forest ecosystems and management regimes in LAC.

FORESTRY CARBON MARKETS AND REDD-PLUS

Carbon markets represent an important source of revenue derived from forests that, in some cases, can compete with alternative land uses such as cattle ranching and agriculture. During the past two decades, forests have had a small share of carbon markets, particularly in the compliance market under the Kyoto Protocol. Only reforestation and afforestation projects were included under the Protocol, leaving avoidance of deforestation of natural forests out of the international negotiations.

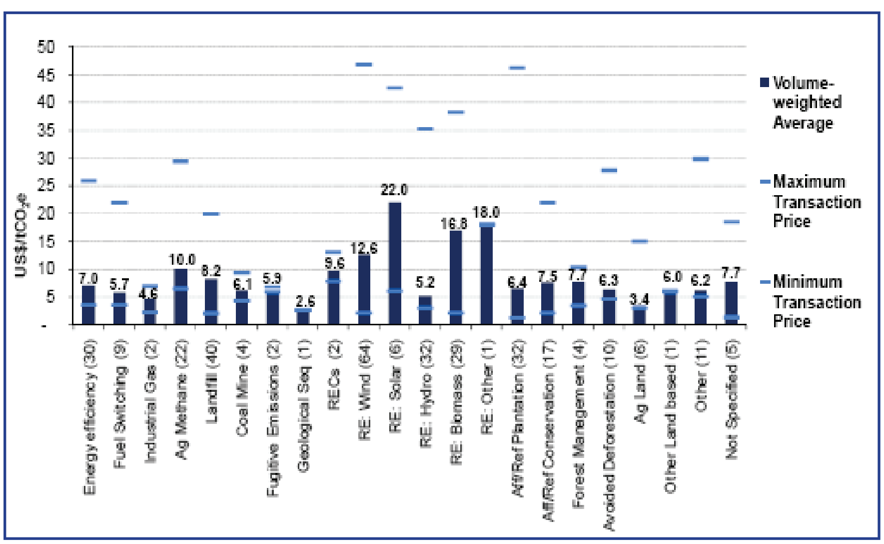
Reforestation and afforestation have presented higher costs then alternative carbon projects, and technologies in the energy and transport sector. New methods to measure carbon stocks in forests are now providing conditions that make investors willing to offset carbon emissions via reforestation and afforestation.

Worldwide funding for forestry for the past decade has been about $1.1 billion/year, excluding forest protection (Ebeling et al. 2008). The World Bank alone, over the last 20 years, built a portfolio of biodiversity projects worth $6.5 billion, in substantial part, dedicated to protected areas, but increasingly focused on improving natural resource management and mainstreaming biodiversity (World Bank 2010). That is a significant investment, but it has not met the mounting need of the forestry sector to overcome governance and institutional failures in order to transition effectively to SEM. Carbon markets, if effectively channeled to sustainable forestry, hold the potential to infuse additional resources to this effort.

For example, international compliance carbon markets transacted $14 billion in 2005, $33 billion in 2006, $64 billion in 2007, and $ 118 billion in 2008 (Ebeling et al. 2008), about doubling each year. However in 2007, only 1% of the credits were allocated to reforestation (Hamilton et al. 2009).

Voluntary carbon markets are also important for reforestation and conservation. In 2007, they transacted $335 million and, in 2008, $705 million in carbon credits, representing 6% of world carbon markets (Hamilton et al. 2009). Forestry projects have a 15% share of voluntary carbon markets, well above the 0.5% of forestry projects under the Clean Development Mechanism (UNFCCC 2010). While voluntary carbon markets generate far less revenue than compliance markets in all sectors, investors are looking for projects not only in afforestation and reforestation, but also in deforestation avoidance (Reductions of Emissions from Degradation and Deforestation — REDD), due to the double benefits of protection and social outputs. In 2008, the price/ton of carbon for projects on Forestry Management, Avoided Deforestation, Afforestation/Reforestation Conservation were, on average, similar to other investment categories (Figure 8.8).

Figure 8.8. Credit Price Ranges and Averages by Project Type, 2008, OTC Market



Source: Hamilton et al. (2009).
Note: Numbers in parentheses indicate number of observations.

The volume of credits produced in the LAC region remained steady in 2006-2008, while its share of the world over the counter (OTC) market decreased from 19% in 2006 to 4% in 2008. Lack of government involvement, less efficient systems, and exhaustion of "low-hanging fruit" are the primary hurdles to project development in LAC. Over 56% of the credits in LAC came from Brazil and 21% from Mexico.

REDD+: Reduction in Emissions from Degradation and Deforestation (REDD-plus) may be included in the post-Kyoto regime, increasing options for owners to receive revenue from standing forests. Under REDD+, developed countries would pay developing countries to reduce rates of deforestation via a range of policies and projects. By linking these payments to carbon markets (i.e., putting a value on avoided carbon emissions), investments in developing countries could cut deforestation rates in half by 2030 (Huberman et al. 2008). A 10% reduction in annual deforestation from this scheme would generate over $600 million annually in LAC, with carbon priced at $5/t; at $30/t it would be $2500 million (Eliasch 2008).

Other estimates of the scale of REDD+ financing vary from $2 billion to $33 billion/year (Ebeling et al. 2008; Stern 2008; Eliasch 2008). Actual amounts invested would depend on details of the final agreement. For Ecuador, the potential yearly income is estimated in $36 million, for Brazil $208 million, Venezuela $35 million, and for Bolivia, Peru, and Mexico just under $20 million each (Huberman et al. 2008).

The LAC region has 17 sub-national REDD+ projects in advanced stages of implementation: in Brazil (7), Ecuador (1), Paraguay (1), Peru (4), Bolivia (1), and Guatemala (3). Together, these projects will protect about 14.8 million ha of tropical forest, avoiding emission of 523 million tons of CO_2 (Cenamo et al. 2009).

For investors, one of the main attractions of REDD+ is the low cost compared to investment in other sectors to reduce emissions, such as the energy industry, and in waste handling and disposal. For providers in developing countries, part of the opportunities are related to high deforestation rates that some LAC countries register, particularly in the Amazon region (see Table 8.10 and Figure 8.9 depicting the potential contribution of Amazon Countries in REDD+ markets; see also Box 8.16.).

Agroforestry on small-scale farms and community forest plantations is also expanding rapidly, with opportunities to promote patterns of agricultural development that enhance ES. The challenge for forestry companies is how to translate these assets into new streams of income

Table 8.7. Deforestation in Amazon Countries: Potential for REDD- Plus Investments

Country	MPV	IRR
Bolivia	−270.000	−0.45
Brazil	−2,821.670	−0.55
Colombia	−47.670	−0.10
Ecuador	198.000	−1.60
Guyana	(0)	(0.00)
Peru	−94.000	−0.10
Suriname	(0)	(0.00)
Venezuela	−288.000	−0.60
Total	−3,719.340	−0.20

Source: Ebeling et al. 2008 [Pls associate with Table 1]

at a time when prices for timber, pulpwood, and other products are relatively stable or declining. Forests could provide potential financial benefits from the sale of the above mentioned ES, improved human capital from associated training and education, and strengthened social capital due to investment in local cooperative institutions (Scherr et al. 2008).

Finally, the creation and growth of ES markets is leading to attempts to stimulate private-sector investment in ES and social development. This includes the creation of the Brazilian Environmental and Social Stock Exchange, and the Healthy Planet Stocks to be issued by Mexico's Sierra Gorda Biosphere Reserve.

Figure 8.9. Potential Contribution of Amazon Countries in Global REDD+ Markets

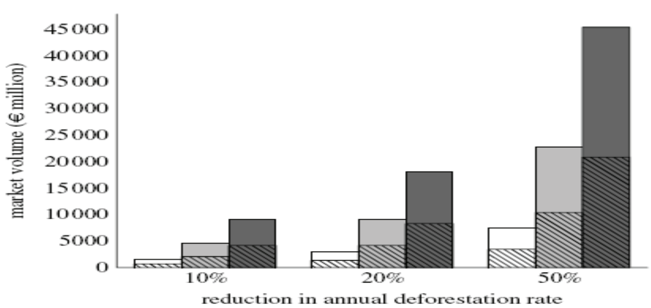


Figure 1. Scenarios for potential global market value of RED credits at variable carbon prices and reductions in deforestation rates. Bars display global potential market value, and diagonal lines represent the contributions of Amazon countries. Carbon price €/tCO_2: open bars, 5; grey bars, 15 and black bars, 30.

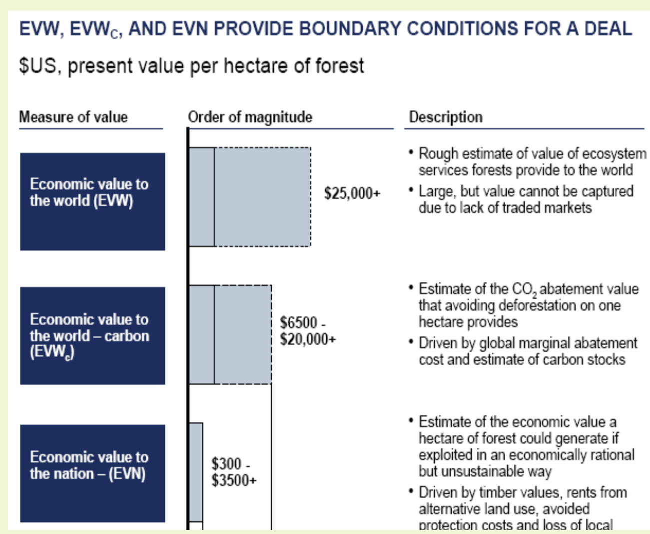
Source: Ebeling et al. (2008).

Note: Scenarios for potential global market value of REDD credits at variable carbon prices, and reduction in deforestation rates. Bars display global potential market value, and diagonal lines represent the contributions of Amazon countries. Carbon price EU/tCO_2; open bars, EU 5; grey, EU 15 and black bars, EU 30.

Box 8.15: Analysis of BAU vs. SEM from Standing Forests in Guyana

In Guyana, with a Certified Emission Reduction (CER) price of approximately $20/t and assuming only credits generated for carbon stored in biomass above ground, CO2 abatement under REDD+ would range from $6,500 to $7,000/ha. Valued at projected global marginal abatement costs of $60 to $80/t in 2030, the economic value could eventually exceed $20,000/ha of forest protected from deforestation. These values vastly exceed most opportunity costs for alternative land use, like agriculture, ranching and timber extraction. The figure in this box shows the values/ha in different markets, and the potential revenue generation for different land uses.
The Office of the President of the Republic of Guyana (2008) estimated a national economic value using a baseline scenario in which Guyana pursues economically rational land-use opportunities: extraction of timber ($1.2 billion)and post-harvest land use such as agriculture and cattle ranching ($4.9 billion) with a contribution from avoided costs of protection ($0.3 billion) and a downward adjustment for the loss of local ES ($0.6 billion).
By forgoing these options, Guyana incurs opportunity costs on the order of $4.3 billion to $20.4 billion in present value, in theory, equivalent to an ongoing opportunity cost of $430 million to $2.0 billion for forest protection. Using a conservative estimate of avoided emissions (~343 tCO2/ha), this sum translates into an abatement cost of roughly $2 to $11/tCO2e, which compares favorably with other abatement options available (McKinsey & Company 2008).

Present Values of Different Land Uses of Forests in Guyana



Source: McKinsey & Company (2008).

PART III

CONCLUSIONS AND RECOMMENDATIONS

8.9 CONCLUSIONS

BAU forestry practices in LAC grew out of conditions of relative abundance of forest resources and scarcity of agricultural land. On the agricultural frontiers, where countries were expanding their economies internally, forests were seen as an obstacle to be overcome. The focus was on taming and settling the wildlands to make their resources available to growing populations and to build productive societies. Forest resources were treated as if they were cost-free inputs to the expansion of economic activities. Externalities fell not on the entrepreneurs, but on relatively powerless communities living close to the forests or downstream. In this context, BAU approaches were successful; they fit the times.

Later, as frontiers matured and the seemingly endless forest lands became scarcer, more developed societies no longer accepted externalization of environmental and economic costs associated with predatory deforestation. Timber-based enterprises and their allies in extracting forest resources have felt the pinch. The evolving situation has brought forth the need for forest management, and a move toward sustainability. SEM approaches have begun to emerge as successors to BAU in these changing times. The importance of natural capital and ecosystem services (ES) has come into focus in one place after another. Examination of this new context, as in the preceding pages, leads to a number of conclusions.

1. BIODIVERSITY AND ES ARE ESSENTIAL TO DEVELOPMENT OF SUSTAINABLE FORESTRY VALUE CHAINS.

ES such as soil fertility, moisture, and stabilization; photosynthesis and growth; biodiversity and gene pools; pollination and seed distribution; water cycles, and many other natural processes are essential to the economic production processes based on timber resources and NTFP of many sorts, both in natural forests and plantations. The many benefits to society by ES, mediated by a diversity of forestry value chains, greatly exceed the costs of conserving them. Forest-related industries contribute well over $50 billion to GDP in the LAC region, counting timber and wood products, NTFP, and processed medicinals (Simula 1999). With proper royalty, fee, and taxation arrangements, forest protection could be put on a self-financing basis. Yet, the price of restoring ecosystems, once they have been degraded, is high. A key target for policy is to ensure that the costs of maintaining ES should not be externalized by the economic interests that benefit from forests. A range of ES essential for sustained forest productivity has been identified in this chapter. Among the more exotic: in Guyana's Iwokrama forest 51% of 172 timber species are dispersed by mammals and 21% by birds, supporting sustainable forestry there (ITTO/UICN 2009).

2. DECISIONS TO CONVERT FORESTS TO OTHER LAND USES OR TO MINE THE RESOURCE DISCOUNT LONG-RUN COSTS.

The decision to convert forests to other land uses or to mine the resource as if it were not renewable (predatory logging) should be based on the economic benefits and costs involved, both private and social. Traditionally, in BAU scenarios, decisions to convert forest lands are based on a private cost, short-term perspective. This BAU preference is reflected in estimates that deforestation worldwide has meant a financial loss of $1.8 trillion to $4.2 trillion (Eliasch 2008).

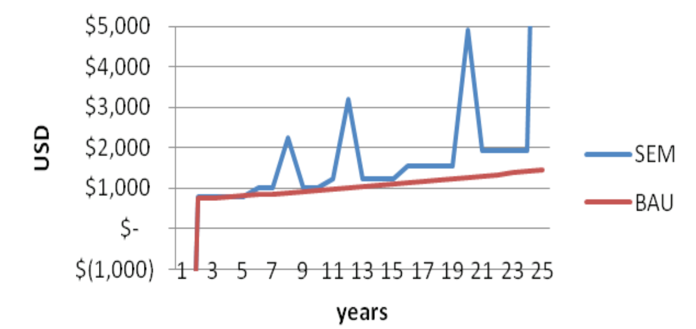
Rarely are negative externalities on a local scale incorporated into private cost decisions; even less so, on a global scale. The decision to deforest 3.5 ha of mangrove forest to plant maize in Barra de Tecoanapa, Mexico allowed farmers to harvest 2,515 kg of grain and realize $88 in net revenues in the two years before the field's fertility collapsed; but, externalities in that period were 32 times higher, including losses of $2,805 in reduced fisheries catch and lost production of honey, wood, fuel, small game, and other NTFP. After five years, the losses totaled $21,741, adjusted for inflation (Hernández et al. 2000).

This kind of decision making is primarily due to weak governance — lack of policies that foster incorporation of such externalities — and also to lack of information on the true costs. Where regulatory measures do exist, such as requiring impacts to be offset, they are rarely enforced.

Clearly, the short-term perspective has been a principle driver of BAU forest conversion. This chapter has referred to examples in LAC that show how long-term economic, social, and environmental benefits, formerly sacrificed, can be achieved by sustainable forestry management (SEM). Case studies illustrate the potential for governments (e.g., Costa Rican Payments for Environmental Services Program), private investors (Futuro Forestal, Planting Empowerment) and local NGOs (Xate Palm Fronds, Maya Nut Program) to engage in programs that improve overall returns from forest use, including progress on social indicators and conservation of biodiversity and ES.

Planting Empowerment (PE), for example, calculates that lease payments from its SEM reforestation projects, with profit-sharing for landowners and communities over 25 years, offers an IRR of 11.24% that is significantly higher than the BAU IRR of 6.24%. Figure 8.10 shows the Net Present Value (NPV) estimates by year using an 8% discount rate. The BAU NPV is for an individual landowner who rents or uses the land for cattle or maize. The SEM NPV is based on reforesting with mixed species (Case Study 8.3). BAU continues to be profitable for the individual, yet falls short of the benefits of the SEM approach. If total social costs and benefits were included in the equation, BAU will likely show a downward slope and SEM would give substantially higher benefits.

Figure 8.10. Net Present Value by Year at 8% discount, SEM vs. BAU (Planting Empowerment)



Source: Planting Empowerment (2010).

SEM PRACTICES CAN LEAD TO REDUCED SOCIAL AND PRIVATE COSTS, AND HIGHER PROFITABILITY FOR FIRMS.

A variety of examples of SEM practices were found to offer better financial returns for companies than the BAU approach. Besides the SEM reforestation model of Planting Empowerment (discussed earlier), reduced impact logging (RIL) has been shown to be competitive with conventional logging (CL), even without taking into account the enhanced value of future production of the better-protected residual stand. A study in Brazil's Amazon (Box 8.9) found that efficiency and productivity increased for a typical RIL operation, compensating for its higher up-front costs. Damage to the residual stand was much lower, and overall cost/m3 associated with RIL was 12% less than the cost of a comparable CL job (Holmes et al. 2001).

Despite the overall benefits of RIL, the lack of information on the real costs of CL and other BAU practices impedes wider adoption of SEM. Land titling and market signals that reflect scarcity are critical to shift current forestry BAU practices to SEM approaches. Without regulatory constraints, the opportunity cost of RIL and other SEM practices may be too high to attract forestry companies to change their behavior until forced by resource constraints.

CERTIFICATION OF SUSTAINABLE MANAGEMENT IS ESENTIAL TO ENGAGE EMERGING MARKET FORCES.

Certification of sustainability, with chain-of-custody sourcing of forest products, is an important tool in crafting a switch to SEM. Certification harnesses market forces to foster formalization of the forestry sector — heretofore, largely informal, inefficient, and unsustainable in LAC countries — on the promise of economic benefits that depend on internalizing basic environmental and social costs. Certification's potential to leverage access to massive markets in the EU and US, where consumer support for certified products is more developed, drives behavior change among entrepreneurs and policy makers alike. The promise of certification lies mostly in better market access; however, in certain niches, certification may also permit access to premium prices for forest products. In Guatemala, FSC-certification permitted community concession enterprises to raise their revenues by 209%, based in part on price premiums for certified mahogany (PROFOR 2010). In Honduras, forestry communities increased their revenues by 128% to $579,375 with only a 19% increase in volume harvested, after attaining certified markets.

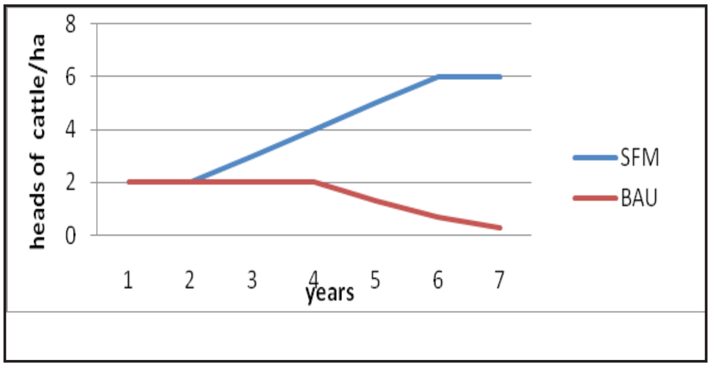
Certified forests are now a very small share of total forested area, around 1.2%. Thus, an important opportunity emerges for companies and communities that exploit forest products to differentiate their products and make them more competitive. Current trends suggest that, in the future, certification will be mandatory in most important markets, thus, losing part of its attractiveness as a differentiator. As more producers get certified, price premiums will lower constantly.

FOREST CONVERSION AND BAU FORESTRY PRACTICES, PARTICULARLY IN THE TROPICS, LEAD TO DIMINISHING RETURNS FOR COMPANIES AND FARMERS.

Within the humid tropics, agriculture, cattle ranching, and forestry plantations following BAU land- conversion practices are, in the long run, only marginally profitable, if at all. This is especially true where accessible, easily-worked bottomlands are deforested first and, then, the more costly clearing of marginal, steeply-sloped areas continues. Sharply declining fertility undermines future agricultural or forest productivity. This ultimately affects not only farmer income but also the livelihoods of forest-dependent people who experience loss of vital NTFP and other resources. Lost soil fertility brings increasing use of fertilizers to compensate, raising production costs, and lowering internal rates of return (Mackensen and Fölster 1999) and finally, polluting ground and surface waters.

Several economic analyses (e.g., Hetch 2008; Almeida and Uhl 1995) show that ranching in the Amazon, due in part to soil nutrient loss after a few years, has very low or even negative productivity if the gains from land speculation are not taken into account. Weeds and soil degradation in Brazil, typically, reduce stocking rates from two head /ha during a pasture's first four years to only 0.3 head /ha a few years later (White et al. 2001). In contrast, Brazilian states that have promoted agroforestry systems on their landscapes have seen productivity raised: as many as three times more cattle per hectare compared to BAU cleared pastures (Brack 2000). Figure 8.11 reflects the SEM and BAU scenario in areas of Brazil on cleared pastures, and the difference in productivity obtained per ha in raising cattle.

Figure 8.11. Head of Cattle per Hectare in Brazil (SEM vs. BAU)



Sources: Projections adapted from White et al. (2001) and Brack (2000).

DIVERSIFIED REVENUE STREAMS HELP CONSOLIDATE SEM, INCLUDING PAYMENTS FOR ES (PES).

Production systems need not be used exclusively; often, options can be created for a range of income flows, particularly for local actors engaged in NTFP, PES, or ecotourism. Companies may focus on timber but license other actors to harvest NTFP in their concessions or private forests, or benefit simultaneously from carbon markets, as does the Futuro Forestal business model in Panama where IRRs average 11%. Timber companies often benefit from income diversification, including revenue streams from carbon sequestration, NTFP, or other ES (Scherr et al. 2004). This will both foster and benefit from an integrated approach to resource use planning and implementation.

In LAC, varied initiatives are underway to value ES and mobilize market-based funding for them. In 2008, at least 22 countries from LAC had engaged in PES projects or in studies to implement one (OAS 2009). PES for watershed services in LAC accounted for $555 million, conserving 8.9 million ha. In Mexico, PES for Hydrological Services (PSHA) are funded by $18 million in federal revenues from water fees (Munoz-Pina et al. 2008). They have also been channeled to implement agroforestry arrangements in seven Mexican states, amounting to $4.8 million in 2008 to protect 86,385 ha. The success of the PSHA is such that, between 2003 and 2005, less than 0.1% of the nearly 300,000 ha covered was deforested; what was deforested was by fires.

Several countries are designing and testing tools to access carbon markets; good opportunity for forest conservation, social development, and revenue generation appears to lie in carbon sequestration schemes like REDD+. Projected revenues for forest land from these markets will be attractive, if a post-Kyoto regime (taking effect after 2012) includes avoidance of deforestation and forest degradation as a service that can be paid. In Guyana, with a Certified Emission Reduction (CER) price of approximately $20/t and assuming only credits generated for the carbon stored in biomass above ground, carbon abatement under REDD+ would range from $6,500 to $7,000/ha (McKinsey & Company 2008). For LAC governments, avoided deforestation may be a tool for rural development, poverty alleviation, and conservation, simultaneously. Some carbon projects and REDD+ initiatives have been piloted; based on these pilots, facilitating conditions need to be put in place: strengthened rural institutions, generation of reliable information for investors (i.e., carbon stocks, additionality, permanence, and monitoring and evaluation), and legal frameworks.

SEM CAN SERVE AS A FRAMEWORK TO PROMOTE EQUITY.

SEM approaches can provide options for forest-based and rural communities, from timber and wood products to NTFP, PES, and ecotourism, among others. The earnings from such revenue streams are of particular importance to less advantaged populations, but the stakeholder involvement, empowerment, and skills building associated with SEM project planning and implementation can be equally important.

Roughly a quarter of the world's poor and 90% of the poorest strata depend substantially on forests for their livelihoods (World Bank 2001). About 80 % of the population in the developing world use NTFP for health, nutritional, and household needs. At least 150 NTFP are traded internationally (Etherington 2008). These patterns are reflected in LAC too. In the Amazon basin alone, formal trade in NTFPs is valued at $200 million/year (CATIE 2008). In Brazil, Bolivia, and Peru the brazil nut production chain provides jobs to 15,000 people (FAO 2009). In Bolivia, brazil nuts constitute 45% of forest-related exports, at $70 million/year (CIFOR 2008a). Forest-dependent people, together with small- and medium- forestry enterprises, have the potential to participate in SEM, provided they have access to start-up resources, technical assistance, and market information. Initiatives such as the Maya Nut Program show that by recovering traditional knowledge of native species use and exploring new markets, local NGOs can conserve threatened ES while improving income and food security for rural communities.

In Guatemala, Rainforest Alliance supported villagers of Uaxactún to establish sustainability standards and certify sustainable forest harvesting of xate palms; 30 million fronds are delivered worldwide each year for home and church decorations (especially Palm Sunday). The shipments earn more than $100,000/year for the community, with over half going directly to the 1,300 collectors. According to Floridalma Ax, a member of the Conservation and Management Organization of the community's forest concession in the Maya Biosphere Reserve, women, who until recently had no cash income, now earn $6 to $7/day harvesting, selecting, and packaging the xate for export. In the Selva Maya, where 50% of the population has no formal education, wild xate harvesting generates about 10,000 jobs, especially for women.

Similar equity promotion through benefits to impoverished rural populations is documented for Costa Rica, where smallholders who protect forest or reforest critical watersheds are paid $30 to $50/ha/year in PES — thus, lifting out of poverty 50% of those who had been below the poverty line (Scherr et al. 2004). In Mexico, where in 2004 similar kinds of PES were being made in similar amounts, 83% of the payments went to marginalized population centers (Ruiz-Perez et al. 2005).

INFORMATION AND AWARENESS NEED IMPROVEMENT.

Better data on the status of forest resources, monitoring and evaluation of SEM, and public information programs should be components of SEM programs at each level: enterprise, community, local government, and national programs need to engage broader understanding and public support. Policy makers, advocates, and investors: all require information to make sound decisions.

These conclusions are consistent with the graphical analysis of the standard BAU/SEM paradigm in Chapter 2 (Figure 2.4). Net gains from BAU forestry — high grading, deforestation, and land-use conversion — decline as accessible, easy to work forests become scarce, thereby raising costs. Growing societal resistance to predatory logging practices and externalization of impacts brings regulation and fees, further raising costs. As the curve for BAU net returns is forced downward, scarcity of forest resources and the development of more sophisticated market opportunities (e.g., certification and PES) raises the returns possible via SEM. Eventually, the evolving trade-off drives a shift from BAU to SEM. Further graphical analysis on the role of market forces, the effects of subsidies, and the introduction of policy instruments is likewise applicable.

THE TRANSITION FROM BAU TO SEM IS FOSTERED BY INTRODUCING POLICY TOOLS INTO DECISION MAKING

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Initial investments required for shifting to SEM in most of the forestry practices described in this chapter — like reduced impact logging (RIL), certification, and establishment of mixed native species — often deter forestry managers from adopting them. However, if total costs and benefits under BAU and SEM are compared at the firm level and forecasted, SEM is often not only affordable but necessary to maintain margin profits. Lack of information of the true costs and benefits, enforcement, forestry planning, and institutional weaknesses in the forestry sector are some of the main bottlenecks in the BAU to SEM transition process. Economic incentives such as tax breaks to companies that invest in SEM approaches and use of government procurement power to establish standards and certification as the norm: these are tools that can facilitate initial uptake.

Policy instruments such as promotion of certification and PES schemes, including carbon markets and fiscal tools to help with initial funding, will pay for themselves in improved fee and tax returns once programs are off the ground. Certifications such as the Climate Community Alliance Standards (CCAS) are important for shifting abandoned areas previously devoted to agriculture or cattle raising under BAU standards to forested areas under a SEM practices, using REDD+ and other carbon storage PES options.

NTFP UNDER UNSUSTAINABLE EXTRACTION RATES CAN CAUSE THE INDUSTRY COLLAPSE.

Rattan was one of the first documented examples of NTFP overharvesting (de Beer et al. 1989); palm heart overharvesting has been shown to underlie the decline in heart of palm production from forest-growing species observed over the last thirty years (CATIE 2008). Unsustainable extraction rates, typically driven by high market demand, have put numerous plants on the brink of extinction. In Ecuador, one of the most well-known medical herbs in the world, Cascarilla cinchona pubescens–the original source of the potent anti-malarial drug quinine — may be threatened by overexploitation (WWF 2010). The number of medicinal plants and other NTFP used in LAC is large;in most cases, there is very little information on their status — population numbers, structure, and whether they are threatened, endangered, or extinct. Nevertheless, the disappearance of valuable plant species from even a single region may have important economic impacts on local populations.

FORESTS AND COMMUNITIES ARE VULNERABILITY TO CLIMATE CHANGE.

Climate change, in general, increases the risks under both the BAU and SEM scenarios. The dieback or geographical shifting of forests predicted by some analysts, due to increasing global temperatures and dryer weather globally or regionally, may affect the forestry industry and communities who make a living from forestry resources. Changing forests will also affect other sectors of the economy through their effects on such factors as biodiversity, water provision, pollinators, pests and diseases, recreational and tourism values, and CO_2 emissions. At the same time, forests may be more important than ever for their provision of ES that contribute to the capture of carbon, storm mitigation, and micro climate modulation. Maintenance of biodiversity and healthy ES will position forests to be adaptable and, thus, more sustainable. Continued degradation under BAU practices threatens that aspect of forests, raising the region's vulnerability to climate change.

8.10 POLICY RECOMMENDATIONS

For success, SEM policies need to be framed to work toward essential goals: reliable information, incentives and markets for forestry production, certification and corresponding procurement, governance and enforcement, diversification of products, formalization of the sector, and improved competitiveness of sustainable forest use.

IMPROVED INFORMATION AND ANALYSIS

Scarcity of reliable information is one of the main factors affecting decisions on SEM in LAC. Knowledge of a general sort is often available, but specific data on the case in point is not. For example, biological information on composition and structure of forests is abundant and, generally, clear ideas on basic forest functioning are available from years of research. Thus, generalizations on nutrient cycling and loss of fertility after deforestation are available, as are overviews of forest reproduction (pollination, seed dispersion, germination, and growth, etc.), nutrient uptake, and many other processes. But the details that control productivity at each site are highly specific to that place, its history, and the management interventions contemplated. Site-specific data to support planning, or the monitoring and evaluation of results are seldom on hand.

Socio-economic information is also needed, and often deficient at specific times and places. For instance, land tenure issues and a lack of definition of property rights remains a barrier to organization of forest enterprises in many places. Property rights are necessary for ES markets derived from forests to develop; yet, property rights are poorly developed in most producer countries. Governance processes are typically weak, including knowledge by users of relevant law and regulatory measures, as well as permitting and reporting processes themselves. Consultation of stakeholders and social auditing of forestry agencies at the local level by stakeholders has been very useful in some countries (e.g., Nicaragua) but is not widely practiced.

Economic effects are often not understood. The external costs of BAU are apparent but perception is limited primarily to academic circles and specialized forestry organizations. Despite the fact that these sources have been reporting for decades on the impacts of BAU, this information has often not yet been internalized in daily business decisions nor taken into account in local or country-level public policy.

A review of existing information and development of standard biophysical and socioeconomic methodologies to obtain the most essential data for decision making could be an important step toward more efficient functioning of Forestry Departments and forestry support organizations in the region. This information would also be useful for decisions affecting forest resources in multi-sectoral areas like rural planning, infrastructure development, mining, agriculture, and tourism development, among others.

Information should be generated on those aspects of economic processes that are likely to be challenged by change and are relevant to the management of forest resources and ES. For example, planning activities at a regional scale may include identification of areas with great or unique biodiversity or specific productive potential, where SEM can contribute to the capacity to adapt to climate change.

Mechanisms to encourage forest enterprises to maintain transparent registers on costs and benefits of their activities are also needed. This will help Forestry Departments understand the economic and environmental trade-offs of different management regimes.

Private and community initiatives will seldom attract potential investors for carbon and REDD+, among other ES markets, if there is no reliable, transparent information on ES provision. One way to provide such data is to establish permanent plots and registers that can give comparative data over time on natural and managed systems. Forest users can provide data on their costs and benefits, while local authorities or monitoring boards can provide data on the flow of forest ES. The use of satellite imagery, GIS, modeling of biodiversity and ES, and modeling of the dynamics and tradeoffs among different land uses are tools being adopted in LAC. These tools and data sets will help frame policy decisions that balance economic, social, and environmental interests.

INCENTIVES AND MARKETS FOR FORESTRY PRODUCTION

Biodiversity and ES are too often lost in regions not only for lack of information but for lack of incentives or the existence of perverse incentives. The use of incentives (i.e., subsidies, soft credit, fiscal credits) has been important for forestry industry development in LAC and, undoubtedly, has driven the rapid expansion of plantations in some countries. But, these incentive instruments may also distort markets and have unanticipated effects.

Some subsidies undermine SEM, as by inducing disproportionate conversion of forested land to favor, for example, biofuel production, timber extraction, or cattle ranching. In countries like Chile, subsidies have promoted rapid appropriation of land by large companies. In Costa Rica and Nicaragua, subsidy programs have been alleged to drive inequity, economic inefficiency, and environmental damage. By facilitating activities that would not otherwise be profitable, such subsidies lead to inefficient allocation of resources from a social perspective, as when they induce land conversion that results in ecosystem degradation.

In cases where social benefit is clearly high but costs to private actors are also high, as in establishment of a biodiversity reserve or a conservation easement involving private lands, incentives to compensate for the cost of lost opportunities may be a useful policy tool to support SEM.

A market price structure for hidden benefits of forest ES may serve to avoid negative externalities and incentivize forest management. One way to achieve this structure for hidden benefits is through legal and regulatory provisions that promote compensation mechanisms to land holders who voluntarily carry out sustainable practices. Legal provisions in the water, biodiversity, protected areas, and forest laws of many countries — Colombia, Paraguay, Peru, Ecuador, Bolivia, Panama, and Costa Rica, among others — foster use of economic incentives to compensate providers of ES. PES initiatives are, thus, one of the options in shifting perverse subsidies toward an SEM approach. PES schemes also take place through private deals. In either case, governments need to provide an appropriate regulatory environment to facilitate widespread adoption of this type of incentive, as has been done in Mexico and Costa Rica, for instance. Another proven tool is tax relief or tax property exemption for those who protect ecosystems.

Other market-based instruments include environmental offsets, regulated in several countries, to facilitate creation of markets around offsets — such as habitat or conservation banking — that help restore or protect critical forest habitats. However, these markets are not likely to contribute substantially to equity and poverty alleviation, unless proactive efforts are made to recognize rights and shape markets to provide equal access to low-income producers of forest ES.

DIVERSIFICATION OF PRODUCTS

Promoting diversification of revenue flows is only prudent. Under SEM, it is often the combination of benefits to various groups that makes a particular land use superior to a BAU approach. Combining primary and secondary production, PES and ecotourism, buffer zones and corridors, with responsible management and conservation of both natural forests and tree plantations, sustainable agriculture and labor-absorbing processing facilities will be essential — both to "grow" the economic benefits of SEM and to build more resilient communities and enterprises that can respond to market variability and adapt to climate change.

CERTIFICATION AND PROCUREMENT NORMS

Third-party certification of sustainable timber and NTFP production is a strategy that helps forestry companies shift to SEM. Certification assures that production practices are carried out sustainably, according to a specific set of criteria that balance ecological, economic, and social considerations. Standardization of products and of quality criteria is an important element. The first step, in order to extend adoption of certification standards is creation of capacity at the forest management unit level. Training programs that build skills, and prepare landowners and enterprises for certification will facilitate expansion of areas in which production is certified; currently, certification activity is low in LAC, compared to other regions. Reducing direct and indirect costs of certification for smallholders or cooperatives will also facilitate adoption of certification. This can be part of a national competitiveness strategy, often targeting international markets.

On the other hand, most of the markets for timber and NTFP are domestic. There is a clear opportunity for public sector procurement policy to support the transformation of natural resource sectors and other sectors that absorb the potentially certified products. Governments are among the largest consumers in an economy; their procurement norms and activities can encourage wider adoption of sustainable practices. This action can include setting norms that require use of sustainably produced products with public funds, favoring certification processes, and raising awareness of the social and environmental consequences of consumption decisions. Similar procurement policies can be extended via regulatory measures extending norms, standards, and fiscal policies to a broader segment of the economy.

FORMALIZATION AND GOVERNANCE

Formalization of the forestry sector is a significant step toward improving both governance and competitiveness. Formalization may be posed more broadly, covering renewable natural resources, in general. While formalization will help reduce deforestation and ecosystem degradation, it should be focused on realizing the long-term economic and social opportunities that the sector presents. Government has a central role in promoting the institutional frameworks in which SEM is possible, taking into consideration the characteristics and needs of the sector: stakeholder involvement, logistics in remote areas, insurance, labor legislation, administrative procedures, and transparent conflict resolution mechanisms, among others. Local governance structures have been widely established, often at the municipal level, and can be key to adaptation of policy to local needs, effective law enforcement, and hands-on management of forest resources.

Illegal logging and overharvesting of NTFP is in part a consequence of poor governance and enforcement structures; poor governance and weak enforcement structures are an obstacle to SEM and to the realization of its economic and social benefits. While better information, improved legislation, and growing markets may increase the profitability of forest management, without competent governance, these conditions may also improve returns from illegal logging, overharvesting, and corruption. The consolidation of the forestry sector, thus, must go hand-in-hand with the emergence of national policies and links to the local implementation of those policies, together with more transparent and capable local governance structures. Strengthening of local administrative capacities and, monitoring and control measures throughout the value chain will be crucial.

Local, regional, and national stakeholders should be engaged in the design and implementation of SEM policy and of mechanisms for dialogue and conflict resolution. Control may carried out by independent agencies in collaboration with law enforcement agencies, but, above all, should be done with local participation in monitoring activities and the elaboration of and use of locally adapted regulations.

IMPROVED COMPETITIVENESS OF SUSTAINABLE FOREST USE

Creation of enabling conditions for competitiveness by strengthening the technical and business capacities for small- and mid-scale producers can greatly contribute to the selection of sustainable land-use options by producers, and will help reduce management and enforcement costs.

Together, with greater business and technical skills, local actors will also need initial credit resources (or subsidies) and specialized loan structures to be able to invest in SEM and overcome financial bottlenecks, particularly for small producers. For example, forest use rights may not be recognized as adequate guarantees for long-term credit applications. Promotion of microcredit and special funds to support forestry development, such as the BioTrade Fund in Colombia that includes NTFP financing, may support producers with direct loans, capital investment, or by developing mechanisms to make them acceptable risks for banks. These mechanisms will need to support use of appropriate technology and to cover start-up costs.

Lastly, the value chains of the sector must be financially viable and inclusive of local actors, to help reduce deforestation and poverty. Overall, political, legal and institutional frameworks should foster the value chain development needed in order to be able to make SEM economically competitive, and thereby, contributing to equity, and conservation of biodiversity and forest ES.