

The Future of the Latin American Natural Forests

Environment Division Working Paper

Marc J. Dourojeanni

April 1999

Acknowledgements

I appreciate the gracious help of Drs. William Vaughan and Kari Keipi of the Environment Division of the Inter-American Development Bank in reviewing this document. A team of unknown reviewers gave a number of constructive commentaries that were considered in the measure they were not discordant with my personal --and I hope also fair--views and experiences on the issues. I thank all of them.

The views and opinions presented here do not necessarily reflect the official position of the Inter-American Development Bank.

Abstract

Deforestation and forest degradation trends of previous decades in Latin America remain unchanged despite international concern and new paradigms such as sustainable development. Social inequities and associated poverty can still be considered the main causes of forest losses, compounded by colonization accepted by governments as part of geo-politics and new economic growth policies--favoring exploitation of natural forests by both the rich and the poor. Natural forests are not being managed, except to some extent as protected areas and, under current social and economic conditions, sustainable management of natural forests may not be profitable. The main opportunity to conserve natural forests may be in the recognition of and payment for the environmental services they provide, and in the production of highly priced "certified green" goods that would make sustainable forest management profitable. However, this solution requires serious world negotiation. Meanwhile, compensatory measures such as the establishment and better management of strictly protected areas are the best tools to delay the loss of ecosystems and species. Also useful are reforestation, agroforestry, restoration of degraded forests and ecotourism.

Contents

Abstract	i
Review of Deforestation Trends	1
The Causes of Deforestation in Latin America Remain Unchanged	1
The Failure of Natural Forest Management for Wood Production	2
The Relative Success of Forest Management for Conservation	3
Signs of Progress	5
The Rhetorical Progress	5
The Practical Progress	6
Upcoming Problems for Remaining Forests	6
The Last Roads in the Forest Frontier	6
Remaining Natural Forest Area and Rates of Deforestation	8
The Privatization Risk	8
Reducing the Role of the State	8
A Country Case: Suriname	9
Reversing Current Trends	10
Environmental Services Provided by Forests	10
Forest Management for Sustainable Economic Gain	12
Opportunities for Conservation Set-Asides	13
Opportunities for Policy Support	14
Conclusions and Recommendations	15
References	17

Review of Deforestation Trends

Even optimistic estimates show the annual rate of deforestation to be increasing--significantly higher than rates forecasted a decade ago. The FAO (1992) estimates annual tropical forest losses for the period 1980-1990 to be 15.4 million hectares per year (0.8% of the remaining world tropical forests). The FAO also estimated an annual loss of only 11.3 million hectares for the period 1970-1980--an increase of almost 50% in the annual percentage loss.

Deforestation, defined here as the conversion of natural forest ecosystems to agriculture, grassland or urban areas, is only one of the problems impacting tropical forests. Just as significant, in terms of future productivity, biodiversity conservation and ecological services, is forest degradation (logging, fire, pollution, soil compaction, fragmentation, hunting, etc.). The statistics on forest degradation hardly exist, but the trends are similar to those of deforestation.

Latin America has the highest rates of deforestation in the world: 7.4 million hectares/year, versus 4.1

million in Africa and 3.8 million in Asia. Brazil has the most deforestation on the continent, with a loss of at least 1 million hectares/year. In relative terms however, the situation of Brazil (with 1% loss a year) is better than in countries such as El Salvador, Haiti and Jamaica (with more than 3% loss a year), or Ecuador, Nicaragua, Honduras and Guatemala (with more than 2% loss a year) (WRI 1992).

Plantation forests cover 43.8 million hectares in the tropics, with 32.1 million hectares located in Asia, and 8.6 million hectares in Latin America (mostly in temperate regions). However, the annual plantation rate by no means palliates the effects of deforestation (2.6 million hectares planted versus 15.4 million hectares deforested annually). In Latin America the gap is immense, with annual deforestation rates 20 times larger than plantation rates. Moreover, plantations are usually composed of eucalyptus or pine, with a low capacity for conserving tropical biodiversity.

The Causes of Deforestation in Latin America Remain Unchanged

The causes of deforestation in Latin America have remained basically the same for the past 50 years. Deep social inequities are the root of deforestation: poverty and lack of social improvement opportunities launch millions of poor against the new opened wildlands; ignorance of poor farmers caused by a restricted educational system; biased and inefficient judiciary systems; primitive public institutions and lack of law enforcement; abuses in the application of the free market economy concept; and institutionalized corruption.

Most deforestation in Latin America results from poor migrants forced to practice shifting cultivation, logging or "garimpo" (primitive) mining to survive. The wealthy also contribute by building roads in the remaining wildlands to open new opportunities for their businesses (trade, land speculation, extensive farming and ranching, forest exploitation and mining, but also energy generation). They are assisted by the traditional political establishment of every country, which seeks progress by expanding the progress

frontiers instead of by promoting sustainable development. This partially conflictive and partially symbiotic relation between those having nothing and those having too much is one of the principal origins of deforestation.

It is true that a primary cause of deforestation is the lack of profitability of tropical natural forest management. In contrast, logging is highly profitable. While profitable forest management *per se* would not preclude encroachment by shifting cultivators, it would reduce encroachment because investors, who are frequently able to make governments enforce legislation, could secure their rights to the land. Also, if forest management is indeed a good economic investment, the poor may have less interest in farming and in shifting cultivation.¹ If they know that a forest has a real, tangible value they will be reluctant to cut and burn it. The answer to containing deforestation is in finding out how to value natural forests and how to make their management economically profitable.

The Failure of Natural Forest Management for Wood Production

In Latin America where forestry is a young profession,¹ forest management has been mostly absent from natural forests while it has been successful in plantation forestry, especially in Chile, Brazil and Venezuela.² In fact, forest management of mixed tropical natural forests hardly exists (Dourojeanni 1987b). Many relatively small efforts have been attempted, and though the majority of these efforts were successful for a while, sooner or later most failed. In a recent review by Kirmse *et al.* (1993), 23 forest management projects are listed in the region. Yet, these management initiatives seem to have been abandoned after one or two decades. The oldest efforts were developed by the colonial powers in Trinidad and Tobago and Suriname, and abandoned soon after independence. More ambitious projects were those in the Tapajoz, Von Humboldt, Iparia and Ticoporo national forests in Brazil, Peru and Venezuela—all of them with technical cooperation from the FAO or USAID. Today, all but one are abandoned, and some have been completely cleared or degraded. The single exception is a fragment of the Ticoporo National Forest, in Venezuela.³

¹ The older forestry schools America were founded in the 1950s, but most were established in the mid 1960s or later (see Dourojeanni 1986).

² Forest management is defined here as sustained production of forest goods. The World Bank adopted the following definition for sustainable forest management: "the controlled utilization of the resource to produce wood and non-wood benefits into perpetuity, with the basic objectives of long-term maintenance of forest cover and appropriate reservation of areas for biodiversity protection and other ecological purposes" (see Johnson and Cabarle 1993).

³ The Ticoporo National forest was established in 1956 with 270,000 ha. By 1972, its area was reduced to 170,000 ha. Out of four units established in 1970 with private sector participation, only one of 40,775 ha. (CONTACA) is still forested and under operation. The CONTACA sector, however

Other efforts were entirely private such as Luconyope, in the Peruvian province of Tingo Maria, Carton de Colombia, in the Choco region and Jari Florestal, in the Brazilian state of Para. The first two are currently abandoned and the third is making questionable progress in natural forest management. Other efforts have been developed in indigenous or communal land, such as the Yanesha project in Peru and the Quintana Roo and Sierra Madre projects in Mexico. They also had heavy support from the US Agency for International Development (USAID), the German Development Agency (GTZ), the World Bank and non-governmental organizations (NGOs). The Quintana Roo project initiated in 1982-83 is on-going and can be considered a partial success (Janka and Lobato 1994). There are also a few joint-ventures with governments and the private sector such as the Chimanes project recently established in the Beni department of Bolivia.

Interestingly enough, none of the aborted projects failed due to technical problems or lack of scientific information (although none of these forests had been managed long enough to test the technical viability and sustainability of the management plan). The causes were consistently the same, often acting in combination: (i) lack of economic profitability; (ii) social and political pressures by the landless to use the land for agriculture or by loggers to exploit the forest without control; (iii) poor administrative management, especially in state-run forests; and (iv) shortage of funding and political support.

Ongoing forest management projects are too new to tell their future, but there is little indication that they will fair better than previous efforts, except in cases

is an impressive example of a successful forest management in Latin America (Plonczak 1993).

where they are research centered and have a secure funding source, such as the Risquetou/Organabo project in French Guyana, funded by the Bureau National des Forêts. Management of forests owned by local or indigenous communities may be more successful because they are less susceptible to invasion by shifting cultivators.

It is also important to analyze whether forest management for non-wood products has been any more successful than management for wood production. The fashionable concept of harvesting non-timber forest products (NTFPs) has led to the establishment of extractive reserves, especially in Brazil where there are more than 2.4 million hectares of state and federal extractive reserves. Many people expected that management by forest dwellers who had some external technical support would produce consistent examples of sustainable forest management. For several reasons this has not been the case. One report on two NTFP extraction systems

in Petén, Guatemala and in West Kalimantan, Indonesia concluded that extractive reserves are far from panaceas (Salafsky *et al.* 1992). Southgate (1996) reached a similar conclusion for reserves near Iquitos, Peru. One can argue that there is not a single extractive reserve being sustainably managed; although generally these areas are better protected than forests without use restrictions. Organizational difficulties and low prices for natural rubber were among the destabilizing factors in Brazil. Today, economics is still the main reason for the limited success of extractive reserves. For the most part, harvesting of latex, Brazil nuts and hundreds of fruits, resins, gums, oils and other forest products still provide a standard of living below the poverty line. Thus, the forest dwellers are usually ready to move to "garimpo" mining, agriculture or logging. Currently, development of sustainable forestry inside extractive reserves is being considered as a way to make them more profitable.

The Relative Success of Forest Management for Conservation

While initiatives in forest management for wood production tend to fail, the management of protected areas established in the natural forests of Latin America have been more successful and have provided the region with an impressive system of protected forest ecosystems.⁴ While many national forests are no longer forested, national parks, biological reserves and other categories of strictly protected areas are still intact. Private forests for timber production are abandoned, while private reserves for ecotourism or pure conservation are flourishing--in May 1996, 86 private reserves covering 709,000 hectares were recognized by the IBAMA in Brazil, and more are proposed. Research for conservation, despite being insufficient, is more significant than research for forest management.

In the Amazon basin, 74 strictly protected areas (IUCN categories I - IV) covering 32.2 million hectares, or 4.5% of the Amazon basin, were established before 1990 (Rojas and Castano 1991). At least half of these areas have been protected for longer than 20 years, over 20% have been under protection for more than 30 years, and 30% have an approved management plan or have had some basic field research, mapping, biota inventories and social studies. Ten protected areas are larger than 1 million

hectares and 3 are larger than 2 million hectares (Pacaya-Samiria in Peru and Pico da Neblina and Jau in Brazil). Threats to forested protected areas are many, however not a single protected forest area in Latin America has been entirely deforested. Furthermore, during the last 50 years the protected areas of Latin America have been under the control of government forest services. These agencies have normally given priority to investment, staffing and annual operating budget for wood production and silviculture. This makes the relative success of management for conservation even more remarkable.

This success story is due in part to the fact that protected areas are not required to be profitable in conventional economic terms. The management plans applied concentrate on ecosystem and biodiversity conservation, research, and public recreation and education. More recently, the management plans of protected areas are also promoting ecotourism. In fact, several national parks located in forest areas have been economic successes, such as Iguazu in Argentina and Brazil. But economics is not the only reason for the relative success of management for conservation. Staff motivation and commitment, the reduced influence of corruption, international and local support, and clearer objectives are also important in explaining the difference from management for production.

⁴ According to the World Conservation Monitoring Center there are 706 protected areas (IUCN categories I to V) covering 230 million hectares only in South America. Of these, 391 covering 67 million hectares are totally protected (IUCN categories I to III).

Signs of Progress

The Rhetorical Progress

The state of the world's forests has become the subject of international debate. Public outcry over deforestation indirectly promoted by the World Bank's development projects in Rondonia, Brazil and Kalimantan, Indonesia was undoubtedly the determining factor in the establishment of strong environmental departments in the World Bank and other multilateral financial institutions.⁵ Since 1988, when President Barber Conable of the World Bank decided to establish environmental conditionalities for all projects, the environmental sector of international development banks became the fastest growing unit in terms of staffing, budget and lending volume.⁶ However, the benefit for tropical forests has been questionable, as there has been an avoidance of investment in tropical areas, rather than a concerted effort to improve tropical natural forest management. For example, during the first half of the 1990s, under pressure from donor countries and NGOs, the revised forest policies of the World Bank and the IDB specifically prohibited investments in the utilization of primary natural forests.

The hesitancy of the banks was caused in part by NGO pressure regarding tropical forests and nourished by the confusion over what was meant by "sustainable forest management." Many non-foresters and a few foresters argued that forest management in tropical natural forests is simply not feasible

(Goodland et al. 1990). Others, invented such a complex set of "sustainability" indicators that under existing social and economic conditions, forest management became economically unfeasible.⁷

Confusion also arose from the jargon that came out of events like the 1972 and 1992 United Nations (UN) conferences on development and environment. Terms like "national parks" and "reserves" became "conservation units" and then "protected areas," concepts that may mean anything from strictly protected areas to agricultural, and even urban, landscapes. The already diffuse concept of sustainable development became "human sustainable development." With regard to forests, a series of euphemistic names were invented such as "social forestry," "parks for people" and "community forestry." These terms redefine with insignificant variation what was already known, and in some cases give new auspices for legitimizing unsustainable forestry practices. A good example is the message that forests and parks would be better managed by local and indigenous people than by forest professionals (Poole 1989). The need for local participation as an element of successful management is not to be argued. However, neither is the need for professional staff.⁸ UNESCO's "biosphere reserves" sent the message that a protected area may be partially exploited, or even deforested. The

⁵ Both projects, while not intending to cause deforestation or intrude in indigenous land, were instrumental in creating an unprecedented rate of deforestation through migration, logging, mining and urban development in nearly pristine areas.

⁶ The staffing of the World Bank for environment and environment related matters grew several times between 1988 and 1994. In the Inter-American Development Bank the staff working directly and exclusively in environment was quadruplicated from 1990 to 1995 and its environmental lending grew from US\$485 million in 1990 to more than US\$1160 million in 1994, averaging more than 20% of the total annual lending.

⁷There are currently at least eight organizations setting criteria and indicators for sustainable forest management. The ITTO, as an example, has drawn 5 criteria and 27 indicators at national level and 6 criteria and 23 indicators at the forest management unit level (IUCN-WWF 1995). While much of the criteria and indicators are difficult to fulfill, many environmental NGOs and scientists consider the ITTO guidelines insufficient for sustainability.

⁸ An excellent example documented by Brandt (1992), describes how the Pataxó Indians destroyed the forest of the Monte Pascoal National Park of Bahia, Brazil, by selling logs and promoting invasion. This is unusual in that few published reports question the role of indigenous people as forest protectors.

questionable "success" of biosphere reserves in tropical countries arises in part from a curious logic that presumes compatibility rather than conflict between competitive multiple uses. This misinterpretation of the real objectives of a biosphere reserve is frequently also the case for sustainable development projects.

The legitimate world concern for natural forests has resulted in a number of bureaucratic expansions, or "inflammations," that, while they focus on important issues, have caused serious internal resistance to the process of making intelligent, functional policies. *Institutionalitis* is the establishment of new international forestry institutions such as ICRAF, ITTO, CIFOR and of forest units in almost every agency of the United Nations and the CGIAR systems--most of them clearly competing with FAO's forestry department and other older institutions. Similarly, *commissionitis* is a swelling in the number of collaborative efforts such as the World Commission on Forest and Sustainable Development, the UN Commission on Sustainable Development, the CSD Inter-governmental Panel of Forests, the Forestry Advisory Group, the FAO Ministerial Meetings on Forestry, the Working Group on Criteria and Indicators for Conservation and Sustainable Management of Temperate and Boreal Forests, the Helsinki Process, the Montreal Process, the Central American Commission for Forests and Protected Areas, the Forest Stewardship Council and many more promoted by international NGOs. *Conventionitis* has spawned the Tropical Timber Agreement, the Agenda 21 Chapter on Forests, the Forest Principles, the CITES convention, the Biodiversity convention, the Desertification convention and, soon, there may be a forest convention. Finally, *programitis* has resulted in the creation of the Tropical Forest Action Program, the G7 Pilot Program for the Conservation of Brazilian Tropical Forests, the Conservation and Sustainable Management of Trees project, and others (Sizer 1994).

In conclusion, there is more interest today for forest conservation than ever before. But there is also

increased confusion in terminology, duplication of effort and competition among agencies. One would expect that with so many efforts there would be some positive results. However, there is often little connection between international efforts and the reality in the tropical countries, especially in the forested regions where social and economic inequities are at the root of deforestation. The unsuccessful experiences in the application of the Tropical Forest Action Plan (Winterbottom 1990) and the Biodiversity Convention in Latin America (Dourojeanni 1994), among others, should guide the preparation of new programs, conventions or agreements about forests.

The Practical Progress

During the past decade there has been concrete progress in tropical forest management. While international discussion and rhetoric has raised worldwide awareness, on-the-ground progress has also occurred, as research in the fields of environment, forest ecology, environmental economics and social sciences has resulted in new possibilities and new tools to better conserve and manage natural forests. Possibly the most important recent progress in tropical conservation has been made in the field of economic valuation of natural resources and forests (Pearce 1993). Advances in this area have provided new and compelling arguments for making management economically profitable and deforestation less attractive. Scientific research has identified and quantified the importance of environmental services, such as carbon fixation in forest biomass, watershed protection and the potential relevance of biodiversity for human welfare. Pure and applied science have also provided new information on tropical soils, water resources, forest sustainability indicators and the ecological importance and management of secondary forests. At the same time, the development of remote sensing techniques is providing better information on the situation of natural resources worldwide, making it more difficult for governments to ignore the facts about forests.

Upcoming Problems for Remaining Forests

It is fascinating to observe that in direct opposition to the worldwide discussion on rescuing forests, mostly promoted by developed countries, these same countries are also indirectly facilitating further destruction of natural forests. This contradiction is occurring because of the promotion of the free market economy that encompasses privatization of natural resources, forest exploitation by multinational enterprises and, simultaneously, a reduction in the size of the State (including forest services), which is rarely accompanied by an increase in efficiency.

Latin American economic recovery is closely linked to the development of wildlands. In 1995, after several years of a burning slowdown, the Brazilian Amazon experienced burning comparable to the worst historical records. Airports were closed in many Amazonian and Mato Grosso cities because smoke made flights too dangerous, as millions of hectares of fallow forests, grasslands and old growth forests burned. Remote sensing satellites detected forest fires in the Brazilian Amazon, estimating 39,900 fires that caused a dense fog over 7 million square kilometers--almost the size of the Amazon Basin, itself (Veja 1995). The number of fires already detected in 1995 jumped 270% over the average for the last five years. In July 1996, the Brazilian Government officially admitted that deforestation in the Amazon had attained 15 million hectares--34% more than in 1991.⁹

The Last Roads in the Forest Frontier

Roads are not good or evil, but they do facilitate deforestation. Roads allow (a) legal deforestation in official settlements and farms, (b) unlawful deforestation for shifting cultivation by the landless and migrating farmers, and (c) increased access to logging and hunting. During the so-called lost decade

of development of Latin America in the 1980s, few roads were built or even maintained as the region faced deep economic crises. This was, in relative terms, a moratorium on forest development. Today, economic recovery is allowing an unprecedented wave of road construction in forest areas. This includes the building and upgrading of extensive roads, such as the Trans-Amazonica, the Trans-Chaco, the Trans-Pantaneira and now the Trans-Oceanic highway which would link the Brazilian Atlantic Coast with the Peruvian Pacific Coast, crossing the last patches of virgin Amazon in at least two parts. Other roads such as the Marginal de la Selva, in Peru and the Perimetral Norte of Brazil are also being completed or rehabilitated. The connections between Brazil and Venezuela, Suriname, Guyana and French Guyana are also being improved. In the north of South America, the construction of the Pan-American Highway between Colombia and Panama crossing the Darien forest is also being promoted, while several roads are being built in the Colombian Choco. In Central America, there are roads planned to link Guatemala's most populated zones to the Peten and to Belize (Dourojeanni 1995). Even the southern forests of Chile are under threat by the Austral Highway and by new roads and related forest development in Tierra del Fuego.

In the past, most roads were built with multilateral financing. Today, roads are increasingly financed by private investors, meaning that building controls are almost nil. Sound development along the roads, environmental impact assessments, indigenous people's rights and deforestation are rarely the concerns of the private sector.

Remaining Natural Forest Area and Rates of Deforestation

Many believe that forest destruction in Latin America will stop when a certain minimal size of the forest has been reached. That has been the experience in Europe, where the forest area today is actually larger

⁹ Simultaneously the Brazilian Government announced a package of forest protection measures, including a two year moratorium on new permits for exploit mahogany and virola exploitation.

than it was two centuries ago. This has also been the case in parts of the United States, such as the Appalachian range. But this experience seems not to work in Latin America. The rich Atlantic Forest of Brazil has been reduced to only 3% of its original extension and most of the reminiscent forest is degraded. Massive deforestation allowed the states of southern Brazil to become wealthy through logging, agriculture and, later, industrial development. However, deforestation of the Atlantic Forest continues at a rapid pace, by the poor migrating from other states, by rich farmers expanding their grassland area, as well as by urban developers.

Upper Amazon watersheds show similar trends. The forested area today is restricted to small patches of strictly protected forests that are very difficult to access. But the poor, ignorant, hungry people still arriving in these valleys opened to agriculture half a century ago are not deterred by difficult access. They cannot have environmental concerns; their struggle is for food and survival. Many wealthy people, on the other hand, may take good care of their own trees and forests, but see forested areas as a means to easy short-term gains through land use changes.

The Privatization Risk

Reducing the role of the state in the management of the economy is a reasonable and desirable goal. Nevertheless, the initial application of privatization may lead to new risks and exploitative excesses such as some being promoted in Latin America (Halle and Steiner 1994; Laarman 1995). Peru's proposed legislation on water and forests provides a good example: a new water law will establish a free market for water rights, independent from land rights. Thus, farmers may have to compete with other users of the water, such as industry and urban consumers, who can pay much more for water in a country where most productive agriculture is done in the desert coastal zone and in the dry Andean zone. It is expected therefore, that the rising prices of water will displace farmers from the poorest coastal and Andean lands. Simultaneously, a new forestry law allows the privatization of public forests located entirely in the

Amazon Basin. The combined effect of both laws, combined with new investments in roads, will probably create a new migratory flux of peasants from the Coast and the Andes to the Amazon, where loggers will sell or abandon land for cultivation after harvesting the wood.

The Peruvian example is not an isolated one. It is an example of the common governmental rhetoric that speaks of poverty alleviation, the environment and even forest conservation, but promotes the opening of new lands and the transfer of public commons to a private sector that is likely to show little social or environmental concern.

Reducing the Role of the State

Developed countries, among others, are promoting the shrinking of government to reduce costs and increase efficiency. This is a reasonable objective for Latin America where countries had millions of employees with miserable salaries and little motivation, training, equipment or work material. In another example from Peru, the Ministry of Agriculture reduced the staff of the combined water, soils, forests, natural resources evaluation, wildlife and parks services from more than 5000 officers and clerks before 1990 to roughly 600 nationwide. Currently all national forests and most protected areas are abandoned, except where NGOs are helping to keep a presence. The salaries and the working conditions of these officers continue to be as miserable as before the "reform." Under these conditions, it is not reasonable to expect any sort of government surveillance over the privatization of water rights and forests. There is, after all, a general consensus that privatization may work only if the State is efficient in the enforcement of laws and regulations, and in solving conflicts among resource users (Naim 1994).

A Country Case: Suriname

As natural forests in Asia and Africa are depleted, investors become more and more interested in the remaining large patches of natural forest in Latin America. Chile's southern forests were early targets, for the production of wood chips mostly exported to

Japan. A large US forestry enterprise is also planning to exploit the natural forests of the Tierra del Fuego (Villaroel 1994). The government of Suriname has been considering three forest investment projects that would exploit concessions on 3.5 million hectares, or some 30% of the country's surface. The areas requested add up to 80% of the primary tropical forest remaining in the country and have an important population of maroons and Amerindians. Of course it is expected that, considering the minuscule size of the Surinamese forest service¹⁰ and the poor record of

these enterprises, no forest management will be applied. Moreover, the bidders are Malaysian and Indonesian companies without experience in forest management in Latin America. In addition they may be able to practice extensive tax evasion (Sizer and Rice 1995). However, the biggest threat to the forests of Suriname would likely be the effects of logging roads that would connect with the road coming from the state of Para in Brazil. This road may allow settlements by Brazilians in Suriname, both rich and poor, in the same way roads did in Paraguay and Bolivia, with devastating effects on the forests.

¹⁰ In 1995, the annual budget of the Suriname forest service was US\$30,000 and counted only four foresters.

Reversing Current Trends

Reversing current trends of forest loss in Latin America without drastic changes in social and economic behavior will be very difficult. The strategy must come from the economic side of the problem, and should consist of four lines of action: (i) developing a market and setting prices for environmental services provided by forests; (ii) increasing the commercial value of natural forest products via certification and green labelling; (iii) expanding forest resource conservation measures such as more and better protected areas, combined with economic opportunities and private sector investment where possible; and (iv) policy and institutional support at the international and national levels.

Environmental Services Provided by Forests

Forest management for wood and non-wood products may not be profitable under current social and economic conditions in Latin America. Additional costs of forest management, due to techniques that provide sustainability, may make it even less profitable in the short run. Therefore, to make sustainable forest management possible it is essential that the environmental services or externalities generated by the forests be accounted for and paid by those who benefit from them. Only then would a forest be carefully managed for the production of goods in order to keep a high level of service generation. These services could be sold to the public in the form of tariffs, as is already the case for water, sewage, energy or recreation.

Many services provided by forests are well known. Today, given the global warming issue (Stone 1992), the newest economic service a forest and other ecosystems can provide is storage for carbon that would otherwise be in the atmosphere.¹¹ The value of

this service may be calculated on the basis of *carbon sequestration* by unit of forest and by the cost of reducing carbon emissions (Dower and Zimmerman 1992). Several analyses based on available data on carbon sequestration demonstrate that the market value of forested land for agriculture or logging, could be less than the value for carbon sequestration (Schneider 1993). It would be even more profitable if this service were provided in addition to the production of timber and other forest products.

Therefore, the idea of a *worldwide carbon tax* on users of fossil energy would serve to compensate those who manage or conserve forested areas (Goldemberg 1990), and may prove to be the solution to making natural forest management profitable in the tropics. For example, Goldemberg (1990) estimated that a tax of only US\$1 per barrel of oil or US\$6 per ton of coal-equivalent, would generate US\$50 billion per year. The collection and distribution of such a tax would be the principal justification of any new "world forest organization." A carbon tax--which already exists in a few countries, including Sweden, Norway and the Netherlands--would need a worldwide agreement in order to standardize implementation. With existing remote sensing technology it would be relatively easy to know exactly how many hectares of forests are cleared or maintained in each patch of land. Even forest degradation could be recorded, and yearly statements could be issued, indicating a country's account balance of forested land. Using these accounts, annual entitlements or payments due could be determined.

Carbon sink or carbon sequestration plantations have been tested in Guatemala and Costa Rica as part of a joint implementation developed in the 1992 Framework Convention on Climate Change. The idea is that polluters in developed countries may find it cheaper to compensate their carbon dioxide emissions by planting trees or preserving trees somewhere else,

atmosphere (CIAT Press Release, Sept. 1994).

¹¹Ecosystems other than forests store carbon: a study of South America savanna grasses indicates that deep-rooted grasses remove up to 2 billion tons of carbon dioxide annually from the

especially in tropical countries. In Costa Rica the CARFIX project already recruited 12,000 hectares belonging to local farmers where new plantations, forest management and forest protection are being conducted by a local NGO in partnership with the Wachovia Timberland Investment Management of USA (Reforma 1995). Of course, plantations are not the only solution, as natural regeneration, forest management and forest protection may be equally important in achieving the same goal.

Of course, carbon sequestration is not the only service provided by forests. Equally important is the conservation of the regional water cycle (Salati 1989) and *watershed protection* for water quality and quantity, especially for energy, industry and urban consumption. Water provision and water quality in a watershed are services that should be estimable for valuation purposes. In a few areas of Latin America the water and energy tariffs include a percentage reinvested in management of the watershed. Such is the case of coffee growers of Colombia who pay a fee to fund the conservation of local watersheds. Typically water is taken as a free commodity by the water processing and distributing enterprises that charge the final consumer for his use, with no money going for watershed management. Notwithstanding, current legal trends show requiring utility companies to reinvest part of their profits in watershed management would be relatively easy to achieve. Any collected monies could then be made available, directly or indirectly, to those who manage their forests or lands following an approved management plan.

Although the *valuation of biodiversity* conservation in natural forests is similar to the case of carbon sequestration, it is substantially more difficult to make people to pay for this service. The Biodiversity Convention established complex rules applying to the access of genetic resources, including all the difficulties inherent to patent and intellectual property rights. The UNCED recommended new and additional financial resources to meet the full incremental costs of implementing the Convention on Biological Diversity. Currently, the Global Environmental Facility (GEF) is serving as the interim financial mechanism. But the GEF has

relatively few resources compared to the size of the task, i.e., a study for the UNDP (RAFI 1994) estimated "bio-piracy" (bioprospecting without compensation) from developing countries to be worth US\$5.4 billion a year, while the GEF provides only a few hundred million dollars a year to developing countries for biodiversity. Furthermore, it is coupled with a highly complex procedure for financing and has failed to set adequate priorities for biodiversity conservation (Mittermeier and Bowles 1993). A possible improvement would be a two-part system where first, an average value is arbitrarily assigned to genetic resources of current, mid- and long-term value from each major natural ecosystem. Second, all users of the products originating from biodiversity prospecting worldwide would pay a fee to be redistributed as a function of the same mechanisms suggested for carbon sequestration.

There are still more environmental services provided by forests: some are tangible such as security against landslides and avalanches; while others are more difficult to measure, such as the value as natural scenery, wildlife refuges, resources for scientific research and existence value (e.g., the value of knowing a tropical forest exists, even though a person may never visit one). The challenge for the future is to estimate and incorporate the value of these services into benefit-cost analyses used to determine optimal forest use.

Ecosystem rehabilitation on degraded lands may provide positive benefits in terms of environmental services and biodiversity conservation. More importantly, perhaps, is that rehabilitation can return degraded land back to a state that is useful for such economic activities as agroforestry and fuelwood production. This option may be highly cost-efficient--as it usually requires modest investments compared to full reforestation with industrial timber species. A good example is being successfully developed in the Guanacaste region of Costa Rica (Janzen 1988 and other publications on the Guanacaste Project). Fallow forest may also be managed for goods without compromising environmental services provided by the forest. This is being demonstrated in Pucallpa and Iquitos, Peru, by joint works of the University of

Toronto and the National Agrarian University of La Molina, Peru (Dourojeanni 1987a; Blain 1996).

Forest Management for Sustainable Economic Gain

In this time of mass consumption, cheap plastic, fast-growing plantation timber, and recycling, tropical and other hardwoods should be highly valued. Mahogany, cedar and virola in Latin America or ebony in Africa are already recognized as such, but mostly because they are becoming scarce. Higher prices alone are probably not going to make forest management of tropical forests profitable. However, if combined with the payment for services, it may be a significant step in the right direction. But how can prices be increased without distortion? Scarcity of precious wood and market forces are determining factors. For the purposes of paying for sustainable forest management it is necessary to do more than allow species to become rare. Vertical integration of production managed by skilled foresters in the producing countries is a good, albeit classical option. Another possibility is to adopt, through international trade regulatory mechanisms, a *formal policy of pricing selected hardwood species* that may also be associated with the concept of "green certification." For this strategy, four conditions need to be met, requiring: (i) place more hardwood species on the international market both to augment forest management profitability and to reduce the pressure on the currently traded species; (ii) ensure that an important part of the benefits of the higher prices remains in the hands of the producers who manage the forests. The same criteria should be applied to the national market, as most tropical timber currently produced in Latin America is for local or regional consumption.

For the purpose of valuing high quality or rare natural forest products, the concept of "green certification" or "eco-labelling" may be useful (see Simula 1997). The original aim of green certification was not to make certified products more expensive, but to ensure to the buyer that the production process is not harmful to the environment. The probability that green certification for natural forest products will

be accepted by exporting countries is increasing thanks to the barriers and boycotts imposed by European countries,¹² and to the fact that some consumers in developed countries are willing to pay more for certified products. For example, Garlipp (1995) reported that 68% of US consumers were ready to pay from 1 - 15% more for certified timber, and that 33% of UK consumers were ready to pay up to 13% more. The same study revealed that the European consumers were also ready to reduce their imports of tropical timber.

Reforestation and Agroforestry for Marketable Products

Rehabilitation of degraded forests can be an economically viable activity. There is a possibility that agroforestry lands and plantations may reduce the pressure on natural forests by providing cheap timber, fuelwood and other raw materials, thereby allowing other uses for natural forests. Plantations should not, however, be established by deforesting natural forests.¹³ In places where there is a market for plantation timber, there will be a corresponding economic incentive to reforest after harvesting, or afforest existing degraded lands. Alternatively, legislation can be used to require a certain percentage of afforestation to accompany any land clearing. An interesting opportunity is provided in Brazil by a law requiring farmers to keep a percentage of their land as natural forests, especially on river banks, hillsides and other areas not suited for agriculture. This legislation, despite being widely ignored, is applied by some large forest plantation estates to conserve remnants of the original forests. Some enterprises such as Veracruz Florestal, in Bahia, have also acquired native forest relicts for strict conservation. Other large Brazilian forestry enterprises, such as

¹² Barriers and boycotts are a double-edged sword: while they may facilitate the adoption of "ecolabeling," they may also discourage the market from trade in these products, further reducing incentives for sound forest management.

¹³ In Chile and Brazil, incentives for plantation forests allowed a substantial clearing of natural forests. One of the better known cases have been the Jari Florestal, in the state of Para, Brazil.

Aracruz Celulose, Amapa Florestal e Celulose, Klabin Paper & Celulose and Champion of Brazil, and as PROFORCA in Venezuela, are following this practice to conserve a substantial amount of biodiversity.

Agroforestry offers economic opportunities on moderately degraded lands and maintains a certain amount of forest cover and biodiversity, among other environmental services. Agricultural and forestry products from these lands provide economic goods that are tradeable in existing local and regional economic markets. Furthermore, plant diversity in agroforestry systems may be a significant partner in biodiversity conservation as well as an excellent carbon reservoir.

Opportunities for Conservation Set-Asides

In the late 1980s, the term “paper parks” was coined to describe protected areas that exist only as a government document, and not as a functioning entity. The term originated from Machlis and Tichnell (1985) who, based on a biased survey and a cursory analysis, concluded that most parks and protected areas would not survive all the threats posed to them. This paved the way for a movement against protected areas, forwarded by a curious alliance of some “environmentalists” and developers. As a result, some social scientists were encouraged to propose the transfer of protected areas to the management of local people. In Peru, for example, the revised national environmental code allows titling of indigenous communities within all categories of protected areas, provided they can prove an area is part of their traditional territory. In Brazil, a proposed protected areas law would allocate 5% of existing national parks for the relocation of “traditional populations,” even if they have no previous relation to the area, and even if doing so would transform a strictly protected area into a partial-use reserve. This movement has also discouraged governments from establishing new, strictly protected areas, as well as donors from investing in them.

Ahead lies the difficult struggle of revamping national protected area systems by differentiating real

protected areas from all cases where protection is only a written objective. Paper parks usually occur because the local population, mostly poor settlers, live inside the park or use the park as an open-access resource. Strictly protected areas with a high area to perimeter ratio and minimum non-tourist traffic and incursion should be the backbone of conservation.¹⁴ Areas with other varying degrees of protection are useful mainly as complements. Thus, more and better designed protected areas are necessary to conserve the entire set of forest ecosystems and the biodiversity they contain. Particularly, management should become more efficient and of higher quality (Pardo *et al.* 1994). The strictly protected areas should be considered an emergency source of biodiversity in case efforts to associate development and biodiversity promotion fail.

Ecotourism is a growing industry that has proved economically viable in numerous cases, and goes hand-in-hand with the concept of protected areas. Nature tourism generated around 7% of all international travel expenditures in 1992.¹⁵ Although not exclusively the case, ecotourism is in large part dependent on protected areas, and conversely provides economic incentives that may make protected areas dependent on it. With few exceptions, controlled eco-tourism is compatible with even the strictest protection levels. In principle ecotourism could pay for the conservation of forests: either directly by investing in public or private protected areas; or indirectly, if the national revenues systems are able to tax this hard-to-control industry. This is partly because a major share of ecotourism operations is currently in the hands of international businesses.

¹⁴ Van Schaik *et al.* (1992) concluded, “...ecologically and economically sustainable development alone will not stop the loss of tropical rain forests caused by fragmentation, exploitation and human activities,” and that, “...while the costs of biodiversity preservation accrue mainly at the local level, the benefits accrue mainly at the regional, national, and especially global level. Therefore, special mechanisms must be devised to fund biodiversity preservation.”

¹⁵ The Ecotourism Society and others estimated that ecotourism generated roughly US\$12 billion in 1991.

“*Natural condominiums*” offer opportunities for the private sector to set-aside land for conservation, effectively creating private protected areas. Private natural reserves may become an important complement to national protected area systems in conserving forest ecosystems or establishing biological corridors between them. There are many private reserves in Latin America, especially in Costa Rica, Brazil and Venezuela. Some are purely for conservation, while others are for profit through ecotourism. Their creation can either be by agreement with governments or as exclusive private initiatives. Some countries, such as Brazil, even provide legal and economic incentives if the area’s status is registered in perpetuity.

The idea of the “natural condominiums” (Dourojeanni 1996) aims to motivate private investment and participation in forest protection. The concept, which is being practiced somewhat in the United States, involves national or international NGOs that act on behalf of a group of investors or benefactors to buy a significant area of wildland. This land “condominium” is then operated under a common management plan--usually prepared and executed by an NGO--in a way that recognizes the right of the owners to take limited advantage of their property, such as building a cabin for their own use, while maintaining most of the land as unimproved natural area. The owners, as with any condominium, may sell or trade their property, provided that the new owners respect the management plan.

Opportunities for Policy Support

At the *international level* policy support could come from a worldwide forest convention and the creation of a world forest organization to enforce it. This would make sense only if the principal goals of the convention were to define and manage compensation mechanisms for the environmental services provided

by forests and other ecosystems. Existing mechanisms, such as the GEF, have a limited capacity to conserve forest heritage. This new organization would not be justified, however, if it ended up competing for funding with the many existing international entities.

At the *national level* forest policy support is badly needed in Latin America. International policy conventions habitually suffer from weak enforcement mechanisms because few countries are willing to give up their sovereignty on an issue where they may have had to make substantial compromises or in cases where other countries gain an advantage by not complying with a treaty or convention. Consequently, only national policies have any sort of enforcement backbone. Despite this fact, most changes that have occurred in national forest policies in Latin America during the last decade show a negative trend for forest conservation. New legislation is eliminating protective barriers for forest use and even facilitating user access to protected areas. For example, a recent revision of the Peruvian Environmental Code allows mining and oil exploration and exploitation in national parks and other protected areas. Other new exploitation-oriented policies include: the opening of export corridors through remaining wilderness; privatization of public forests with high probabilities that these forests will be transformed into grassland or agriculture; promotion of tropical wood exports; and the dismantling of already weak state forest services, reduced investments in university education and research. Additionally, some governments are still looking at the last natural areas to “solve” the problem of landless farmers. For example, the Brazilian Ministry of Agrarian Reform is searching for “unproductive land” (which includes forests and other natural ecosystems) all over the country to mitigate the country’s urban crowding and underemployment (Padua 1996).

Conclusions and Recommendations

Over the past fifty years in Latin America, there is solid evidence that management of natural forests for conservation has been more successful than management for wood production. Protected areas have lost less ground over longer periods of time than national or private forests. It is also widely acknowledged that protected areas make up the backbone of biodiversity conservation. Therefore, it is worthwhile to strengthen efforts to establish and manage protected areas in tropical forests. This effort is not to be carried out only, or even primarily by governments, but should be increasingly taken over by NGOs and the private sector. Private reserves, nature condominiums, NGO participation in public protected areas management, among other available options, may benefit from activities such as ecotourisms, recreation, and management of natural resources that does not diminish the quality of the environmental services provided by these areas.

The failure of projects aiming at natural forest management for production is rarely caused by technical problems or a lack of scientific information. The single dominant cause has been the lack of economic profitability. There are certain unavoidable natural causes for this situation, such as the remote location of most remaining natural forests. However, more significant causes of economic failure of sustainability stem from deficient planning and poor administration of forest enterprises, scarcity of long term funding, low returns for producers of forest products, competition with tropical timber coming from Africa and Asia, and lack of political will to prevent forest invasion. Just as important as the above factors, however, is the continued absence of a strong and efficient public administration to apply equitable and reasonable rules for forest exploitation. The result has been that it is more profitable to practice anarchic logging and forest conversion than forest management.

One of the most likely solutions to improving the valuation of tropical forests is to require society to

pay for the environmental services it receives. Carbon sequestration, water provision, water quality protection, and biodiversity conservation are all critical environmental services that need to be developed for their market value.

In reviewing the existing network of international institutions, commissions, agreements and programs, it becomes evident that never before have forests received as much attention as today. Nonetheless, it is evident that conservation efforts are being undertaken with a great deal of overlap, interagency competition and inefficiency. The author concludes that a world forest convention and the establishment of a world forest organization would make sense only if the principal goal were to define and manage the compensation mechanisms for the environmental services provided by forests.

The threats to the last primary forests of Latin America have changed little in the past half century. However, the intensity of deforestation has been reinvigorated by the present economic stability of the region. Moreover, the threats are under minimal control as a consequence of a general adherence to theories espousing the free market economy. New roads and other infrastructure improvements are now being built in forest areas with private funding. At the same time, state controls have been weakened by reductions in the size and responsibilities of state agencies.

Public forests are being privatized and large international enterprises are starting to operate in the region in the absence of sound legislation or public monitoring of resource extraction. Similarly, invasion of indigenous tribal territories and forest conversion continue unabated. Raising public and private interest in the natural forests by charging for forest services could motivate governments to confront this situation.

Finally, the international institutions should behave more in-line with what they preach to developing

countries--adapting their programs to fit their mandates and specialties, and avoiding costly duplications of effort. The multilateral financial institutions, with their relatively strong influence, should act responsibly by financing the public and private sectors in a way that encourages sustainable forest management. They also must place strong emphasis on financing the restructuring of public

institutions that manage natural resources to improve institutional quality and efficiency. The banks should be proactive on these matters, because otherwise Latin American governments are not likely to make these tasks priorities. Finally, the banks must do more, especially with concessionary funding, to improve the quality of management long term of national protected area systems.

References

- Blain, D. 1996. Fertility factors limiting the growth of pioneer trees on upland fallow soils of the Amazon basin, Iquitos, Peru. Ph.D. Thesis. Graduate Department of the Faculty of Forestry, University of Toronto 142p.
- Brandt, S. 1992. Parque nacional de Monte Pascoal: población indígena y unidades de conservación. **In** Espacios sin Habitantes? Parques Nacionales de América del Sur (S.A. Amend & T. Amend, eds.) pp. 125-135 UICN, Ed. Nueva Sociedad, Caracas.
- Centro Internacional de Agricultura Tropical (CIAT). 1994. Press Release. PRI-064, September.
- Dourojeanni, M.J. 1986. La calidad de la enseñanza forestal actual. *Unasylva* 154(38):22-31
- Dourojeanni, M.J. 1987a. Aprovechamiento del barbecho forestal en áreas de agricultura migratoria en la Amazonia peruana. *Rev. For. del Peru* 14(2):15-61.
- Dourojeanni, M.J. 1987b. Manejo de bosques naturales en el tropico americano: situacion y perspectivas. *Rev. For. del Peru* 14(1): 91-108.
- Dourojeanni, M.J. 1994. Some thoughts on the applicability of the Convention on Biodiversity in Latin America. Inter-American Development Bank, Washington, D.C. Working Paper ENP/104, February.
- Dourojeanni, M.J. 1995. Evaluacion ambiental de proyectos de carretera en la Amazonia. Seminario Regional de Evaluacion Ambiental de Proyectos de Desarrollo en la Amazonia. Tratado de Cooperacion Amazonica Tarapoto, Peru. July 9-13.
- Dourojeanni, M.J. 1996. Condominio natural: Una nueva estrategia para establecer reservas naturales privadas. *Medio Ambiente* 11(68): 44-51. Lima, Peru.
- Dower, R.C. and M.B. Zimmerman. 1992. The right climate for carbon taxes: Creating economic incentives to protect the atmosphere. World Resources Institute. Washington, D.C. August.
- Food and Agriculture Organization (FAO). 1992. Evaluation of Forest Resources in 1990: Tropical Countries. FAO Forest Document 112. Rome.
- Garlipp, R.C.D. 1995. O boom da certificacao: E preciso garantir a credibilidade. *Silvicultura* 16(61): 15-22 Brazil, March/April.
- Goldemberg, J. 1990. A simple plan to stop global warming. *Princeton University Technology Review* November/December pp.24-31.
- Goodland, R., E. Asibey, J. Post and M. Dyson. 1990. Sustainability of hardwood extraction from tropical moist forests. New Delhi, Centre for Sciences and Environment 35p.
- Halle, M. and A. Steiner. 1994. Ajuste estructural y medio ambiente. IUCN. Gland, Switz. 11p.

International Union for the Conservation of Nature and World Wildlife Fund (IUCN/WWF). 1995. Initiatives Setting Criteria and Indicators for Sustainable Forest Management. *Arborvitae* 1. September, 5p.

Janka, H. and R. Lobato. 1994. Alternativas para enfrentar la destruccion de selvas tropicales: La experiencia del Plan Piloto Forestal de Quintana Roo. Libro de lecturas del Taller sobre Reforma de las Politicas de Gobierno Relacionadas con la Conservacion y el Desarrollo Forestal en America Latina 1-3 de junio de 1994 Washington, D.C. (ed. H. Cortes-Salas) IICA, San Jose 320p.

Janzen, D.H. 1988. Tropical dry forests: the most endangered major tropical ecosystem. Pp. 130-137 In: E.O. Wilson and F.M. Peter (eds.) *Biodiversity*. National Academy Press. Washington, DC.

Johnson, N. and B. Cabarle. 1993. Surviving the cut: Natural forest management in the humid tropics. World Resources Institute. Washington, DC.

Kirmse, R.D., L.F. Constantino and G.M. Guess. 1993. Prospects for improved management of natural forests in Latin America. LATEN Dissemination Note # 9, December 1993. The World Bank Washington, DC.

Laarman, J.G. 1997. Government policies affecting forests in Latin America. An agenda for discussion Environment Division, Inter-American Development Bank Working Paper ENV-108. Washington, DC. 57p.

Machlis, G.E. and D.L. Tichnell. 1985. The State of the World's Parks: An International Assessment for Resources Management, Policy, and Research. Westview Press.

Mittermeier, R.A. and I.A. Bowles. 1993. The Global Environment Facility and biodiversity conservation: Lessons to date and suggestions for future action. *Biodiversity and Conservation* 2: 637-655.

Naim, M. 1994. Instituciones: El eslabon perdido en las reformas economicas de America Latina. The Carnegie Endowment, Washington, DC. 47p.

Padua, M.T.J. 1996. Biodiversidade é conversa para sem-terra dormir. *Parabolicas* 13(2):7.

Pardo, C., H. Torres and C. Ormazabal. 1994. South America In Protecting Nature. Regional Reviews of Protected Areas. (J.A. McNeely, J. Harrison, P. Dingwall, editors) IVth World Congress on National Parks and Protected Areas, Caracas, Venezuela IUCN.

Pearce, D. 1993. Valuing the environment: past practice, future prospect. Paper for the First Annual Conference on Environmentally Sustainable Development. World Bank Washington, D.C. September 30-October 1.

Plonczak, M. 1993. Estructura y dinamica de desarrollo de bosques naturales manejados bajo la modalidad de concesiones en los Llanos Occidentales de Venezuela. Instituto Forestal Latinoamericano Merida, Venezuela. 139p.

Poole, P. 1989. Developing a partnership of indigenous people, conservationists, and land use planners in Latin America. Policy, Planning and Research Working Papers, The World Bank August,

Reforma. 1995. Cuando un secuestro es buena noticia. *Reforma* 2(4) June 1995. San Jose, Costa Rica.

Rojas, M. and C. Castano. 1991. Areas protegidas de la cuenca del Amazonas. INDERENA, Bogota, Colombia. Tratado de Cooperacion Amazonica 213p.

Rural Advancement Foundation International (RAFI). 1994. Conserving indigenous knowledge: integrating two systems of innovation. Ottawa.

Salafsky, N., B.L. Dugelby and J.W. Terborgh. 1992. Can extractive reserves save the rain forests ? A Report of The Center for Tropical Conservation. Duke University. April 24 p.

Salati, E. 1989. The climatology and hydrology of Amazonia. pp.18-48 In Amazonia (ed. by G.T. Prance & T. Lovejoy) Pergamon Press, Oxford, England.

Schneider, R. 1993. The potential for trade with the Amazon in greenhouse gas reduction. LATEN Dissemination Series. The World Bank. April.

Simula, M. 1997. Trade and environmental issues in forest production. Environment Division. Working Paper. Inter-American Development Bank, Washington, DC.

Sizer, N. 1994. Opportunities to save and sustainably use the world's forests through interantional cooperation. World Resources Institute, Washington D.C. (WRI Issues and Ideas: December 1994)

Sizer, N. and R. Rice.1995. Backs to the Wall in Suriname: Forest Policy in a Country in Crisis. World Resources Institute. April.

Southgate, D. 1996. Alternatives for Habitat Protection and Rural Income Generation. Working Paper. ENV-107. Inter-American Development Bank. Washington, D.C.

Stone, P.H. 1992. Forecast cloudy: The limits of global warming models. Technology Review February/March. pp.32-40.

Van Schaik,C., R. Kramer, P. Shyamsundar and N. Salafsky. 1992. Biodiversity of Tropical Rain Forests: Ecology and economics of an elusive resource. Report of The Center for Tropical Conservation Duke University. December.

Veja. 1995. The Amazon is burning. (edition of November 8, 1995).

Villaroel, P. 1994. Proyecto Rio Condor: Explotacion forestal en el confin del mundo. Ambiente y Desarrollo: Diciembre pp.27-38.

Winterbottom, R. 1990. The Tropical Forestry Action Plan: What Progress? World Rainforest Movement/Friends of the Earth. The Ecologist, London .

World Resources Institute (WRI). 1992. World Resources 1992-1993. Washington, DC.