

Policy Instruments and Financing Mechanisms for the Sustainable Use of Forests in Latin America

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Foreword

The Environment Division, in collaboration with several technical units of the Bank and other international organizations, is preparing a guideline document on forest development in Latin America and the Caribbean in the context of sustainable management and conservation of renewable natural resources. The document will examine several topics. It will analyze, among other things, the impact of alternative macroeconomic and sectoral policies on forest resources, environmental considerations in the trade of forest products, the impact of nonwood products and services, stakeholder participation in designing strategies for sustainable forest management with special emphasis on land tenure issues of indigenous peoples, and the roles of privatization, use of incentives and forest resource utilization contracts in sustainable development.

The concepts and recommendations in the present document on policy instruments and financing mechanisms in forestry, written by Ramón López, are essential elements for the preparation of the guidelines. The document analyzes global versus national benefits of slowing down the current deforestation process, and presents a framework for a comprehensive international agreement to reduce deforestation in light of recent policy reforms and international market developments.

Information presented in the document, as well as the conclusions and suggestions for the protection of remaining forests, provide a solid basis for discussion and will contribute to the improvement of the quality of the Bank's investment projects in this area.

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Introduction

About 800 million hectares of natural tropical forest are estimated to remain in Latin America, which is equivalent to more than 60 percent of the world's remaining tropical forests. In 1992, the United Nations Food and Agriculture Organization (FAO) estimated that tropical forest losses around the world for the decade of the 1980s were about 15.4 million hectares per year, compared with annual losses of only 11.3 million hectares per year for the previous decade. That is, tropical deforestation is not only very significant but it is accelerating. During the 1980s, annual forest losses in Latin America were estimated at about 7.5 million hectares (or 0.9 percent of the remaining forest cover) per year. This constitutes almost 50 percent of the total deforestation of world tropical forests. The fastest rates of deforestation are occurring in Central America and the Caribbean. According to the World Resources Institute (1994) annual deforestation in El Salvador, Jamaica, Haiti, Nicaragua, Honduras and Guatemala ranges between two percent and three percent.

The rate of deforestation in Latin America decreased between 1980 and 1990 compared to the previous decade. This was apparently due in large measure to the economic crisis of the 1980s. There are, however, indications that, as economies recover, deforestation has accelerated during the last two years in several countries. Moreover, the substantial increase in the international price of timber between 1991 and 1994, and the more recent recovery of grain and other agricultural commodity prices, are also likely to have contributed to accelerating deforestation.

Dourojeanni (1995), for example, reports that more than 34,000 forest fires were detected in July 1995 in the Brazilian Amazon, a 275 percent increase over the July average for the preceding five years. Similarly, it appears that deforestation has recently increased in areas of Bolivia that had suffered very little forest losses during earlier periods (Kaimowitz, 1995a). Selective logging of valuable

species, mainly mahogany, has led to their almost complete disappearance from Bolivian forests. Additionally, road construction into forested areas has risen to levels exceeding those prevailing in the seventies. Some of these roads are cutting through the last remaining patches of virgin forests (Dourojeanni, 1995).

Despite its vast resources, the production of timber and forest goods in Latin America is low and inefficient. Total production of industrial timber in 1990 was about 90 million cubic meters of industrial roundwoods, compared to 140 million in Asia (excluding India and China), even though tropical South America has almost three times as much forest area as Asia. (World Resource Institute, 1994). Additionally, in various cases, the value added of the wood processing industry is negative (Stewart and Gibson, 1994).

The objectives of this paper are two-fold: to analyze the role of international and domestic policies on the sustainable use of forests in Latin America; and to examine potential financing mechanisms to promote sustainable forest development and a more efficient wood processing industry. The paper will examine the role of a more intensive exploitation of natural forests as a mechanism to promote the national interest as opposed to the global interest in Latin America. It will also analyze the potential for cooperation to allocate land in a globally optimal way, and mechanisms to finance such cooperation. The paper considers the objectives for the forest sector given a particular land allocation, emphasizing the factors that can frustrate their achievement. It also analyzes recent policy and international market developments that are likely to affect the forest sector, and discusses domestic policies to promote efficiency and mechanisms to finance investments in forest. The equity implications of the policies are considered, and the importance of various international agreements is reviewed. The paper concludes with suggestions for IDB actions.

Deforestation: National versus Global Interests

Is Deforestation Good for Latin America?

Much destruction of tropical forests in Latin America is the product of efforts to promote economic development. Some of the forest destruction, however, has had questionable effects on economic growth. Examples of wasteful forest loss are deforestation in areas where soils are particularly poor and, therefore, inadequate to support agriculture or other activities even for short periods, or deforestation in steep areas and watersheds that is likely to cause flooding and soil erosion. According to the World Resources Institute (1995), during the 1980s, the annual rate of deforestation of hill mountain ecosystems in tropical Latin America was 1.2 percent higher than in other ecosystems.

Not all deforestation is, however, wasteful. The “mining” of certain tropical areas for lumber, agriculture, minerals or oil can provide positive net returns to the extent that the loss of trees does not cause serious domestic negative externalities. Thus, if public policy is devised exclusively from a domestic perspective, it would have to promote forest conversion to agriculture and other activities in areas that allow for positive rates of return after considering all local externalities. There is an optimal degree of deforestation from the point of view of individual countries which, given the current high stock of forests in most of tropical South America, is probably far from being reached.

Contrary to common beliefs, the conversion of forests to agriculture and cattle production in tropical areas has yielded adequate rates of return even when the profitability is calculated excluding government subsidies. A recent study by Schneider (1993), using a large volume of empirical evidence of settlement and colonization projects in the Amazon, concludes that “...in economic terms, agriculture in the Amazon is doing relatively well,

incomes and asset accumulation by colonists in the Amazon appear high relative to similar indicators elsewhere in Brazil...”¹ A study by Mattos, Uhl and Gonçalves (1992) found that ranching in the Eastern Amazon is economically viable under a variety of circumstances. In fact, they found that ranchers, particularly holders of medium and large tracts, are currently investing in improving degraded pastures and obtaining sizable profits from doing so. Furthermore, a detailed analysis of five settlement projects in the Brazilian Amazon by Ozorio de Almeida (1992) provides evidence that crop yields are increasing and real land prices are rising. Other studies, in particular FAO/ UNDP/ MARA (1992) and Jones et al. (1992), provide evidence consistent with these findings. In particular, they show that incomes in Amazon settlements are generally high, allowing for significant rates of capital accumulation and that soil fertility has not declined.

This empirical evidence covers settlement projects that have remained active during the last two or three decades. Trying to make generalizations for Amazon settlements out of these cases is risky, however, mostly because of the sample selectivity biases that may be involved. The settlement projects that have survived for long periods are by definition those that were implemented in areas suitable for agriculture. The more pertinent question is: how many settlement projects have failed and been completely abandoned because they were

¹ Schneider does indicate that turnover remains high and the abandonment of plots is still reported. He shows, however, that the most likely causes for this are differences in the opportunity costs and discount rates between early settlers and newcomers, as well as certain government interventions, and not the agronomic limitations of the soil.

not economically feasible.² An unbiased assessment of the agricultural potential of the Amazon can only be obtained by analyzing both surviving and nonsurviving settlements. Notwithstanding this important caveat, what the existing empirical evidence seems to show is that profitable agriculture is feasible in many areas of the Amazon and that at least part of the deforestation can result in economic improvements.

However, if the global externalities of the Latin American tropical forests are also considered (carbon sequestration and biodiversity reserve), it is clear that the optimal level of tropical forests is much greater than if only intracountry or even intraregional effects are considered. It is even possible that global welfare maximization would require a forest area larger than currently exists. On the other hand, welfare maximization for individual Latin American countries may imply natural forest areas perhaps only modestly larger than those in North America or other developed countries, where less than 10 percent of the original natural forests remain.³ This could imply providing public incentives for the protection of ecosystems that clearly generate domestic positive externalities, including the preservation of river basins, watersheds, other water sources, recreation areas and forest areas necessary to prevent soil losses.

It is important to qualify the previous statement by differentiating between cutting trees for land conversion, and the sustainable management of forests. In principle, a sustainable exploitation of natural forests could bridge part of the gap between the global and the national interest. To the extent that sustainable forest management is feasible and profitable, the promotion of such practices could increase national income and at the same time

allow the maintenance of large forest areas for carbon sequestration. Unfortunately, as argued below, sustainable natural forest management appears to be difficult to achieve.

While Mexico and most Central American countries have reduced their forests to levels so low that it is hard to imagine that it is in their national interest to continue doing so, other countries (including Brazil, Bolivia and Peru) with large remaining forested areas are likely to continue to increase national income by cutting natural forests in the “right” places, i.e., in relatively flat areas, places with reasonably good soil qualities or areas particularly rich in oil, minerals or highly priced wood. For these countries, the national interest is not whether or not to continue cutting down the natural forests, but where to cut. The national interest requires the protection of ecosystems whose destruction could cause substantial negative domestic externalities or where alternative uses of forested lands cause little economic benefits.

Compensation for the Global Benefits of Latin American Forests

In principle, the global and national interests of most of the heavily forested countries of South America are not compatible. Serving the world interest presumably requires a much greater natural forest reserve than serving mainly the national interest. Since the forests belong to the countries, not to the world, the world would have to compensate tropical countries for preserving a larger forest area than the optimal dictated by national interest. The policy framework needs to be different depending on whether the global welfare is maximized or only the country’s interest is served. In the latter case policies and investment should be devised to avoid wasteful deforestation and to promote “rational” exploitation and conversion of the natural forests.

In the former case, even certain exploitation and forest conversion that increase the net income would have to be avoided. This section deals with the potential for trade in carbon emissions between the North and South rather than with aid from the

² Schneider does include abandonment in his analysis, but this refers only to abandonment within projects that, on the whole, have survived.

³ Given the fragility of tropical soils, the role that natural biomass plays in tropical areas is more important than in temperate areas. Thus, one could expect that the individual country’s interest would call for somewhat greater forest areas in the tropics than in temperate regions.

North.⁴ When we henceforth refer to international support for the South we do not mean foreign aid provided for the benefit of the individual countries that receive it, but rather, mutually beneficial cooperation between the North and the South.

Figure 1 illustrates this analysis. The horizontal axis measures the remaining forest areas before any settlement, with F -bar being the land area originally covered with forest, or the maximum forest area. The vertical axis measures the forest land (rental) value. The schedule NN represents the net marginal value product of the alternative uses of the forest lands (i.e., agriculture, logging,

standing forest for the countries where the forest is located. The NN curve is upward-sloping, reflecting the increasing opportunity cost of conserving a forest area. The downward sloping of the D^W and D^L schedules reflect the increasing cost of deforestation for both the world and the landlord countries as the forest gets depleted. The position of the demand schedule D^W is naturally dependent on the availability of forest in the rest of the world. Thus, the analysis is conditional on a fixed level of forest outside Latin America.

The D^L schedule includes all the benefits that the standing forest brings for the landlord countries,

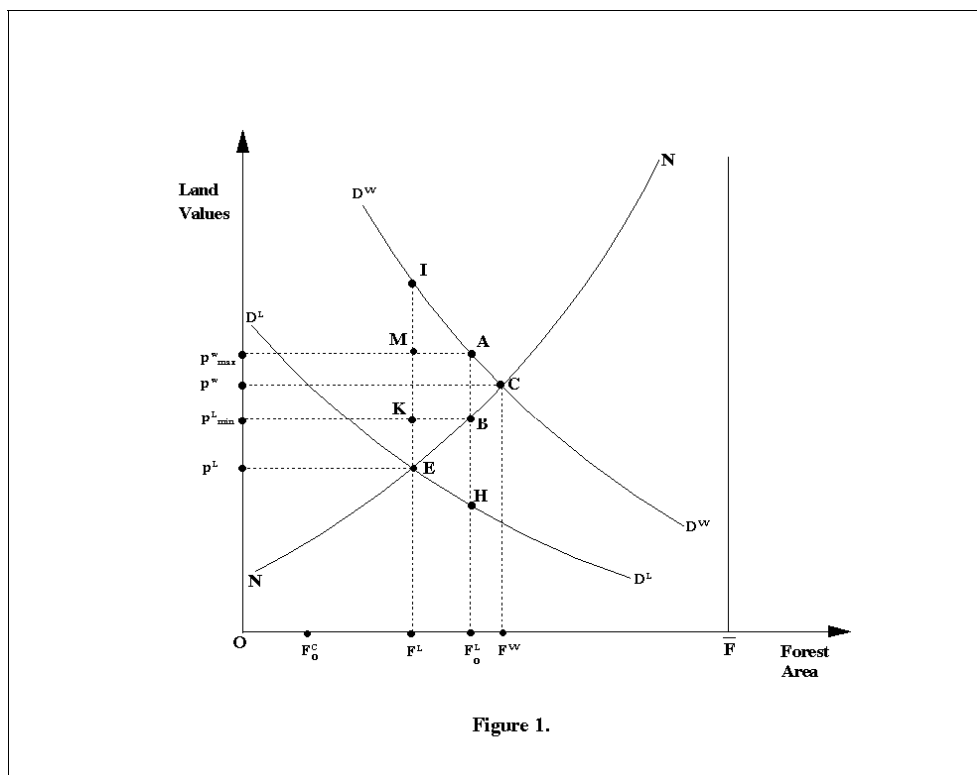


Figure 1.

etc.). The schedule D^W shows the marginal value product of the standing tropical forest for the world as a whole and D^L shows the marginal value of the

including protection against slides, floods and soil degradation, as well as the valuation of their biodiversity and carbon sequestration capacity. The D^W schedule is the summation of the D^L schedule and the benefits for the rest of the world that the standing forests provide (mostly associated with the avoidance of global climatic changes and the value of biological reserves). This schedule is drawn as a convex curve to reflect the fact that the

⁴ The fact that about 25 percent of all carbon emissions are associated with tropical deforestation (World Resource Institute, 1994) suggests that the scope for lowering carbon emissions by reducing deforestation is indeed very significant.

marginal value of standing forests increases very fast as forest stocks decline.

Welfare of the world as a whole would be maximized at point C where the stock of forest is F^W and the marginal value of the forest is P^W . By contrast, the welfare of the landlord countries that own the forest is maximized at point E, at a forest level of F^L and a rental value of the forested land of P^L . Deforestation takes time and investments and, thus, the landlord countries may not yet be at the point of welfare maximization. Suppose that the current level of the forest remaining is between F^L and F^W as is the likely case in most tropical South American countries where there is still a large area covered with forests. If the world does not compensate the landlords, deforestation would continue at least to level F^L with large losses to the world (indeed it could go beyond F^L if the domestic externalities are not internalized). If the loss of natural forests is more or less irreversible (biodiversity losses, for example, are likely to be irreversible), the best that the world can do is to minimize further losses by stopping deforestation at level F_0^L .

In principle, the world can easily compensate the landlord countries to stop further deforestation since the world marginal gains are P_{\max}^W and the marginal opportunity cost of the landlord countries is only P_{\min}^L . The actual compensation at the margin will be anywhere between these two prices, depending on the negotiating capacity of the landlord countries vis-à-vis the rest of the world. Since the landlord countries also obtain benefits from the standing forest (represented by schedule D^L), the rest of the world would only have to pay BH as a minimum and AH as a maximum. Indeed, the minimum total compensation in order to stop deforestation at F_0^L would be the area EBH and the maximum possible total compensation would be the area IEHA. The important thing is that even if the rest of the world pays the marginal price P_{\max}^W per hectare for all the excess (potential) deforestation ($F_0^L - F^L$), the rest of the world would still have

a net gain of IMA.⁵

Forests at a level between the world optimum and the individual country optimum, such as point F_0^L in Figure 1, probably depict the situation that prevails in most tropical South America. The situation in Central America and Mexico is perhaps better approximated by a point such as F_0^C in Figure 1, that is, where current forest levels are below even the individual country optimum.

This distinction is important because international cooperation in the form of technical assistance, policy advice and concessionary loan projects to decrease deforestation (which are the most common forms of international involvement) are likely to be more effective and encounter true cooperation from the national governments in cases illustrated by F_0^C than in those represented by F_0^L in Figure 1.⁶

⁵ In fact, studies have shown that the value of Amazonian forested lands for agriculture or logging is less than its value for carbon sequestration (Schneider, 1993b). But, of course, this large carbon sequestration value is obtained by considering the benefits for the whole world. If only the Amazon countries' benefits of carbon sequestration are considered, the agriculture and logging value is probably greater.

⁶ Given the current world concern about tropical forest losses, national governments are not likely to publicly recognize that their true objective is to exploit their forest resources more intensively. Greater forest exploitation in countries that still have massive forest areas is not only economically beneficial for the countries' economies, but also politically expedient. Forest colonization is often an important way of relieving social pressures stemming out of excessive land concentration and poverty. Additionally, forest development can be used to attract foreign capital and establish national sovereignty (López, 1992). The expansion of roads and infrastructure into forested areas (with or without international assistance) in many countries of tropical South America is consistent with this hypothesis. Massive forest concessions currently being negotiated in various countries in the region, is another indication of the true objectives of the country governments (Dourojeanni, 1995). The willingness of governments to actively promote forest loss has been recognized in the literature: "... Most of the policies leading to forest loss and degradation are well intended, *but others have been adopted with full knowledge of the destructive consequences*" (Johnson and Cabarle, 1993, emphasis added by the author).

In the latter case governments are not likely to cooperate and many international initiatives could be diluted.

In the absence of a comprehensive program of action and compensation to reduce or eliminate deforestation, sporadic internationally financed projects to protect specific sites are likely to be ineffective even if the actual projects are successful. The reason is that if countries are not committed to reducing deforestation, all that these projects achieve is to shift the deforestation elsewhere. That is, a government may agree to receive aid to protect specific sites, but without a true national priority to reduce overall deforestation, more deforestation would be allowed elsewhere. There is a degree of substitution or fungibility in the geographic location of deforestation.⁷

In summary, international policy advice, technical assistance and sporadic concessionary loan projects to arrest deforestation are likely to be effective in countries that, because of their extreme past forest losses, are already below the optimum forest level from the perspective of their own national interest. These international measures may be less effective in countries that could still benefit from greater deforestation.⁸

The reason is that in the former case, it is more likely that interests between the individual country and the rest of the world may coincide, facilitating cooperation. This implies that international support in its present form is likely to be better invested in Central America and Mexico than in most

of the still highly forested countries of South America.⁹ In South America, international support should be very selective and limited mostly to the protection of ecosystems that provide domestic positive externalities (including watershed protection) or that are particularly unique and have little substitutability with other forests. Apart from those cases, the only way to reduce deforestation significantly in most of South America would be through a comprehensive international agreement that incorporates the national governments in the conservation objective through an adequate compensation mechanism.

Although the above arguments are valid from the viewpoint of intensification of the exploitation of forest resources, there is an important qualification to be made in connection with the way in which this process of intensification takes place. As shown in the next sections, it appears that deforestation in Latin America involves too much waste of potentially valuable timber due to the extreme reliance on fire as a means to clear forest lands. One reason for this may be insufficient roads and other infrastructure in remote areas to make logging profitable. If agriculture is less intensive in transportation than timber, then the lack of adequate transportation would give forest burning for agriculture an advantage over logging.

In this latter sense, there is a certain coincidence of interest between the tropical countries of South America and the rest of the world. Since forest burnings are a major source of carbon dioxide emissions that contribute to the global greenhouse effect, a change in the method of deforestation toward more timber extraction and less forest

⁷ Foreign assistance might still be effective in preserving certain unique localized ecosystems which might be particularly important to protect for special characteristics that are not found elsewhere. That is, foreign assistance to the still highly forested countries of South America can be effective when it is targeted to the protection of sites that do not have good substitutes.

⁸ It is important, however, to focus international assistance on either protecting remaining natural forests or on degraded areas where their restoration is not too difficult or expensive. Some areas may, indeed, be so degraded that their restoration would be extremely expensive.

⁹ It might be argued that there is too little forest remaining in Central America and the Caribbean to have any significant impact on carbon sequestration. Although deforestation has been very intense, five Central American countries (El Salvador, Honduras, Guatemala, Panama and Costa Rica) have about 17 million hectares of natural forest remaining (Kaimowitz, 1995b). Moreover, there are large areas of secondary forests that can still be preserved. Additionally, there are certain unique ecosystems in Central America that are worth protecting for the benefit of the world.

burning is also in the interest of the world as whole. It is true that most of the wood extracted will eventually be released into the atmosphere as CO₂ and, hence, that carbon emissions will increase regardless of the method of forest clearing used. There is, however, an important difference: When forests are burned, there is a massive emission of carbon gasses over a very short time period, while if the wood is extracted for industrial uses, the emissions are spread over a long period of time. To the extent that the world ecosystem has a limited carbon clearing capacity per unit of time, and to the extent that carbon-reducing technological innovations are developed through time, a

gradual emission of carbon is probably less serious as a source of greenhouse gasses than if such emissions are concentrated in time.

Thus, there may be room for cooperation in promoting this shift without any need for significant compensation. That is, even within the current narrow mechanisms of North-South cooperation, it is possible to achieve important gains for both, Latin America and the world. This would require focusing international assistance more sharply on reducing forest burning instead of diluting the efforts on projects that are not economically feasible or lack ecological uniqueness.

Elements for a Comprehensive International Agreement to Reduce Deforestation: Mechanisms and Financing

A comprehensive international agreement would have to encompass the vast majority of the forested lands in order to avoid the “substitution” leakage. It will need to focus on land allocation and on a system of compensation and monitoring of deforestation. Land use can be classified into four categories: (i) Areas designed for conservation of natural forests; (ii) areas designed for benign exploitation of natural forests including ecotourism, biodiversity prospecting, nontimber forest products and sustainable natural forest management for wood production; (iii) areas for industrial forest exploitation and reforestation with commercial species; and (iv) areas for intensive exploitation including agriculture, mining and oil exploration.

An international agreement would be directed mostly to increasing the land allocated to categories (i) and (ii). But, as Dourojeanni (1995), using a large number of empirical studies, has documented, natural forest management for productive purposes has been largely a failure, and thus, most of the efforts should be directed to increasing conservation. There are more than seventy protected areas in the Amazon Basin, covering 4.5 percent of its area. Many of the protected areas are threatened by encroachment and pressures from commercial interests who want to exploit their resources.

A cornerstone of an international agreement would have to involve a dramatic expansion of the protected areas. The idea is to include most forest areas that can be reasonably protected, excluding only those that are already in settled areas or that are highly threatened given existing population and development pressures. Given that, as argued before, the piecemeal approach does not work, it is essential that the protection programs encompass a very sizeable portion of the forested lands. The larger the protected areas relative to the total forest, the less important the substitution effect.

A sufficiently large compensation fund would be necessary in order to assure a real commitment from national and local governments. The fund would be devoted to investments in already settled areas and to rural poverty programs to reduce pressure on national parks. Additionally, part of the fund would be invested in improving the physical protection of national parks, particularly in establishing an efficient system of park rangers.¹⁰ Subject only to broad guidelines on the use of the international fund, national and local governments should decide for themselves how the money should be allocated to best assure the protection of the national parks. The countries would receive an annual payment on the basis of the natural areas which they commit to protect. The annual payment would be conditional on the preservation of the agreed areas, which can be closely monitored using remote sensing as well as other techniques.

To finance a scheme like this, Dourojeanni (1995) and others have proposed a worldwide carbon tax. The rationale for the carbon tax is that the preservation of the forest would mainly play a role of carbon sequestration needed to mitigate the climatic effects of carbon emissions. Financing of this initiative could also involve an expansion of the “joint implementation” provision of the climate convention signed in Rio de Janeiro. This system allows firms in the North to enter into direct agreements with developing countries to develop experi-

¹⁰ The need for park police to enforce national park protection is rarely mentioned in the literature. However, effective national park protection requires *both* reductions in the incentives to encroach and exploit national park resources and the physical protection of the parks. No matter what you do to decrease incentives, there will always be people interested in obtaining easy profits by exploiting the resources of the national parks. In the absence of adequate enforcement, most efforts to decrease encroachment incentives are likely to be lost.

mental carbon-offset schemes. That is, firms could either choose to restrict their carbon emissions or could fund carbon sequestration projects in the South, usually by promoting less deforestation or greater reforestation. Some U.S. utility companies are entering into agreements with Costa Rica to develop carbon sequestration projects.

An important advantage of the joint implementation system is that it works in a decentralized manner and does not require the establishment of another bureaucratic body. Also, the fact that no direct new tax is involved is a feature that could make the scheme easier to accept politically, particularly in the United States. The firms that provide the funding retain some control over its use, an additional factor that could increase the acceptability of the scheme. Finally, the fact that the joint implementation procedure was approved at the Rio Convention suggests that most countries in the North and South would be prone to implement it. Notwithstanding these advantages, it is likely that the joint implementation mechanism may not be of sufficient scope by itself to permit the massive transfer of resources required to ensure that most remaining tropical forests will be protected.

The issue of acceptance of a forest protection scheme by the South is very important. As shown below, the North can afford to pay the South more than their opportunity costs for most forested lands. That is, the South and the North can both gain by allowing carbon trade through forest protection. Economic benefits, however, may not be sufficient to entice the South to accept an international agreement. Many governments are likely to regard such an agreement as a loss of sovereignty over their territories, which could lead to a reluctance to participate even in the presence of clear economic benefits. These concerns, however, can be greatly reduced by the early integration of national, state and local governments, as well as community organizations and local NGOs, into the analysis of the cost and benefits of alternative uses of the forested lands, planning of the additional areas to be protected, the allocation of the funds into different programs, and monitoring and enforcement of the measures designed to

protect the forests.¹¹

An important question concerns the cost of protecting a large portion of the tropical forests remaining in Latin America. The opportunity cost of the lands to be protected is difficult to estimate. But recent estimates of the land values of settlements in the Amazon can give an idea of the orders of magnitudes involved. The average land value in eight large Amazonian settlements estimated by Ozorio de Almeida (1992) and reproduced by Schneider (1993a) in 1991 was \$219 per hectare (unless otherwise indicated, all figures are in current U.S. dollars) or about \$245 in 1995 dollars. Since this includes the value of investments attached to the land, as well as the value of part of the public infrastructure required to bring the land into production, the actual value of the undeveloped forest land for agriculture must be much less. Thus, the \$245 per hectare represents an absolute upper bound for the opportunity cost of land.

The lowest observed average land value among the eight settlements was about \$70 in 1995 dollars. Since this value applies to the least developed and most remote settlement, we may use it as a better estimator of the opportunity cost of undeveloped

¹¹ An interesting example is the case of Suriname, where a recent study by Sizer and Rice (1995) clearly demonstrated that the benefits of providing logging concessions to certain logging firms are far less than what the country could obtain from international sources interested in protecting the forests or in promoting sustainable exploitations. In fact, the IDB has participated in designing an assistance package that could compensate Suriname for protecting those forests.

Table 1.
Net World Benefits of an International Agreement Under Alternative
Scenarios Considering Carbon Sequestration Only

	Carbon Sequestraion Value per Hectare		
	Lower Bound	Mid-point	Upper Bound
	\$200	\$671	\$4,950
Infinitely elastic world demand and supply schedules for forests	\$58.5 billion	\$270 billion	\$2.2 trillion
Unit elasticity in world demand for forests; infinitely elastic supply	\$125.5 billion	\$692 billion	\$3.8 trillion
Unit elasticity in world demand and supply schedules	\$146 billion	\$713 billion	\$3.89 trillion

Assumptions:

- (1) The agreement consists in saving 650 million hectares of tropical forest in Latin America (mostly in the Amazon).
- (2) In the absence of an agreement, the closed forest area in the Amazon would decline to 200 million hectares.
- (3) The lower bound carbon sequestration value per hectare corresponds to the lowest estimate of global warming costs available. The mid-point level corresponds to the lowest implicit value in the carbon taxes enacted in Europe,

forest. Schneider (1993b) provides a range of estimates of the value of forest land in agriculture for various Amazon regions. He found that these values fluctuated between \$2.50 and \$300 per hectare.¹² Our \$70 falls well within this range.

An opportunity cost of \$70 per hectare implies a rental annual value of about \$7 to \$14 per hectare if we assume a discount rate in the 10 percent to 20 percent range (and an infinite time horizon). Apart from the opportunity cost of the land, one also has to include the cost of physically protecting and managing the national parks.¹³ Assuming

annual management cost in the order of \$2 to \$3 per hectare, the total annual cost per hectare of forest land protected would range between \$9 and \$17. This would imply that compensation ranging between \$6.5 billion and \$10 billion per year could promote the conservation of a very large portion of Latin America's tropical forests, perhaps as much as 70 percent to 80 percent of it.

According to estimates by Goldemberg (1990), a tax equivalent to only one dollar per barrel of oil or six dollars per ton of coal-equivalent would generate \$50 billion annually. Thus, preserving a vast proportion of the remaining natural forest in Latin America would require a tax equivalent to less than 20 cents per barrel of oil (or \$1.2 per ton of coal-equivalent). This would amount to a value added tax on carbon of about one percent. Another way of putting in perspective this cost is to consider that

¹² These values, however, include the value of investments attached to the land as well as part of the public infrastructure value that is capitalized in the price of land.

¹³ It is possible that investment in forested areas may provide rates of return to capital above the market rates, that is, that a disequilibrium situation may prevail in which the rates of return to capital invested in formerly forested areas are higher than elsewhere in the economy.
(continued...)

¹³(...continued)
Compensation should, thus, also allow for this additional opportunity cost.

world GNP in 1994 was about \$30 trillion. Thus, the total forest protection bill would amount to less than 0.03 percent of total world income.¹⁴

Schneider (1993b), using various estimates based on measures of the marginal world damage from global warming per ton of carbon, found that the cost per ton of carbon saved (i.e., not released into the atmosphere) varies between \$1.80 and \$66. The implicit cost in enacted carbon taxes, mostly in Northern European countries, ranges from \$6 to \$45 per ton of carbon saved. Multiplying the cost per ton of carbon by the carbon content per hectare of Amazon forest, he found that the value of carbon sequestration per hectare of the Amazon fluctuated between \$198 and \$803 when the marginal world damage cost estimates were used. It ranged between \$671 and \$4,950 when the implicit cost of carbon in the European tax scheme was used. Consequently, it appears that there is ample room for mutually beneficial trade in carbon emissions between the North and the South. The minimum price that the Amazon countries would require to avoid conversion of forest lands (\$70 per hectare) is less than 40 percent of even the lowest estimates of the marginal benefits of the forest that the North would be willing to pay (\$198 per hectare).

Using Figure 1, we can obtain a lower bound measure of the net benefits for the world of an agreement that would place 650 million hectares of South American forest under permanent protection.¹⁵ Assuming the lowest carbon sequestration estimated value per hectare, $P^w_{\max} = \$200$, $P^L_{\min} = \$70$ and $F^L_0 = 650$ million hectares. Also, suppose that in the absence of an international agreement, the South would continue reducing its forest cover until only about 20 percent of the original forest

remains, i.e., deforestation would cease at about 200 million hectares that is, $F^L = 200$ million hectares in Figure 1. The total benefit for the world of implementing an international agreement that stops deforestation at 650 million hectares is equal to the area IABE. Since we do not know the slopes of the D^w and N curves, we cannot determine the size of this area. However, it is minimized if both, D^w and N are flat. That is, the minimum gain out of the agreement is the area AMKB, where $KB = 450$ million hectares and $AM = P^w_{\max} - P^L_{\min} = \130 . Therefore, the minimum net global benefit of the agreement, considering only the carbon sequestration value of the Amazon, would be about \$58.5 billion. This is the absolute minimum for two reasons: First, we are using the lowest carbon sequestration value per hectare of Amazon land and second, we are assuming that both the demand for carbon sequestration and the supply of forest land are infinitely elastic, clearly a highly unrealistic assumption.

Table 1 provides a range of estimates for net world gains of stopping deforestation in the Amazon (leaving about 650 million hectares covered with forest), under alternative assumptions. The D^w demand schedule is likely to be steep, that is, as the forest is reduced its marginal value increases very rapidly. Hence, assuming conservatively that the elasticity of demand for forests is equal to one, the value per hectare of carbon sequestration increases as we move from F^L_0 to F^L , that is from \$200 to \$655 per hectare. In this case, the area IMA is equal to almost \$67 billion and the total net gain for the world increases to \$125 billion. If the value per hectare of forest is estimated using the lowest implicit cost in enacted carbon taxes, \$671 per hectare, the net benefit of an international agreement reaches about \$692 billion. The most plausible values in Table 1 are those given by the middle scenario, with unit elastic supply and demand curves. This yields a net gain of about \$713 billion, corresponding to the total present value of the cumulative benefits for the world. Using a 10 percent discount rate, implies a net annual benefit of about \$70 billion, or approximately 0.2 percent of world GNP.

¹⁴ Because such a transfer would benefit both the North and the South it is not appropriate to compare it to current levels of foreign aid.

¹⁵ The 650 million hectares figure is used as an illustration of the potential benefits of the agreement. More detailed studies would be required to establish the optimal forest areas to be protected.

National Objectives and Main Threats to Their Achievement

From the previous section, it is clear that the allocation of forest lands between conservation and various degrees of exploitation will depend on the financial support and involvement of the rest of the world in the process. A likely outcome is that the involvement and financial commitment of the rest of the world will continue to be limited to scattered projects and initiatives. It will, therefore, continue to have a negligible impact on land use. But regardless of how much forest land is destined to various purposes and the land allocation mechanisms used, the countries of the region need to define clear land allocation and zoning objectives. In this section we consider the land allocation objectives as given and examine the main problems of achieving particular ones.

For the purposes of the ensuing analysis, we can consider three main objectives for the forest sector: (i) conservation of designated protected areas; (ii) efficient and sustainable utilization of areas designated for industrial forestry and agroforestry, as well as efficient wood processing activities; and (iii) reforestation and efficient subsequent exploitation of selected degraded lands.

The greatest direct risk to sustainable exploitation of public forest reserves, and even to preserving national parks, arises from land speculation in anticipation of the continuous expansion of public infrastructure and colonization to frontier areas. In studies of Central America and the Amazon, Jones (1990) and Schneider (1993a), respectively, describe similar speculative processes by which colonists invade public forested lands and clear them with the purpose of establishing property rights. Southgate and Whitaker reached similar conclusions for Ecuador. In many cases, clearing is a prerequisite to obtain the recognition of rights. Even if the law does not require deforestation to demonstrate possession, land clearing and the

planting of pastures is a way to discourage squatters and avoid agrarian reform action because the lands are “idle” (Kaimowitz, 1995b). Thus, a significant part of the deforestation is not due to an immediate real alternative economic use of the land, but rather to obtaining property rights, with the expectation of attaining capital gains related to increased land values as the government brings in more infrastructure and further colonization.¹⁶

With the exception of parts of Central America and Mexico, the main agents of deforestation in Latin America are not so much the large masses of poor peasants in search of land, but rather commercial interests including speculators, loggers and cattlemen in search of profits who are, directly or indirectly, supported by the government. The poor seem to play a role in deforestation mostly on the edges of the forests and in densely populated areas, but their role seems to be minor compared to the effects of commercial interests. Nevertheless, in the densely populated areas of Central America and Mexico, the poor have played a greater role in deforestation and in degrading marginal lands.

The relatively small importance of land demand for agriculture as an immediate source of land clearing is illustrated by the observed extremely extensive use of the land in the frontier areas. The rate of animal stocking per unit of land is extremely low in the newly colonized areas. It also appears that as the profitability of cattle operations declined in the last decade, the amount of pasture lands increased, despite a significant reduction in herds in Central America (Kaimowitz). This is consistent with the hypothesis that land clearing is not closely linked to

¹⁶ Certainly, speculation is ultimately based on the potential profits of the land in agricultural production as well as other benefits of owning land (tax shelter, etc.).

the demand for agricultural land, at least in the short and intermediate terms. It seems that speculation and the need to establish land rights are the prime motives for land clearing. This has been recognized in the recent literature on deforestation, "...Producers do not engage in cattle ranching as a productive activity so much as to speculate in land and establish a hedge against taxation and inflation" (Laarman, 1995, p. 40). Also, Booth (1989) demonstrates that the peak of forest burning (in 1987) took place two years after most fiscal incentives and tax holidays to cattle raising in the Amazon had been rescinded.

This conclusion is supported not only by several case studies cited by Schneider (1993a), Kaimowitz and others, but also by econometric evidence based on aggregate data. A recent study by Cropper and Griffiths (1994), for example, found that deforestation in Latin America is increasing with per capita income and is not affected by rural population density. Thus, if higher average per capita income and lower rural population density are associated with less rural poverty, as is reasonable to expect, these findings indicate that rural poverty is not a major source of deforestation. In many instances the poor have been direct agents of deforestation, particularly in areas of steep slopes, but this happened mostly because the poor had been displaced from their lands due to the expansion of large capital-intensive commercial activities such as large-scale cattle operations (López, 1992, Heath and Binswanger, 1996). Deininger and Minten (1996), in a thorough empirical analysis of deforestation in 2267 municipalities in Mexico during 1980-90, found that deforestation was not affected by population density. Municipalities with larger percentages of indigenous people experienced less deforestation despite their high incidence of poverty. Pfaff (1996) obtained similar results for deforestation in the Amazon.

The net effect of land speculation is that more land than what is necessary for economic development is cleared. Moreover, in the rush to clear the land, the preferred and cheapest method is burning. The lack of interest in extracting the timber in the early (and most speculative) phase of the settlement

results from the fact that the necessary infrastructure for profitable timber exploitation is not yet in place. A large amount of potentially valuable timber is, thus, lost early in the settlement process. In the Andean countries (Bolivia, Colombia, Ecuador, Peru and Venezuela), for example, out of a total annual wood loss estimated at about 190 million cubic meters, 150 million are burned while only eight million are used for industrial purposes and the other 32 million are used for fuelwood (Razetto, 1994).

An important implication of the above is that even if governments have as a goal to exploit and eventually convert the forest land into agriculture, land speculation is not desirable and needs to be discouraged because it promotes more forest burning than what is optimal for the country and induces a faster rate of deforestation.

Forest reserves are also at risk of being overexploited by logging firms that gain legal concessions on usually large tracts of land.¹⁷ Concessions are generally granted after the approval by the government of an exploitation plan that is supposed to provide for a rational and sustainable extraction of forest resources. A major problem is that loggers usually have no incentives to implement the plans and the governments do not enforce them. Typically, the concessions are for short periods of time and thus loggers have all the incentives to extract as much timber as possible in as short a time as possible.

Apart from the threat of predatory exploitation by legal loggers, the forest reserves and even the national parks face the threat of illegal timber extraction by smaller logging operators and of illegal fuelwood extraction and land clearing by

¹⁷ Legal concessions have increased quite fast in many countries of the region. In Bolivia, for example, 70 percent of the closed productive natural forest (about 30 million hectares) is under concessions. The area under concession in four Latin American countries (Bolivia, Brazil, Peru and Colombia) was estimated at 38 million hectares or about 8 percent of the area of the productive natural closed broad-leaved forest (Johnson and Cabarle, 1993).

poor peasant cultivators. Most of the illegal activities of the poor, however, are concentrated near the forest boundaries in areas of high population density. In most cases, the deforestation caused by these groups is of lesser importance than that caused by large commercial interests. However, the impact on forests of large numbers of poor peasants are becoming more important in Central America, Mexico and some Caribbean countries where rural population density and rural poverty tend to be higher than in most of South America.

In summary, it appears that the largest risks to the rational exploitation of forest reserves arise from land speculation and conversion to agriculture mostly by large commercial interests. This is corroborated by both case studies and aggregate studies. It is also consistent with estimates of forest biomass losses available for the Andean region, indicating that almost 80 percent of these losses are due to forest burning. The second largest risk appears to arise from unregulated logging exploitation by large firms and by the use of forest resources as an industrial energy source. Deforestation carried out by the rural poor appears to be somewhat less serious than that resulting from the activities of commercial interest.

Recent Policy Reforms and International Market Developments

Structural Adjustment and the Forest Sector

Most Latin American countries have undertaken far-reaching policy reforms since the late 1980s. Adjustment has led to significant changes in the structure of incentives, with important consequences for the forest sector. The agricultural sector, which historically has been discriminated against in favor of industry, has benefitted from these policy shifts. As Krueger, Schiff and Valdés showed in 1990 economic distortion such as over-valued exchange rates and import restrictions acted as a burdensome tax on agricultural producers in most countries. At the same time, the agricultural sector was, in part, compensated by special tax treatment, credits and input subsidies.

The net effect, however, was a large tax that significantly reduced agricultural incentives. This can be measured using the producer subsidy equivalent (PSE), a comprehensive indicator of intervention that gages both price intervention and nonprice transfers to producers.¹⁸ According to Valdés (1995), the PSE for agriculture between 1985 and 1990 averaged -3.4 percent of the value of agricul-

tural production in Brazil, -22.5 percent in the Dominican Republic, -18.1 percent in Ecuador and -42.2 percent in Paraguay. These figures mean that the effect of economic distortions overshadowed the compensating effect of subsidies by a wide margin. Moreover, the producer subsidy equivalent for Brazilian agricultural importables was -20.5 percent of the value of agricultural imports during the period, and that for agricultural exportables from the Dominican Republic, Ecuador and Paraguay was -48 percent, -46 percent and -42 percent, respectively, of the value of agricultural exports.¹⁹ These data are most significant for cattle production because beef was an importable commodity in Brazil between 1985 and 1990, while it was an exportable commodity in the other countries. Among all the tropical countries analyzed by Valdés, only Colombia showed a positive producer subsidy equivalent measure.

The role of tax allowances and subsidized credit for cattle ranching was often considered a major source of deforestation during the 1970s and 1980s (Binswanger, 1991). But, since the net effect of policy intervention was to tax agriculture, including the beef sector, one has to conclude that the overall incentive policy intervention did not promote more deforestation through agriculture and cattle production incentives.²⁰ That is, if the tax

¹⁸ Governments intervene in a variety of ways in an attempt to assist agricultural producers. Although price interventions represent an important form of assistance, nonprice measures could be important as well. The producer subsidy equivalent (PSE) can be defined as compensation to farmers for the loss of income resulting from the removal of domestic agricultural policy measures at a given level of production. Specifically, it is the sum of net output market support, input subsidies, marketing/transport/storage subsidies, deficiency payments, and nonprice transfers (research, extension, irrigation). Expressed as a sum, the PSE is an absolute aggregate monetary figure and can be calculated both for individual commodities or as an overall sector PSE. However, to make the PSE comparable across commodities and countries, the aggregate PSE should be expressed as a ratio. It is a ratio of policy transfers compared to the total value of domestic production (valued at domestic prices)

¹⁹ Importable and exportable goods are subsets of tradable goods subject to the following relationship:

Importable goods: Local cost > CIF

Exportable goods: FOB > Local cost

where: CIF is the cost, insurance and freight charges on imported goods, and FOB is the free on board cost of exported goods.

²⁰ It is true that cattle production in the Amazon received some special incentives over and above the tax allowances and credit subsidies that production elsewhere received. The exchange rate and trade policy distortions in Brazil

(continued...)

allowances and credit subsidies were only a partial compensation for the negative effects on the profitability of the sector due to overvalued exchange rates, export taxes, and large import protection to the industrial sector, one can hardly argue that the incentive policies were promoting the expansion of the cattle industry and, thus, were causing further deforestation.

By the same token, the removal of most of these policy distortions is likely to increase rather than reduce the competitiveness of agriculture and in particular the cattle industry. The elimination of tax allowances, credit and other input subsidies that, in fact, took place in Brazil and most other countries in the region, was accompanied by a reduction in trade protection to the industrial sector, the elimination of export taxes and restrictions affecting agriculture and other primary exports, a deep devaluation and exchange rate liberalization. Since the beef sector is eminently tradable, the more realistic exchange rate is likely to cause a positive impact on the competitiveness of the cattle industry.²¹

Also, the removal of extremely high levels of industrial protection, allows agriculture to compete more effectively for the allocation of capital and other resources. Thus, the net effect of eliminating price distortions is to increase the competitiveness of agriculture (including the cattle sector) and, therefore, to increase the profitability of, not only agricultural intensification, but also of expanding the agricultural frontier into forest areas.

²⁰(...continued)

and other Amazonian countries were, however, so deeply discriminatory against agriculture, including the cattle industry, that it is hard to imagine that the special Amazon subsidies provided enough compensation.

²¹ After the first real devaluation, the real exchange rate started to gradually appreciate in several Latin American countries, because of market forces rather than government intervention resulting in large capital inflows between 1991 and 1994 (López, 1995). Prevailing real exchange rates are still well above (i.e., less overvalued) historical levels in most countries in the region.

In fact, in many countries in the region, the elimination of exchange rate distortions and the reduction of protection to the industrial sector was not accompanied by a comparable reduction of nominal protection to the agricultural importable sector. Hence, the net effect of government intervention has been not only to eliminate the anti-agricultural bias, but also to create positive net incentives for import substitution in agricultural products. This important change is likely to make the Latin American economies even more dependent on primary sectors with a consequent relative contraction of the industrial sector.²²

The structural adjustment process has also led to important reforms that directly affect the forest sector. In the process of reducing trade restrictions, export taxes and prohibitions affecting raw and semiprocessed logs have been eliminated in several countries. Bolivia, for example, eliminated all restrictions on exports of timber as part of the effort to increase nontraditional exports (Kaimowitz, 1995a). Nicaragua and several other countries are now in the process of eliminating restrictions on timber exports (Laarman, 1995). At the same time, several countries have reduced the protection of the wood processing sector by eliminating quantitative import restrictions on processed products. In the past, these policies contributed to the inefficiencies of the wood processing sector and some authors have argued that, by depressing domestic timber values, also contributed to deforestation and to the generation of disincentives to forest plantation (Kishor and Constantino, 1993; Stewart and Gibson, 1994).

Forest plantations, however, cover a minuscule fraction of the forested land in Latin America, not only because of low timber prices, but also because

²² In most countries of the region this phenomenon is not yet detectable, mainly because of the relatively short time that has elapsed since the reforms. In Chile, however, a country that initiated the reforms much earlier, available statistics show the primary sectors (agriculture, mining, fisheries and forestry) growing at a rate 25 percent faster than the economy as a whole, and a significant decline in the contribution of the industrial sector to total output (López, 1995).

there are plenty of forests that can be exploited at little private cost. The problem is that given the lack of enforcement of forest regulations and the lack of collection of royalties and stumpage fees from timber extraction in public lands, the incentives to private plantations are minimal even if timber prices are good. Private plantation timber production requires costly investments and, therefore, can hardly compete with timber extracted from open-access or semi open-access forest lands where the only effective cost is the cost of extraction and transportation. High timber prices in the presence of vast effectively open-access public lands are more likely to result in greater timber extraction from public lands than more private tree plantations.²³

Thus, the liberalization of the timber trade is likely to cause even greater incentives to cut trees in public forest reserves. There is empirical corroboration for this. In fact, Cropper and Griffiths (1994), using aggregate data, found that timber prices and deforestation are positively correlated in Latin America. The evidence from Chile points in the same direction. Although Chile has had no restrictions on raw timber exports for many years, the development of private tree plantations has required the use of heavy subsidies, despite the fact that in Chile, unlike most countries in South America, the availability of open access or semi-open-access forest lands is quite limited and concentrated in relatively isolated areas.

An important issue is the sequencing of the policy reforms. Before completely liberalizing timber trade it is important to introduce reforms in the management and enforcement of regulations affecting public forest lands. As indicated, regulations affecting logging concessions are not enforced and concessions typically last a very short time. This provides all the incentive to maximize timber extraction regardless of the environmental consequences. Moreover, royalties and stumpage fees,

that theoretically should be large enough to capture rents out of exploiting public lands, are not effectively used. In reality, the collection of royalties and stumpage fees corresponds to only a small fraction of the true forest rents. Thus, if the idea were to reduce deforestation and really promote forest plantation, before liberalizing trade in timber products, it would be necessary to reform the system of management of public lands and concessions. Additionally, greater physical protection of forest reserves and national parks should be implemented to avoid illegal forms of deforestation which are likely to increase in a liberalized policy environment.

For countries not interested in slowing deforestation, liberalizing the timber trade without implementing the above complementary measures may, however, be rational. The elimination of the discriminatory policies against the logging industry associated with traditional trade policies, is likely to increase deforestation, but at the same time, reduce forest burning as a mechanism for land clearing. The reason for this is that as timber products become more valuable, greater efforts would be devoted to wood extraction rather than the cheaper forest burning alternative. Since, as we indicated before, excessive forest burning is a major problem for many countries, the change in the pattern of deforestation resulting from the liberalization of timber trade, is probably consistent with the national interest.²⁴

In general, structural adjustment, as implemented in most of Latin America, is likely to result in increased deforestation policies that improve production incentives for the primary sectors where not accompanied by policies to ameliorate distortions in the use of forests. Protection of national parks, the enforcement of forest regulations and charging stumpage fees are examples of measures that have not been taken in parallel with structural

²³ On the other hand, higher timber prices allow logging activities to compete better with agriculture for the use of forest lands. This could have the effect of reducing forest conversion to agriculture.

²⁴ Of course whether deforestation is carried out through burning or logging is equally negative for the rest of the world from the point of view of biodiversity losses.

reforms.²⁵

The Role of International Commodity Prices

In the late 1980s and early 1990s, the new policy environment was accompanied by a considerable deterioration in the international prices of meat and many other agricultural commodities that, in large part, offset the improved profitability of agriculture and the cattle sector brought about by the new policies. As shown in Table 2, the real international price of beef has declined steadily since the early 1980s. In 1994, beef prices were less than half their 1970 level and about 60 percent of the price prevailing in 1980. Similarly, real prices for most commodities that are important to Latin America and that compete for land with forests, have tended to decline significantly. The decline in cereal prices was particularly important because cereals are the second most land-intensive agricultural output, after cattle production. Declining international prices for agricultural commodities and beef mitigated the effects of the structural reforms on forests, resulting in less deforestation than would have occurred otherwise. However, agricultural commodity prices are beginning to show clear signs of revival. For instance, the international price for bananas has increased by almost 40 percent since June 1995. The price of maize has risen by more than 30 percent since November 1994; rice by more than 40 percent during the same period; and wheat prices began moving up in April 1995, also posting a 30 percent increase. Even beef prices have shown signs of a modest recovery since their trough in July 1995.

There are indications that the recent upswing in prices reflects more than just temporary fluctuations or weather-related problems. It appears that the fast economic growth that several highly populated developing countries have been experiencing (mainly China, Indonesia and India) is beginning to affect the demand for agricultural commodities and meat products. Accordingly, an eventual new agricultural commodity boom combined with recent free market reforms, could lead to an acceleration of deforestation in Latin America in the near future, particularly if complementary sectoral reforms are not implemented soon.

Slow regional economic growth in the eighties and early nineties has also tempered the pace of deforestation, as few public funds were available for building roads and other infrastructure into forest areas. Slow growth also reduced the availability of private funds, implying fewer investments in forest areas and a lower demand for land. However, growth has resumed in most of the large countries in the region. The effects of this revival in growth is already beginning to be felt in many places in the Amazon, where forest burning has increased significantly.

Looking ahead, three factors are likely to lead to greater forest loss. First, a liberalized policy framework seems to have eliminated most of the historical anti-agricultural bias and is in the process of also eliminating anti-timber biases. Second, international agricultural commodity prices seem to be rising. And third, economic growth is accelerating. Even more importantly, free market policies may now allow for a rapid and complete transmission of international price booms into the domestic economy. This is in sharp contrast with the historical patterns where domestic distortions hindered the full transmissions of international changes.

²⁵ López (1994a) in a more general conceptual framework, showed that trade and other economic reforms that decrease macroeconomic and trade distortions are likely to reduce natural resource stocks in a context of open or semi-open access resources.

Table 2.
International Commodity Prices in Constant 1990 dollars

	1970	1980	1985	1990	1994	1995*
Beef/Kg	5.20	3.84	3.14	2.56	2.12	1.65
Sugar \$/Mt	323	878	130	277	242	247
Bananas \$/Mt	659	527	551	541	399	376
Rice \$/Mt	504	571	287	271	243	278
Wheat \$/Mt	219	240	198	136	136	153
Maize \$/Mt	233	174	164	109	98	106
Soybeans \$/Mt	466	412	327	247	229	223
Cotton/Kg	2.52	2.84	1.92	1.82	1.60	1.88
Logs \$/M3 (species)	171	350	253	344	300	295
Sawn timber	699	551	448	533	745	645

Source: The World Bank, November 1995.

* Projections.

The improvement in economic performance due to the combination of higher commodity prices and more rapid use of forest resources may benefit the region's forested nations in the short run. However, the consequences for the rest of the world are

likely to be negative. Countries with abundant forest resources are likely to benefit even if one considers the potential long-run cost of forest conversion and tree cutting.

Policies and Financing Mechanisms for an Efficient Forest Sector

In this section we discuss a policy framework to promote the effective conservation of protected areas, efficient and sustainable exploitation of areas designated for industrial forestry and agroforestry and efficient reforestation of selected degraded lands. It is assumed that the land allocation goal has been already determined and that the policy objective is to accomplish the allocation goal and obtain the largest economic benefit. If an international agreement as the one previously described is reached, the structure of land allocation is going to be completely different than without such an agreement. If an international agreement is implemented, the largest efforts would have to be directed to protecting areas targeted for conservation, while in the absence of an international accord the problem of conservation and protection is likely to be restricted to a much smaller geographic area. In this case, the major task is to focus on how to develop the vast forest areas that are going to be designated for agroforestry, timber extraction and conversion to agriculture, generating the highest returns and minimizing negative domestic environmental losses.

Regardless of the extent of international involvement, the countries in the region need to develop a land allocation blueprint for public lands, specifying clear goals for their utilization. At the same time, regulatory and policy mechanisms need to be designed in a manner consistent with land utilization goals.

General policy, management and investment requirements to meet these objectives are discussed below. An analysis of the financing mechanism to cover the costs of these measures also follows.

National Parks and Protected Areas

Although deforestation in Latin America is caused more by large commercial interests than poor

peasants, most threats to national parks come from the poor. National parks cover only a small fraction of the forested lands so that deforestation within their boundaries constitutes a minor portion of total deforestation. While illegal encroachment by poor peasants practicing slash-and-burn cultivation and by small illegal loggers is a problem for the preservation of parks, the implied deforestation is small relative to the loss of forest outside national parks.²⁶ The most serious risks are faced by parks that are close to heavily populated areas.

The selection of the site for a national park should take into consideration the feasibility of effectively protecting it. For this reason, new national parks should not include areas that are already densely populated. Additionally, for parks with an increasing resident population, the options are either to retrench and reduce the size of the park to new boundaries that can be protected, or to provide incentives to the local population to voluntarily relocate. In any case, whatever option is chosen, local communities should be actively involved so that they can understand the value of forests and the rationale for establishing the park. They should also participate in the process of planning and protecting the new boundaries, and in the planning of the voluntary resettlement, if that is the option chosen.

The relocation of poor people out of a national park and/or the reduction of the pressure of the poor on the park boundaries, need significant positive incentives. Land, housing and basic services need to be provided. The provision of agricultural land to the rural poor may require the enactment of a land reform that improves the

²⁶ Indeed, large commercial interests are often too “visible” to illegally encroach on national parks although they have also caused damages in isolated incidents. Also, land speculation is much less likely in national parks.

unequal distribution of good agricultural land prevailing in most of the region. Government assistance in the form of agricultural extension, schooling, credit and other services should be made available outside the protected areas to entice local residents to stay outside the park boundaries.

Perhaps the largest financial cost of effectively protecting national parks is the provision of these services as well as the cost of land redistribution to large numbers of poor people. But, in addition to reducing the incentives for the rural poor to settle in national parks, national parks must be protected physically. A clear demarcation of park boundaries is essential, as well as ample information to the public about such boundaries. A sufficient number of park rangers is needed to patrol the parks. Provision should also be made for hiring the administrative and professional staff to monitor the national parks. The physical protection of the national parks implies significant costs that require financing.

Management of Forest Reserves and Other Public Lands

One of the most serious problems facing public forest lands is their semi-open access status and the lack of government enforcement of regulation. Given current administrative, institutional and financial capabilities, governments in the region are simply unable to control the use of forests in public lands. The almost complete absence of government control and misdirected incentives concerning the establishment of private property rights over public lands, have given rise to a chaotic process of land speculation, where forest burning is the main mechanism for land clearing. This has led to large timber losses and serious local environmental consequences. The failure of the government to enforce concession conditions, low or almost nonexistent stumpage fees and royalties, and the legitimization of land encroachment (after “proper development” of the land), has led to the underdevelopment of forest plantations. The fact that public natural forests are almost freely available (legally to those with sufficient clout in the government and illegally to almost everyone else), makes

it very difficult for tree plantations to compete with the exploitation of public lands. The lack of enforcement of concession agreements and short concession periods, are invitations to predatory behavior in public forests.

The key measures proposed concern improving government enforcement capabilities and accepting that, even if they do improve, it is not likely that it will be sufficient to allow for the effective control and enforcement of regulations in all existing public lands. As result, rather than permitting the continuation of the process of alienation of public lands currently in existence, it would be better to allow for an orderly and transparent process of land privatization. In a previous report for the IDB, I (López, 1994b) suggested a scheme for privatizing public lands giving priority to lands that are closer to populated areas and to forests that are less unique in terms of biodiversity, and are located in environmentally stable areas. That article proposed three types of lands for privatization. First, lands to be sold only in large tracts to responsible enterprises, including NGOs, under restricted conditions, to be exploited only for agroforestry, nontimber products, ecotourism and other forms of relatively benign exploitation. Second, lands that can be utilized for timber extraction but that cannot be burned. Third, lands to be sold without restrictions on their future use or method of clearing.

In order to ensure the transparency of the privatization process, the report suggested the use of an auction mechanism and appropriate public information campaigns. The government would retain a forest reserve that it can realistically manage or for which it can administer a concession. Various countries in the region are already seriously considering such a privatization process, Peru is in the most advanced stage.

In the forest that the government ultimately retains, concessions should be transparently allocated through an open bidding mechanism. Concessions should be long term so that firms have the incentives to really manage the forest. This probably requires concession lengths of 25 to 40 years.

Stumpage and royalty fees should capture most of the economic rents and an effective collection system should be established.

The management of the remaining public lands should be given to the state or local government, allowing them to retain a significant part of the revenues collected. This should provide incentives to local governments to enforce regulations in order to ensure a more or less steady flow of financial resources out of the concessions. Also, part of the revenues should be earmarked to peasant organizations, charities and local NGOs, so that private sector organizations can develop a stake in controlling local government actions, to diminish corruption and other nontransparent practices.

The construction of roads and other infrastructure into forest areas should be carefully planned, beyond usual environmental assessments of projects. Roads should only be constructed in areas that appear profitable to develop, that is, in areas where deforestation is not likely to cause serious local environmental problems, where there is an ample supply of timber or where the land can support agriculture in a profitable and stable way.

Public Policies for Improving Forest Utilization and Creating Domestic Sources of Financing

Incentives should be designed so as to reduce land speculation. A closely related goal should be to diminish the incentives to the anarchic sequence of land occupation, forest burning and land rights that has prevailed. Furthermore, incentives should be market-oriented.

A straightforward mechanism to reduce land speculation and excessive forest burning is to tax the speculators. In fact, some countries in the region have legislation concerning taxation of capital gains on land, but these taxes are rarely collected. In Brazil, for example, there is a 25 percent federal capital gains tax on land sales (Moran, 1993). Yet, the government lacks the ability to collect it. The best way of assuring tax collection is to leave it in the hands of the local

governments, with the incentive that they can retain part of the revenues. As with the royalties and stumpage fees, a study should be prepared to estimate the potential revenues of such a tax. Local private sector organizations should be entitled to a certain fixed percentage of potential tax revenues. This should help maintain the accountability of local governments and force them to collect the taxes.

Lack of a land tax or the inability to collect the tax leads to unequal distribution of land and to land speculation. Land is valued as a tax shelter. This makes it attractive to speculators and other investors, raising the price of land well above the present value of net farm revenues. It also reduces access to land by poor peasants. A land tax that exempts forested areas from taxation would also diminish incentives to clearing excessively large areas of land and burn forests. Indeed, it would allow the tax shelter role to continue but applies it only to the forested land. As with the capital gains tax on land, the regular land tax should be collected by local governments, and revenues should be distributed between the local government, local private organizations, and the national government. Local private organizations would receive a fixed percentage of potential revenues.

Despite their efficiency and equity advantages, land taxes are politically difficult to implement. However, as the enactment of legislation to liberalize imports and privatize state-owned enterprises shows, the fact that land taxes have been difficult to implement in the past does not mean it would be impossible to do so in the future. In particular, public information campaigns to adequately explain the proposed legislation, and the government's commitment to the measures would make their implementation politically more palatable. A larger capital gains tax on land sales can be instituted in the meantime. This tax is more likely to be accepted since it does not tax the land itself, but only the appreciation of its real value.

The complete elimination of export restrictions on timber and other raw wood products, in the absence of complementary policies, is risky. It could

create a large demand for natural timber that, if not matched by higher stumpage fees or royalties and greater controls, could lead to the massive extraction of timber products from the almost open-access public lands. Since land privatization and the implementation of the measures discussed would take some time, it might be advisable to consider replacing timber export controls with a temporary export tax. The export tax should yield revenues that can be used to finance the many initiatives previously discussed. In any case, before putting this tax into effect, a careful empirical analysis should be carried out to quantify its effect on deforestation.

To avoid reducing incentives to planting trees and sustainable timber extraction, the export tax should be clearly presented as temporary. A fixed schedule indicating a gradual reduction of the tax rate should be made public and strictly followed. Since forest investments are long run, a temporary export tax with a credible withdrawal schedule, should not only be innocuous to forest plantation, but should cause a reduction in deforestation in the short run as people find it more profitable to delay cutting the trees until the tax is phased out.

The wood processing industry could potentially make an important contribution to the region's economies in terms of both income and employment. Moreover, the fact that Latin America has significant comparative advantages in the production of timber, can lead to similar advantages in wood processing because the large transportation costs of raw timber creates a wedge between the domestic price of raw timber and international (CIF) prices. Additionally, the wood processing sector is relatively labor intensive and its expansion can play an important role in increasing rural employment and reducing poverty. For these reasons, it appears convenient to provide some support to the wood processing industry. The sector can suffer a severe compression as trade protection is reduced. Diminishing import duties will lower prices of finished goods, and the removal of export restrictions will raise raw material prices, creating a profit squeeze. Technical assistance and the provision of unsubsidized credit, particularly to

small- and medium-sized wood processors, can smooth the transition of the industry from a highly protected environment to free market one. Assuring the provision of unsubsidized credit to small- and medium-sized firms is important because, given the imperfections of credit markets, these firms are likely to suffer liquidity shortage as profit margins decline.

Another issue of importance is property rights and their enforcement. Lack of definition of property rights and tenure insecurity limit long-term investment, particularly investments in land, including tree planting. Perhaps even more important is the inadequate protection from squatter encroachment on private forested lands. This forces landlords to cut trees to show that the land is being used and discourage squatters.²⁷ An important policy implication is that governments should provide the necessary institutions to facilitate legalization of land titles and should consistently enforce property rights and protect private lands from squatters. This should go a long way toward discouraging deforestation as a means to securing property rights. Additionally, land reform laws should consider forests an appropriate use of the land and eliminate the existence of forests as a cause for expropriation of the property.

Reforestation of certain degraded lands can result in positive local externalities, which is a justification used to subsidize reforestation in degraded land. Haltia and Keipi (1995) have shown that the subsidies are justified under relatively strict conditions; the case for plantation incentives arises only when the private net returns are lower, but the returns including externalities are greater than the returns to alternative land uses. Furthermore, subsidies are sometimes used to promote afforestation for fuelwood in lieu of the natural forest, becoming a mechanism to protect the national forest. Unfortunately, in many cases the subsidy programs for reforestation have become expensive,

²⁷ A recent World Bank (1995) study for Guatemala clearly documents the use of deforestation to establish property rights not because of any legal requirement to develop the land, but simply to reduce encroachment.

ineffective and inequitable. In Brazil, for example, generous subsidies were provided to plant trees as sources of energy for pig iron smelters. The subsidies were paid mostly to large landlords producing charcoal but because enforcement was lax, very few trees were actually planted, and instead, the charcoal was extracted almost entirely from the natural forest (Moran, 1993). The problem is that tree plantations are often unprofitable and the required subsidies large. Also, the enforcement is difficult and the potential for corruption is high.

The concept of charging user fees for the use of natural resources has been very difficult to implement in the past. Given the increasing consensus on the expanding role of markets in Latin America, it is likely that user cost charges can now be implemented in many areas. In particular, national parks should be allowed to charge fees for entry and other services. The goal is that user charges cover a significant part of the maintenance costs of national parks. Additionally, large beneficiaries from protecting major watersheds, such as electric utilities, should be charged special fees to cover the costs of protection. Colombia provides a good example of the feasibility of this initiative (López, 1994b).

An important feature of these policies is that, apart from promoting economic efficiency, many of them also may result in large financial flows to fund the programs and investments proposed in the foregoing. A land tax, a capital gains tax on land, and stumpage fees and royalties could make a sizable contribution to financing national park protection as well as improving public institutions and the capacity of local and national governments to conduct forest policies and programs.

The privatization of forest lands at market prices can also raise revenues. For example, the privatization of 20 percent of the Amazon may yield \$9 billion to \$10 billion assuming that land is sold at an average of \$60-\$70 per hectare. Assuming a 10 percent net rate of return, this could yield \$900 million to \$1 billion, which could cover a large portion of the additional annual funds needed to

improve the staffing of forest departments and the management of public lands. This figure is almost twice as large as the total annual concessional environmental contributions that Latin America receives from the industrial economies (López, 1994b). In fact, total foreign aid for environmental projects (not only to the forest sector) including bilateral aid, the Global Environmental Facility, the Montreal Protocol, Debt for Nature Swaps, the Brazil Rain Forest project and private sector contributions were estimated at about \$461 million per year.

At least part of the financial resources raised using the measures suggested in this section should be earmarked to promoting and protecting national parks and, more generally, to promoting the sustainable development of forests. On the other hand, it is inevitable that part of these financial resources will be allocated to other purposes. The important thing is to develop explicit criteria to assign a significant portion of them to the forest sector.

Local Communities as a Source of Funding to Correct Local Externalities

Several of the negative local externalities of deforestation and forest degradation are felt on the availability and quality of water. Local populations normally understand the connection between deforestation of certain key areas and soil erosion, and the increasing scarcity and deteriorating quality of water for consumption and for productive purposes that they experience.²⁸

The clear understanding and concerns of many local communities about this problem suggests the potential for financial contributions by the affected communities to protect, maintain and renovate forests that directly affect water sources and

²⁸ The importance of these issues is illustrated in the case of Nicaragua as indicated by Ricardo Quiroga in his comments on an earlier version of this paper. In other Latin American countries water issues are also of prime importance as indicated in the *World Bank Development Report* (1992).

reservoirs. Funds can be collected by community organizations with the assistance of local governments through water and energy tariff surcharges for the protection of the forests in the water sources. Further, in the cases where the protective forests are privately owned, it is possible to promote forest buy-back schemes, through which local communities are able to control the forests that are vital for their water supplies.

The same concepts can be applied to local forest-related externalities that are not related to water. An interesting example is the Baboon Sanctuary in Belize (World Bank, 1994). Local residents decided to join efforts and money to invest in the protection of local forests where baboons live. The investment paid off well as the residents obtained large benefits from ecotourism revenues.

International Financing Sources

The Global Environmental Facility (GEF) is one of the most important mechanisms used to direct the financial contributions of the North to promote environmental sustainability in the South. In March 1994, negotiations were concluded to extend the GEF's operations, increase funding to \$2 billion over the next three years and to broaden its scope of action into deforestation, land degradation and desertification.

In 1994, total ongoing GEF investment projects around the world amounted to about \$1.3 billion, of which Latin America and the Caribbean received \$160 million. Only a relatively minor fraction of these funds went to projects that have a direct effect on forests. The fact that financing projects to reduce deforestation and land degradation are now an integral part of GEF activities implies that financial flows for these purposes are likely to increase significantly in the near future.

The Brazilian Tropical Rainforest Trust Fund (BTRTF), established in 1991 by the Group of Seven, is another mechanism to channel international funding to Latin American forests. A fund of \$250 million was set to implement projects to conserve biological diversity, strengthen forest

management institutions and related projects. Over the last few years, the annual proceeds of the BTRTF have fluctuated between \$15 million and \$20 million (Figueroa, 1995).

Debt-for-Nature Swaps (DNS) allow countries in the South to convert part of their external foreign debt into obligations in domestic currency to be used in promoting environmental sustainability. DNS have been used in a limited way in Latin America; 15 agreements have generated about \$68 million in conservation funds over a five year period. A large proportion of these funds have been used for wildlife conservation and for the protection of national parks. The largest beneficiaries have been Costa Rica, Brazil, Bolivia and Ecuador.

In addition to official financing, significant sums are contributed by the private sector of the industrialized countries. It is estimated that annual private contributions from the North for sustainable natural resources management in the South ranges between \$25 to \$35 million (López, 1994). A large portion of these go directly or indirectly to the forest sector. Apart from traditional contributions via NGOs, there are other international contributions from the for-profit private sector. Among those, the most promising is the Joint Implementation Mechanism. It permits international carbon trade by allowing firms to obtain carbon credit by contributing to forest protection. Given that the reductions in carbon emissions in the United States and several other developed countries are, so far, purely voluntary, this mechanism has been used to a limited degree. The most important joint implementation agreements have involved U.S. electric utilities in Costa Rica.

The total annual contribution to the forest sector from the various international sources is unlikely to be much above \$150 million. To put this into perspective, gross estimates of required expenditures in Latin America forests to bring about sustainability should be considered. Our own estimates of the annual expenditures that would be required to cover just the opportunity cost of a large portion of Latin America's tropical forests

are in the \$6.5 billion to \$10 billion range. Of course, this assumes that most of these forested lands could be converted into other uses in the near future. In fact, many of them are currently inaccessible and for the time being, are not threatened. A recent study by the Amazon Commission on Development and the Environment (1994), estimates that the total cost of protecting ecosystems in Amazonia is about \$10 billion per year.

These figures indicate that international funding to support sustainable forest in Latin America is minimal compared to the needs. The North will have to accept a much greater financial responsibility to effectively promote forest protection and sustainability in the South. The Joint Implementation Mechanism has great potential to increase the financial flows of the private sector in the North. But this requires that the agreed upon carbon reduction objectives be effectively implemented so that reductions in carbon emissions become compulsory for each country.

Public and Private Sector Roles in Forest Financing

An important role of the public sector is to identify and exploit potential sources of financial revenues (taxes, fees for public services, royalties) that promote economic efficiency. The use of policies that are, in addition, equitable is another important criterion in this respect. Most of the policies discussed above are beneficial under these criteria. They provide financial resources that can, at least in part, be used to promote sustainable development; they promote economic efficiency by leading to a more proper valuation of forest resources; they are equitable by forcing mostly large- and medium-sized producers to reduce the rents they obtained from national resources.

The proper use of the revenues raised in this way is an important task of the public sector. The financial resources should be used in the most decentralized way possible, providing ample support to local governments, private NGOs with a proven record

of promoting sustainability, and to other community organizations. The public sector should use part of the revenues to provide effective protection to the national parks and other protected areas. Similarly, a portion of the revenues should be used to allow national and local government agencies to monitor changes in forest resources and enforce the implementation of existing forest regulations.

Private financing of forests depends very much on the incentive framework. For instance, if rents from logging public forests are eliminated through royalties or other means, incentives for private investment in reforestation projects will increase, at least in certain areas. Similarly, if private industries are forced to pay the full market value of the wood extracted from public lands to produce charcoal, they will have greater incentives to produce wood in private lands.

In many instances, private firms can make large contributions to protecting natural forests and related ecosystem if this will improve for their public image, thus contributing to their long-run profitability. Private financing of forests for public relations purpose also requires the right incentives. For example, the government may make such expenditures tax deductible. Promoting public recognition of these contributions in a manner that enhances the reputation of the corporations involved is another way of attracting private financing in forestry.

National and international NGOs also play an important role in raising funds to finance forest initiatives. The state should facilitate NGO initiatives by developing a clear legal framework and promoting joint ventures with for-profit firms and local community organizations. Finally, as already discussed, local populations are frequently willing to make financial contributions to protect forests that generate positive externalities that benefit them. Governments should support local communities in these efforts and, at the same time, provide the legal means to facilitate these types of actions.

Equity Issues

Several of the existing public forest policies discussed have negative connotations not only from the point of view of economic efficiency but also from that of social equity. Forest concession systems, user fees, capital gains and land taxes, and credit policies generally favor the wealthy, lead to unsustainable forest practices, and create obstacles to raising revenues to finance sustainable forest development.

The lack of transparency of the public lands concession system contributes to corruption and the allocation of land to wealthy and politically powerful groups, depriving access to land to the rural poor. In many cases, forest concessions have a negative effect on forest dwellers (mostly poor native groups), as their lands are given in concession to large commercial interests. The proposed changes to the system of forest concession, increasing transparency and fully incorporating local populations into the decision-making process regarding the allocation of land and monitoring of concession conditions should reduce rents to large forest interests and permit greater benefits from forest resources to accrue to local dwellers.

The proposed greater emphasis on collecting user fees, including stumpage fees and royalties, for the right to exploit public forests, should provide the financial resources to compensate local populations for any indirect losses caused by the exploitation of forest resources. One of the proposed measures was to allow a portion of the revenues raised in this way to remain with the local governments and community organizations as an incentive to promote enforcement of the collection of fees. Such a measure would protect forest resources, increase economic efficiency and improve income distribu-

tion.

The lack of taxation of capital gains and collection of land taxes clearly benefit land speculators and large landowners. An effective system of tax collection for speculative capital gains and of land taxes, as proposed in this paper, will raise economic efficiency, protect the environment and improve social equity. Part of the revenues raised by these taxes can be used to finance education and other social programs for the benefit of the rural poor.

Public credit programs in many countries are heavily biased in favor of large producers. In many instances, subsidized credit is used to convert forests into pastures for livestock and to expand production of land-intensive crops (Heath and Binswanger, 1996). Most of these activities do not demand much labor, causing the displacement of the local population into more marginal lands and greater poverty. The elimination of credit subsidies will also have a positive impact on economic activity, social equity and the environment.

Some of the recommendations provided in the previous sections, however, do not necessarily improve social equity. Policies to increase protection of private land holdings against squatters may affect the ability of poor people to acquire land. These obviously favor the largest land properties (which are the ones most vulnerable to encroachment by squatters), leading to a worsening of income distribution at least in the short-run. On the other hand, improving land rights for small farmers and increased protection of forest lands owned by native communities are consistent with improved social equity.

International Agreements and the Forest Sector in Latin America

Some of the most important international agreements affecting Latin American forests are the Convention on Climate Change (CCC), the Convention on Biodiversity (CBD) and the Convention on International Trade of Endangered Species (CITES).²⁹ The goal of the CCC is a reduction in CO₂ emissions and other greenhouse gases to the levels prevailing in 1990. Most of the other goals are qualitative, including the agreement to monitor emissions by country, the use of national programs to mitigate climatic changes, promote scientific research and develop more efficient technologies to reduce emissions, and the promotion of educational and public awareness programs. The CCC also recommends increasing the transfer of financial and technological resources from the North to the South to assist in reducing emissions. Additionally, the CCC recommends that aid to the developing countries that are most vulnerable to climatic changes be increased to cover the costs of mitigating those changes.

The CCC has spearheaded efforts to mitigate potential climatic changes in a more or less coordinated worldwide scale. At the same time, it has established some important principles and mechanisms to reduce greenhouse emissions. It has furthered the notion that the North, being by far the main source of emissions, should take the lead in reducing emissions.

In light of this paper's analysis, it is evident that the CCC has serious drawbacks that need to be corrected. In the first place, while it rightly emphasizes the importance of international cooperation, it fails to promote trade in carbon emissions be-

tween countries in the North and the South. By setting targets to reduce emissions in the North without explicitly allowing for trade in carbon emissions, the cost of reaching the main goals can become too burdensome. This, in turn, could cause the North to fall short of the agreed goals. As discussed earlier, there is a considerable potential for reducing world carbon emissions by reducing deforestation in the South. The cost would be only a fraction of the cost of emission reductions in the North. Since about 25 percent of annual CO₂ emissions in the world are due to forest destruction, it is clear that reducing this can make an important contribution to the achievement of the CCC's main goal. Thus the CCC should be amended to explicitly allow countries in the North to obtain credits for carbon reduction programs that they finance in the South.

A second problem of the CCC agreement is the lack of specific quantitative goals for the transference of the required financial and technological resources from the North to the South. Clearly, the establishment of mechanisms such as the GEF and others are important steps in the right direction. However, the financial resources transferred through these mechanisms are little more than just a token contribution when compared to the overall needs. Detailed studies are needed to determine specific quantitative goals for North-South financial resource transfers according to the opportunities for low-cost greenhouse emission reductions in the countries of the South.

The CBD establishes a framework for the preservation and exploitation of biodiversity that combines conservation and economic objectives in a coherent way. Another CBD objective is the fair and equitable sharing of genetic resources. It promotes the development of national strategies and recommends the integration of conservation

²⁹ Other agreements, such as ITT (International Tropical Timber Agreements) have been ratified by a relatively limited number of Latin American countries.

and the sustainable use of genetic resources into national programs and policies. The Convention on Biodiversity establishes that each country will provide adequate identification and monitoring of biological resources. It also recommends the establishment of more protected areas and increased research and transfer of technologies. Financial transfers from developed to developing countries are guided by the incremental cost principle. However, in practice it is very difficult to separate incremental global costs and benefits from the national costs and benefits of biodiversity conservation and biomass increases.

The Global Environment Fund has been, in large part, geared to biodiversity objectives. The fact that reforestation and improved forest protection are now incorporated into GEF projects should facilitate the achievement of biodiversity conservation. The relatively limited scope of GEF projects vis-à-vis existing needs creates serious problems despite recent budget increases.

The fact that CITES now covers endangered tree species makes it directly relevant to the forest sector in Latin America. The CITES is intended to regulate and restrict international trade in species threatened with extinction. Several timber species have been placed on a list of species that could become threatened and trade in them is being regulated. There are currently several initiatives to restrict trade in mahogany and other species that are important components of the timber extraction industry in Latin America.

In general, the impact of timber trade restrictions on deforestation is difficult to quantify. The

problem is that the alternative to logging is not only conservation but also forest conversion to agriculture, entailing the intensive use of forest burning. Timber is usually extracted from areas that have become accessible as a result of the construction of roads and other infrastructure. In the absence of strong protection, accessible forests are either exploited for timber (sustainably, or more often, unsustainably) or are cleared and burned for agriculture. A reduction in the demand for timber brought about by trade restrictions may, under certain conditions, cause greater deforestation by burning as the value of timber products declines.

In certain cases, however, logging and conversion to agriculture may be complementary activities rather than substitutes as implicitly assumed in the previous paragraph. Logging expands road networks into forests facilitating access to large farmers and slash-and-burn cultivators. Therefore, a reduction in the profitability of logging caused by trade restrictions would, in fact, reduce road building and, hence, also forest conversion to agriculture. Furthermore, government road construction can be highly responsive to commercial logging interests so that trade restrictions could reduce incentives to building roads into forested areas, leading to a decline in both logging and forest conversion.

The issue of whether or not logging and forest conversion are substitute or complementary activities is of crucial importance to understand the consequences of both international and domestic restrictions on trade. Empirical studies of this issue should be promoted.

Suggestions for IDB

Policy Support and Program Financing

The IDB should lead the development of an international framework to promote trade in carbon emissions at a scale that can make a real difference in reducing deforestation. This is by far the most important action for the IDB that arises from this study. The Bank, in conjunction with other international organizations as well as with individual countries, should promote international institutions that facilitate the expansion of initiatives such as the Joint Implementation and the GEF. By so doing the potential gains from trade in carbon emissions may be fully realized. This can only be achieved by setting carbon emission quotas by country with the specific condition that such quotas can be freely traded both nationally and internationally.

Much research is needed to establish an operational framework for international trade in carbon emissions. It is important to value the opportunity cost of forest lands at a fairly detailed level by region; it is also urgent to determine the forest areas that would qualify for joint implementation agreements and, also, to determine the most effective means to allow for transfers of financial and technological resources to the South. Additionally, it is critical to establish the systematic monitoring of forests designated for conservation or for sustainable management as well as of reforestation efforts. It is also important to understand the impact of tropical timber export restrictions on the rates of deforestation and reforestation. These are just examples of high priority research that is urgently needed. The IDB should take the lead in promoting these studies in the region and contribute to their financing.

The successful implementation of structural adjustment in most countries has shown that pressure from multilateral banks is important in convincing

governments to enact policies that raise economic efficiency. The fact that many of the policies suggested in this paper may be politically difficult to implement should not discourage the Bank from proposing them. In particular, the enactment of measures that contribute to improving efficiency, raising financial resources that can be used to promote forest sustainability and increasing social equity should be avidly pursued. Capital gains taxes on land and other land taxes, adequate user fees for environmental services and the diligent collection of stumpage fees and royalties are policies that, if adequately designed, can lead to gains in the three fronts mentioned. The Bank should decidedly promote these policies and assist governments in implementing them. The Bank should also encourage the earmarking of part of the revenue raised so that it can remain in the areas where it was collected to be used to strengthen the policy design, implementation and monitoring capacities of the forest departments of local governments.

Concomitantly, the IDB should promote the involvement of local governments, communities and private sector organizations in the collection of revenues and in monitoring and enforcement. It should continue to fund projects implemented by local agencies, including local governments, NGOs and the private sector. Particular emphasis should be placed on local initiatives to internalize forest-related externalities. Finally, the Bank should continue supporting projects that improve land demarcation as well as the clarification, legalization and enforcement of land property rights. The provision of legal land rights and enforcement against illegal occupation or expropriation is very important to reduce the use of deforestation as a means to protect land rights.

Conclusion

In many respects, the forest sector in Latin America is caught in the worst of two worlds. Tropical forests are being lost very rapidly in an anarchic process of forest burning. Moreover, the forest sector is highly inefficient. It produces only marginal economic benefits to the region and large gains to the world as a whole in terms of carbon sequestration and biodiversity.

Industrialized countries are reluctant to commit resources to forest protection in a decisive way and content themselves with token contributions. The scattered projects that they support, by and large, are ineffective to reduce forest losses because they lack scope and are misguided. At the same time, the Latin American countries are not able to develop a program to exploit forest resources more intensively in order to increase the sector's economic contribution. The forest policies of Latin American governments are contradictory. They are unable to openly recognize that their objective is to exploit forest resources for the economic benefit of their nations. At the same time that they enact legislation to "protect" forests they invest heavily

in expanding roads and other infrastructure into forest areas and implement policies that promote a more intensive exploitation of forests. There is increasing recognition that this situation cannot continue, particularly given the successful completion of structural adjustment in most countries. The forest sector in Latin America is at a crossroads. The time has come to make an unequivocal decision regarding policy aims.

In this paper we have discussed the main features of an international agreement to protect most of the remaining forests. We have also shown that, just considering the value of carbon sequestration, the preservation of the tropical forest is an extremely profitable enterprise for the world, generating net annual benefits (after fully compensating the countries of Latin America for the opportunity cost of their forests) of the order of 0.2 percent of world GNP or about \$70 billion. If the value of preserving biodiversity is also included, the net benefits for the world are likely to be much greater.

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