

DEFORESTATION AND PROPERTY RIGHTS
IN LATIN AMERICA

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ABSTRACT

This paper analyzes the property rights/deforestation linkage in Latin America. It recognizes that tenure issues have an effect on land clearing pressures in two areas. The first deals with the security of individual property rights on established agricultural lands and its effects on agricultural production and employment. The second involves alternative tenure types and their impact on land clearing in forest areas.

Excessive deforestation has been taking place in tropical areas of Latin America for the past several decades. Among the causes of accelerated deforestation are population and income growth, extensive logging, expanding agricultural growth patterns and lagging agricultural yields. Government policies have also contributed to accelerating deforestation, by adopting measures to increase the profitability of agriculture in forested areas, constructing roads in frontier areas and adopting patterns of agricultural growth favoring large-scale mechanized production and low employment generation.

According to economic theory, improving tenure security in established agricultural areas should increase productivity, labor use, and the efficiency of land market transactions. Recent empirical evidence in Honduras, Paraguay and Brazil has confirmed that access to a secure title increases access to credit and promotes on-farm investments. Therefore, strengthening property rights is an important element in a strategy of agricultural intensification and employment generation. It will reduce demographic pressures on forest resources as well as the demand for additional agricultural output. However, increased tenure security must be complemented by removing those policy biases that facilitate land concentration and the under-utilization of productive lands.

Tenure issues play an important role in the complex dynamics associated with excessive forest clearing in frontier areas. Although empirical evidence is still scant, recent studies in Brazil and Guatemala suggest that establishing formal individual property rights does not seem to reduce land clearing rates. This is explained by the greater private profitability of agricultural and ranching activities. Hence, alternative property regimes in forested areas are necessary to discourage forest removal.

State ownership of forested areas is only a partial solution to the problem since most Latin American governments at present do not have the means to fully enforce property rights over all public forest lands. In long-inhabited areas with a low population density and cohesive communities, common property regimes have been shown to be an efficient method of managing forest resources. However, these regimes may not be appropriate for active frontier areas, where new tenure modalities must be designed to discourage expanding settlements. Governments should consider granting restricted property rights to private agents and NGOs who display the capacity to safeguard forests. Lower land taxes and favorable income tax treatment for those who preserve forests may also help protect these resources.

Property rights policies alone cannot be the central element of a strategy to reduce deforestation pressures at the frontier. Regardless of tenure policies, forest clearing is likely to persist if settled

areas do not offer sufficient employment opportunities to potential migrants. Also, deforestation trends will endure if government policies continue to support land clearing by granting *ex post* property rights to settlers and increasing the private profitability of alternative, unsustainable land uses.

Governments in the region should adopt a policy agenda to diminish excessive deforestation rates. Zoning and land use planning policies need to establish which lands are suitable for agricultural use and which are better left under forests or other uses. The institutions that support property rights must be strengthened. For settled agricultural areas, individual property rights should be issued to stimulate agricultural intensification. Governments need to grant individual property rights to untitled agricultural lands, eliminate barriers to land sales and land rentals, and suppress regulations that introduce risks to hiring rural labor.

In addition, complementary policies are required to promote a more efficient pattern of land use and greater employment in agricultural activities. These measures include:

- a) modifying macroeconomic and sectoral policies that stimulate inefficient land uses;
- b) reforming labor market provisions to promote a more intensive use of human resources in agriculture;
- c) promoting appropriate credit sources for poor farmers;
- d) redirecting public investment in infrastructure;
- e) promoting research and extension for the benefit of smallholding sectors; and
- f) adopting complementary measures to increase employment generation in both urban and rural settings in non-agricultural activities.

In forested areas, tenure policies also have an important role to play in reducing deforestation pressures. Governments need to implement several reforms, such as eliminating the practice of requiring proof of land clearing in order to obtain legal title or credit, ending support of formal and informal colonization efforts in areas without agricultural potential, defending and enforcing protected areas, and designing creative tenure arrangements to preserve forest lands. Among the latter, priority should be given to strengthening formal property rights among indigenous and other traditional communities, granting logging concessions in favor of local forest dwellers, and establishing restricted private property rights over forest areas that cannot be appropriately safeguarded under public ownership. In addition, governments should promote pilot efforts to enact local land taxes with higher rates for pasture and crop lands than for forest uses.

No single factor alone will halt the deforestation currently occurring in the region. However, a combination of reforms and policy changes — including the alteration of present land tenure practices — will reduce the excessive rate of forest clearing. It remains for the governments of Latin America to act on policy recommendations to face the complex challenge before them.

INTRODUCTION

There is increasing support for the notion that current rates of deforestation in Latin America are excessive. There is less agreement about the role that property rights over land play in the processes that lead to excessive deforestation. In some interpretations, ill-defined rights are largely accountable for poor resource management in the region. In others, property rights issues have a secondary influence on the rapid pace of deforestation.

This paper analyzes the property rights/deforestation linkage in Latin America. The analysis recognizes two separate areas where tenure issues have an effect on land clearing pressures. The first deals with the security of individual property rights on established agricultural lands and their effects on agricultural production and employment. The second involves tenurial arrangements on forested areas and their impact on the sustainable management of resources.

The analysis concludes that strengthening property rights should be an important part of a strategy to reduce deforestation rates in the region. However, it also suggests that tenurial reforms are not a solution by themselves to prevent excessive land clearing. Property rights measures need to be accompanied by complementary actions, including the elimination of ill-conceived government policies (macroeconomic and sectoral) that encourage an extensive pattern of agricultural growth and that subsidize the settlement of forested areas.

This paper is divided into four chapters. The first chapter discusses deforestation trends in Latin America and their relationship to property rights issues. The second explores the linkage between deforestation pressures and the strengthening of individual land tenure on established agricultural areas. The third chapter analyzes property rights issues on forested areas and the fourth presents some policy recommendations.

CHAPTER I

DEFORESTATION AND PROPERTY RIGHTS

A. *Deforestation in Latin America*

Deforestation of tropical forests is not just a Latin American phenomenon. The tropical forest area cleared each year in the region during the 1980s was about 7.4 million hectares (according to FAO data), almost as much as the annual deforested area of Asia and Africa combined. Within Latin America, most of the deforestation — over 85% — takes place in the Amazon Basin of South America. However, the highest *rates* of deforestation are reported in Mexico and Central America, where relatively few remaining primary forests remain. Table 1 clearly shows how much faster the forests are disappearing in Mexico and Central America than in the rest of the region.

Table 1 - Deforestation Rates in Latin America

Region	Number of Countries	Land Area in millions ha.	1980 Forest Cover (millions ha.)	1990 Forest Cover (millions ha.)	1981-1990 Annual deforest. (millions ha.)	% per annum deforestation
Central Am. and Mexico	7	239.6	79.2	68.1	1.1	1.5
Caribbean	19	69.0	48.3	47.1	0.1	0.3
Tropical South America	7	1,341.6	864.6	802.9	6.2	0.7
Total	33	4,778.3	1,910.4	1,756.3	15.4	0.8

(Source: FAO, 1993)

Deforestation has been largely credited to the expansion of crop land and permanent pasture. Since 1980, most of the expansion of agricultural land uses in the region has been at the expense of tropical forests, leading many observers to the conclusion that the driving force behind Latin American deforestation is the expansion of agricultural and grazing lands. Harvesting trees for fuel wood — a major cause of deforestation in other tropical areas of the world — is only a secondary contributor to deforestation rates in Latin America.

Although precise measurements are lacking, not all deforestation has negative impacts for the region (López, 1997). A percentage of recent land clearing activities has been taking place on areas where soils can sustain agricultural activities. According to FAO, there are still areas that offer agricultural

potential in the Brazilian Cerrado, the plains between Colombia and Venezuela, and sub-tropical regions of the Bolivian and Paraguayan Chaco. However, deforestation is increasingly a phenomenon that involves lands with particularly poor soils that are inadequate for sustained agricultural activities or, in the case of steep hillsides, result in erosion and downstream sedimentation. In these areas, deforestation is likely to be socially unprofitable, although it may seem attractive to private farmers with low opportunity costs and high discount rates.

According to soil studies in Latin America, a large proportion of areas in agricultural crops and pasture is actually suitable only for forestry uses (Kishor and Constantino, 1993). However, land capability criteria do not necessarily conform to economic considerations. It is quite possible that some lands that have adequate soils for forestry may yield higher private and social returns if used in agricultural activities. Nonetheless, in all countries of the region — with the notable exception of Cuba — land use decisions are overwhelmingly made by private agents. As a consequence, externalities associated with land use are generally not considered.

It is widely reported that clear-cutting of forest lands for alternative land uses can impose significant costs to the national economy. Such costs include increased erosion and land degradation, sedimentation of water sources, and reduced revenues from non-timber products and services of the forest, including eco-tourism. Deforestation can also impose costs that impinge on populations outside of the country, such as reduced carbon sequestration services, and lower existence and option values. Thus, there is a significant discrepancy between social and private profitability of land use which suggests that current deforestation rates are probably above socially optimal levels (López, 1997). Barbier and Burgess (1997) suggest that “excessive” deforestation has been taking place in tropical areas due to the failure to take into account the full opportunity cost — including environmental benefits — of forest conversion.

The aim of this study is to discuss the possible beneficial effects of property rights policies on current deforestation rates. The analysis focuses exclusively on “excess” deforestation and not on forest clearing of lands suitable for alternative land uses.

B. *Causes of deforestation*

The causes of the rapid pace of deforestation in Latin America are complex. Recent empirical analyses detect a significant relationship among a number of important factors. With data from 24 countries in the region, Southgate (1990) finds that the expansion of agricultural land in Latin America between 1982 and 1987 is related to population growth, agricultural export growth, and changes in agricultural yields.³ Cropper and Griffiths (1994) find that annual deforestation rates in Latin America, Asia and Africa are related to per capita income and border-equivalent prices of tropical logs for a

³ Southgate also includes a ‘land constraint’ dummy variable to capture differences between countries where there is still abundant land for conversion to agricultural uses and those where primary forests have nearly disappeared.

pooled cross-section time-series sample covering 1961 to 1988. Barbier (1997) finds that the change in forest cover between 1980 and 1985 in 21 Latin American countries is closely related to per capita industrial roundwood production, agricultural yields and rural population density.

The detected relationship between demographic pressures and deforestation reflects both a demand for income-earning opportunities by poor migrants as well as an indirect growing demand for food production by increasing populations. Deforestation pressures stemming from this growing demand for agricultural goods can also come from outside, as demonstrated by the relationship with agricultural export growth. For example, expanding commercial soybean production has been a major factor in deforestation in Brazil, Bolivia and Paraguay. The association with rural population density suggests that deforestation pressures are greater in those areas where land resources are already intensively exploited.

The relationship between deforestation and income is more problematic. The results of Cropper and Griffiths (1994) suggest an inverted-U shaped relationship, with the level of per capita income at which deforestation peaks being US \$5,420. Results among the Honduran indigenous Tawahka communities confirm the inverted-U relationship at much lower income levels (Godoy et al., 1997). This suggests that beyond a threshold, income seems to reduce forest clearance. This may be due to the effect of agricultural intensification, the pursuit of non-farm occupations, and migration. However, the inverted-U relation may also be due to other factors, such as regulatory capacity and positive income elasticity of the demand for conservation. There is also a wealth of micro evidence suggesting that there is a positive yet complex association between rural poverty levels and resource degradation (Reardon and Vosti, 1995; López, 1997a).

In most Latin American countries the value of domestic forest utilization is still low. Hence, the empirical link between deforestation and logging activities is probably more indicative of the process of making remote forest areas accessible for agriculture through road building. Studies have confirmed the strong link between road construction and deforestation in several countries of the region (Chomitz and Gray, 1996; Alston et al., 1995; Mahar and Schneider, 1994). The rugged terrain and high cost of building roads in Bolivia has been used to explain the relatively low rate of deforestation in that country (Kaimowitz, 1996).

The studies by Barbier (1997) and Southgate (1990a) find a negative correlation between agricultural yields and deforestation rates. This indicates that there is a strong link between productivity performance in long-established agricultural areas and pressures on the frontier. A technologically dynamic agricultural sector probably offsets the demand to bring new land into production and also provides more employment to the rural population, thus reducing the pool of migrants to the frontier. In some cases, this linkage is related to government efforts to provide research and extension to farmers, as well as adequate property rights arrangements and institutions in established agricultural areas. Both of these factors are critical ingredients in determining productivity growth rates and, indirectly, on providing job opportunities to the rural population (Southgate, 1990).

While demographic pressures, road building, income growth and agricultural yields seem to be the critical variables in explaining aggregate deforestation rates, differences in land clearing processes have been detected in different areas of Latin America. At least two general patterns can be discerned. On the one hand, a pattern has been identified in Central America where the bulk of forest clearing over the last three decades has been motivated by the expansion of pastures for large commercial livestock operations (Kaimowitz, 1996). On the other hand, deforestation in a large share of the Amazon frontier seems to be driven by demographic pressures spearheaded by low-income shifting cultivators (Barbier, 1997; Kaimowitz, 1996). This pattern is most obvious in countries like Colombia, Ecuador and Peru where migrants from rural areas are responsible for the bulk of forest clearing. In Brazil, the pattern is mixed. Most areas have been cleared by rural migrants searching for livelihoods on the frontier. However, a substantial share sell cleared plots to ranchers and move on to clear new lands further into the frontier (Mueller, 1997; Alston et al., 1995; Schneider, 1995).

A number of government policies are also often cited as contributing to accelerating deforestation. In particular, policies that increase the profitability of agricultural activities in the frontier are frequently blamed for inducing inefficient land use. These cleared areas typically have soils incapable of sustaining agricultural exploitation for extended periods. Generally, the government policies include credit, input and marketing subsidies, road construction and other transport subsidies, tax incentives, and price supports through tariff and non-tariff protection for selected crops (Binswanger, 1991; Barbier, 1997).

Less attention has been given to the link between deforestation and government policies that affect the exploitation of long established agricultural lands. For some analysts, the key to reducing pressure on natural forests lies in promoting the intensification of crop and livestock production away from the frontier (Southgate and Whitaker, 1992; de Janvry and García, 1992; Barbier, 1997).

In most countries in Latin America, development strategies have altered the relative prices of crops and inputs in an attempt to favor a pattern of agricultural modernization that emphasizes large mechanized production (Grindle, 1986). Protected crops have usually been those produced on large-scale mechanized farms, and they receive the bulk of the benefits from government-funded research and extension efforts (de Janvry et al., 1997). Credit subsidies, low tariffs and overvalued exchange rates have lowered the relative price of farm machinery and induced early replacement of traditional labor-intensive methods in the past.

Policies to provide workers with social security benefits and wages comparable to urban levels have discouraged the use of manual labor in rural sectors. The risks associated with hiring labor for agricultural activities include such legal provisions as giving special tenure benefits to tenants and agricultural laborers. In many countries, the high implicit costs of hiring labor and the availability of non-productive benefits from holding land — i.e., credit subsidies, inflation hedge, tax advantages, potential capital gains from urban expansion, etc. — have also promoted holding a substantial share of agricultural lands in low productivity activities, such as extensive cattle-ranching (Binswanger et al., 1995).

Agricultural growth patterns in most Latin American countries have not been friendly to the interests of the smallholder sector, despite the fact that smallholders account for the bulk of agricultural employment. Output and yield increases in the modern farming sector have absorbed few additional labor resources, accelerating the outflow of inhabitants from the countryside. This has contributed to the premature growth of urban centers and to the occupation of fragile lands. As a consequence, eliminating poverty and excess labor in rural areas has been a slow process in most countries in the region. This pattern contrasts sharply with the labor-intensive agricultural growth of the Southeast Asian economies.

C. ***Property rights and deforestation***

Recent advances in the study of tenure issues suggest that property rights evolve in response to complex demographic and social trends. In the early stages of development, when agricultural lands are abundant and productivity is low, shifting cultivation is the predominant mode of production (Boserup, 1965). Diffuse property rights prevail, due to the low value of land resources (Feder and Feeney, 1991). However, as the population grows relative to the surrounding natural resources and agriculture becomes a more profitable activity, communities increasingly formalize rules of access to such resources. These rules resolve competing claims and facilitate the investments required to intensify production (Demsetz, 1967). Failure to develop successful property rights institutions and higher productivity levels may lead to land degradation through mining the soil fertility and organic matter, and through encroachment of cropping onto steep hillsides, forest margins and other fragile areas. The prevailing regime in developed countries illustrates the successful development of property rights institutions in the face of high population pressure, technological change and greater opportunities for agricultural commercialization (Barbier, 1997).

While appropriate property rights institutions may develop naturally in some societies, it is not clear that this is true in all cases (Otsuka et al., 1996). Anthropological evidence suggests that customary resource management institutions may be an effective means of managing common resources, including forests (Ostrom, 1990). However, these institutions may collapse under pressure from outside forces (i.e., strong migratory flows), leading to open access and rapid degradation of common resources (Binswanger et al., 1995; Rudel, 1995; Southgate, 1990). In such cases, the difficulties in organizing sufficient collective action to manage common property, policy failures, and legal restrictions may all inhibit the necessary institutional responses (Otsuka, et al., 1996). Thus, policy interventions may be needed to prevent wasteful environmental use.

Many analysts have argued that tenurial problems and, in particular, the absence of well-defined property rights are among the key causes of rapid deforestation in Latin America. Analytically, it is useful to distinguish the effects of tenure problems in long established agricultural lands from those faced in forested frontier areas (although in reality it is more of a continuum than a clear-cut distinction). In the former, the insecurity of property rights prevents farmers from increasing their land use intensity. Investment, output and employment levels are lower than with full property rights. In addition, property markets do not effectively transfer land to the most efficient users. The risks of

expropriation associated with land reform laws make labor hiring and tenancy contracts risky. These factors depress employment generation in agriculture and accentuate the effects of other policies which favor labor-saving large-scale agricultural activities. This trend inevitably results in greater outflows of labor from agriculture into urban and frontier areas (Heath and Binswanger, 1996).

In frontier areas, where lands not suitable for sustained agriculture prevail, tenurial uncertainty also promotes deforestation. The key tenure problem in these areas is the open access character of public forested lands. For the most part, the governments of Latin American countries do not have the ability to enforce their property rights since the costs of enforcing them have been prohibitive due to the sheer size of available public lands in relation to the funds available to governments. Further, colonization of public lands has provided an escape valve to brewing social tensions in other areas, particularly in the face of strong migratory flows of laborers without employment opportunities in traditional rural or urban settings. In many cases, geopolitical interests have often encouraged the colonization of previously unoccupied areas, as in the Brazilian Amazon and Guatemala's Petén.

These migrants are attracted to the frontier because they can gain access to land and establish their rights by clearing the forest. In these areas, deforestation is a practical method to increase tenure security (Southgate, 1990a; Kaimowitz, 1996). Forest clearing followed by attempts at cropping or livestock production increases the likelihood of rudimentary commerce flows and further migration, which may eventually attract a government presence and a significant increase in the price of land (Mueller et al., 1994).

Aside from the open access of public lands, Latin American governments typically induce deforestation in the frontier with other tenure-related policies. On public lands, removal of the forest cover has traditionally been a requirement for titling. This has been documented to be a major factor in frontier agricultural conversion in Costa Rica, Ecuador, Honduras, Panama and other Latin American countries (Kaimowitz, 1995; Peuker, 1992; Mahar and Schneider, 1994; Southgate and Whitaker, 1992). In recent years, a greater awareness of the deleterious effects of the land clearing requirement has led to its elimination in several countries of the region. However, even where it has been formally removed, it continues to be required in practice, possibly reflecting the absence of alternative, low-cost methods to assign individual rights in newly settled areas.

On lands with formal property rights held by individuals, some deforestation has been shown to be encouraged by a variety of government policies. In some cases, forest removal is promoted by laws which threaten "idle" lands with expropriation or with higher land taxes. The rapid removal of forests in Paraguay in recent years has been attributed to this phenomenon (López and Ocaña, 1994). In other cases, legal provisions that require payment for land "improvements" (i.e., removal of trees) have motivated squatters to clear forests in private lands. Such inducements have been at work recently in Nicaragua (Kaimowitz, 1995). In some countries, deforestation is encouraged by policies that separate ownership of land from forest resources (known as "*vuelo*"), particularly when trees are legally owned by governments. In such cases, lack of enforcement capacity makes forests on private lands an open access resource.

In summary, tenure problems are among the key causes of rapid deforestation in Latin America. Tenure insecurity in agricultural lands prevents a more rational and labor-intensive use of lands that could reduce migratory pressures to the frontier. In frontier areas, the inability of governments to enforce their property rights, and other misguided policies, promote removing the forest cover.

CHAPTER II

PROPERTY RIGHTS TO AGRICULTURAL LANDS

Recent advances in the study of the evolution of tenure systems suggest that the establishment of formal individual rights is a critical step on the road to agricultural intensification (Binswanger et al., 1995; Otsuka et al., 1996; Feder and Feeney, 1991). While most countries in Latin America have cadastral and registry institutions designed to fulfill these needs, informal and uncertain property rights are still prevalent in many areas of the region (Jaramillo, 1997). It is estimated that less than 50% of farmers in the region have legal title over their lands (López and Valdés, 1997).

This chapter argues that a well functioning system for assigning and enforcing formal property rights in settled agricultural lands is a critical element in any strategy to reduce deforestation pressures in Latin America. Simply put, if farmers have access to secure property, this should facilitate agricultural intensification and employment generation in settled areas which will then reduce demographic pressures on forest resources as well as reduce the demand for additional agricultural output.

This analysis looks at the expected effects of extending secure property rights to farmers who lack them. It proposes that a greater security of ownership should increase productivity, labor use, and the efficiency of land market transactions. Secure property rights are therefore a necessary element in a strategy of agricultural intensification and employment generation. These should also be complemented with measures to spur labor demand in rural areas and urban demand in other sectors. However, increased tenure security must be preceded by removing policy biases to forestall further land concentration and the under-utilization of productive lands.

A. *Productivity*

Generally, secure individual property rights over land induces an exertion of higher levels of labor and management effort and higher levels of investment to protect or enhance land fertility (Feder and Feeney, 1991). Theoretical models developed by Feder et al., (1988) illustrate that increased security of tenure is expected to enhance the productivity of farmers through at least two channels. One is the “intensification effect” which reflects the effects of land tenure security on the incentives to invest, particularly in capital goods attached to land. If there is a positive probability that the current operator may not be allowed to reap the long-term benefits of current investments, investments levels are reduced in comparison with a situation of secure property. Although intensification in established agricultural areas can reduce deforestation by tying up labor and/or capital, similar intensification in frontier areas may have the opposite effect as it will make agriculture more profitable on new lands and thus promote further agricultural expansion.

The second way to increase farming productivity through tenure is to increase allocative efficiency by relaxing of the credit constraints typically faced by farmers without title. With limited access to

credit, farmers allocate inputs under quantitative constraints. With secure title as collateral, these constraints are eliminated and farmers can borrow freely to increase their application of inputs to profit-maximizing levels.

Productivity may also increase through more indirect channels. Secure rights will induce a more rational use of the natural resources associated with the land — such as water and trees — as farmers take into account their long-term benefits. Of course, this does not mean that no tree removal will occur since there may be alternative activities that yield a higher private return. Greater tenure security also reduces the costs of defending uncertain rights, allowing more time and resources for productive activities.

Despite the prevalence of tenure insecurity in many areas of the Latin American countryside, few studies have looked empirically into the actual consequences of increasing the security of property rights for farmers. An early study by Strasma and Barbosa (1984) concluded that farmers with title in the Brazilian state of Maranhao earned significantly higher income than squatters. A more detailed empirical study was carried out by Feder et al., (1988) for Thailand, and found that a secure title increased productivity mainly through greater access to credit. However, studies by Seligson and Nesman (1989) and Stanfield and Nesman (1990) about the effects of USAID-financed land titling projects in Honduras yielded ambiguous results; they provided no clear support for a relationship between land title and productivity or farm income.

Recent studies in Paraguay by Carter and Olinto (1996), in Honduras by López (1996) and in Brazil by Alston, Libecap and Schneider (1996) confirm that land tenure security is an important factor affecting farmers' use of variable purchased inputs and their level of land-attached investments (see Box 1). These studies also make a valuable methodological contribution by recognizing that simple correlations between tenure status and production are likely to exaggerate titling effects, since other household characteristics (e.g., education, income, assets, soil quality, etc.) may be responsible for the greater productivity of certain segments of farmers. Results from the three countries confirm that the productivity/titling link is strong enough to correct for other possible causes of higher productivity. However, the studies for Honduras and Paraguay find that only a minority of farmers can take effective advantage of the effects of greater tenure security through credit access, since most poor smallholders do not have access to formal credit regardless of tenure status.

Aside from the constraints imposed by a limited access to credit, assigning formal property rights to farmers may not lead to increased productivity in some Latin American contexts. Formal title may not actually increase tenure security when the institutions that guarantee and enforce property rights — i.e., the cadastre, registry, judicial and police systems — do not work effectively. This is particularly true in remote areas where there is little presence from government agencies. Furthermore, many titling efforts exhibit design flaws that reduce their effectiveness. A key issue has been the high cost of the titling procedures. When these costs are borne by the beneficiaries, many small farmers are excluded from the process. Even when governments have subsidized the majority of expenses, net costs per title tend to be high, calling into the question the wisdom of the investment from a social standpoint (Wachter and English, 1992). In some large titling projects, formal title has

been granted to farmers without their inscription in public registries. In some particular cases, pre-existing informal institutions — such as common property schemes of close-knit communities — may have already granted sufficient tenure security, so that issuing formal titles has little effect on behavior patterns.⁴

BOX 1: The Effects of Land Titling in Honduras and Paraguay

Economic theory suggests that land tenure security should enhance the productivity and income of farmers. However, empirical confirmation of this simple hypothesis has proven elusive in the Latin American context. The few studies available until recently looked at differences in means or simple correlations which tend to overestimate the relationship, since the effect of omitted household characteristics (e.g., education, income, or assets) may be responsible both for greater tenure security and higher levels of productivity among certain segments of farmers.

Researchers have taken advantage of the availability of large farm household surveys in Honduras (López, 1996) and Paraguay (Carter and Olinto, 1996). In the case of Honduras, a detailed farm household survey of a subset of beneficiary farmers of a USAID-financed titling project was conducted in the departments of Santa Barbara and Comayagua in 1983-85. A control group of farmers that were not to receive legal titles were also surveyed. In 1994, a subsample of 450 of the same farmers surveyed in 1983-85 was carried out. This permitted a comparison of the performance of farmers that received titles with those that did not receive them. Similarly, in Paraguay a sample of 300 farm households was interviewed in 1991 and in 1994.

The panel structure of the survey data makes it possible to identify the impact of land tenure regimes stripped of the influence of latent farm and farmer characteristics (e.g., land quality and farming skill) which may be correlated with tenure regimes. It also permits disaggregation of the impact of titling into its two main effects: security-induced investment demand and collateral-induced credit supply.

Findings from both countries confirm that land title appears to significantly affect farming productivity. A pattern is revealed in which land title both enhances the demand for investment in capital goods attached to land and improves access to credit. In both Honduras and Paraguay, most of the income effect is derived from the greater access to credit. The investment demand effect is weaker and concentrated in land-attached capital goods.

In Honduras, the average household income of farmers that received titles increased by about \$100 per year, reflecting an increase in per capita income of 5%. As a result, it appears that investing public funds to provide land titles, even without targeting populations most likely to obtain credit, can yield a high rate of return of at least 17% (López, 1996).

However, in both countries title only enhances a formal credit supply for those farmers that satisfy a minimum level of education and a minimum land area (about 20 hectares). Only this group benefits from titling. Consequently, governments need to adopt complementary policies that broaden access to capital markets to prevent an inegalitarian distribution of the benefits from titling

⁴ More discussion and some examples of tenure security and customary institutions appears in Rudel (1995) and Ostrom (1990).

B. **Labor**

Establishing firm and secure tenure rights to land in most Latin American countries would require eliminating legal provisions that threaten farmers with expropriation when they have tenants on their land. Tenants have benefitted in the past from “land to the tiller” provisions that attempted to redistribute land away from large *hacienda* owners. However, traditional *haciendas* have mostly disappeared while these provisions have remained on the books. This situation has subsequently resulted in denying a means of access to land for many of the rural poor, promoting an under-utilization of lands, and fostering an adoption of productive technologies favoring non-labor inputs. Eliminating these provisions would reduce the perceived risks from renting out land and alter production activities in favor of labor. Naturally, these effects would be greatest well within the agricultural frontier, since at the frontier labor is scarce and more labor extensive practices may be justified.

Many Latin American countries facing high rural population growth need to adopt a strategy to promote labor-intensive growth in agriculture. The suppression of tenure-related risks to hiring labor and renting land could be an important ingredient of such a strategy. In addition, generating more rural jobs may be possible with complementary policies that focus on developing smallholder agriculture. This would include reforming the minimum wage and social security regulations that exert perverse employment effects. In the absence of effective land reform policies, access to land could be provided through rental agreements to segments of the rural landless population, a mechanism which has been shown to offer opportunities for social ascent in some East Asian countries (Otsuka, 1993) as well as in the Brazilian Amazon (Lena, 1991).

C. **Land markets**

A well-functioning land market should facilitate transactions between land owners with high marginal productivity and those with low marginal productivity (Feder and Feeney, 1991). This requires property rights that are universally recognized and fully tradable. However, with few exceptions, land markets across Latin America display serious inefficiencies (Jaramillo, 1997). Land markets in the region tend to be informal, reflecting the widespread absence of formal property documents and institutions. Markets also tend to reflect transactions between members of limited communities, as informality aggravates problems of unequal information between seller and buyer. In this setting, theory suggests that the price of land often does not reflect its true social value and the extent of land transactions is thus less than optimal (Feder and Feeney, 1991). The inadequate functioning of land markets contributes to explaining the persistence of underutilized agricultural lands in many Latin American countries (Jaramillo, 1997).

Developing an effective system for assigning and enforcing secure property rights to land would aid in formalizing land market transactions and reduce inefficiencies and transaction costs. Most importantly, by facilitating the exit of low productivity farmers and the entry of potentially higher productivity farmers, it would promote a more intensive use of land and labor resources in settled

areas which could lower incentives for deforestation in the frontier. The best example of a dynamic formal land market in the region is Chile. Strong institutions in that country guarantee land tenure rights and the result is a dynamic sales and rental market for agricultural land that has led to an intense use of land resources and the absorption of rural labor surpluses (Muñoz, 1993).

Increasing the effectiveness of property rights systems to encourage formal land markets poses some inherent risks. Under the still prevalent regime of selective government support for certain influential farming groups, increased transactions may lead to greater land and income concentration (de Janvry et al, 1997). Also, if tax exemptions, high inflation and other non-productive benefits of holding land continue to prevail, more land transactions could actually lead to a greater share of agricultural land devoted to low productivity activities. Thus, it seems essential to remove policy biases and reduce benefits for holding unproductive lands. This would be the only way to ensure that a more active and formal land market can induce more effective land usage, greater employment generation and diminished pressure on natural forests.

Despite the benefits described above, policies that guarantee a more efficient and neutral operation of land markets may face substantial barriers. More dynamic and formal land markets still confront many natural and government-induced costs relating to the search and registration of transactions (Jaramillo, 1997). In addition, policies that favor medium and large-scale mechanized farmers have proven difficult to eliminate, even after the implementation of liberal reforms since the late 1980s (de Janvry et al, 1997). Perhaps most difficult may be the elimination of benefits for holding unproductive lands, since strong political interests will oppose the removal of favorable tax and credit programs.

D. *Complementary policies*

Increased tenure security can be an important element in any strategy to promote a more intensive and sustainable pattern of agricultural development. However, other measures are also important in such a strategy. Most importantly, policy biases which have served in the past to promote patterns of growth based on labor-saving technologies must be eliminated. These include selective protection and tax measures, research and extension, credit and marketing subsidies and artificially low prices for inputs, including machinery. These policies have traditionally benefitted only large mechanized farmers. In a new strategy, the removal of these policies must be complemented with promoting smallholding sectors to encourage a pattern of agricultural growth with intensive labor. Policies should include the promotion of credit sources for small farmers, the suppression of labor market regulations that artificially increase the cost of hiring rural labor, and the redirection of public investment into infrastructure, research and extension for the benefit of smallholders.

A more difficult issue to deal with is whether substantial resources should be used to promote farming at or near the frontier by populations of recent migrants. There are several reasons why this is likely to be an inappropriate use of public resources. First, scant public funds for research, extension and other services should be oriented towards those areas with high population density where they are likely to have a greater impact. Second, investments in recently settled lands tends to increase land values and attract more migrants to the forest (López, 1994). Third, frontier areas are characterized

by a low labor-to-land ratio that requires technologies that are less labor intensive than in other areas. Finally, development of technologies appropriate for marginal agricultural lands is likely to induce deforestation in areas more apt for forest uses. Therefore, research and extension efforts should have a greater social payoff if they are directed at developing technologies that improve the profitability of more intensive production systems. Such efforts should reduce deforestation pressures (Kaimowitz and Angelsen, 1997).

E. **Summary**

Stronger individual property rights in settled agricultural areas is a necessary element in a strategy to intensify agriculture and reduce pressures on forest resources in Latin America. Increased productivity, lower costs of hiring labor and an increased efficiency of land markets should promote employment opportunities and reduce demand for additional agricultural lands.

However, policy makers should note that land tenure policies are not likely to be enough in achieving these results. To ensure favorable effects, increased tenure security must be preceded by the removal of policy biases that facilitate land concentration and under-utilization. Furthermore, measures should be adopted to spur employment generation in both urban and rural settings in non-agricultural activities. Governments must take care to avoid promoting labor-saving (mechanized) agricultural intensification, as this may displace laborers and encourage out-migration into forested areas.

CHAPTER III

PROPERTY RIGHTS TO FORESTED LANDS

The analysis of property rights to forested lands with little potential for sustained agriculture is more complex than in settled agricultural areas. In these areas, private and social values about removing forest cover may differ greatly and some of the damages caused may be irreversible.⁵ Agents responsible for forest clearing do not perceive the bulk of the negative effects caused by deforestation, such as, for example, diminished carbon sequestration and downstream sedimentation effects. In the absence of any first best interventions to enable settlers to internalize these values, granting individual property rights to forested lands may not be the most appropriate way to maximize social welfare.

The complexity of property rights issues on the frontier is compounded by the lack of empirical evidence on how settlers behave under different tenure regimes on forested areas. This is partially explained by the high costs of reaching target populations in remote areas. Many of the critical research questions require expensive studies to determine how forest clearing patterns of settlers respond over time to different tenurial regimes as well as to other variables. Until more definitive research is conducted, conclusions about the impact of property rights on natural resource use must be treated as tentative.

Despite the above reservations, this chapter argues that tenure issues loom large in motivating forest clearing in frontier areas. However, the available evidence suggests that unrestricted individual property rights seem ineffective in preventing massive clearing of forests at the frontier. Hence, a policy of indiscriminate privatization of forests is unlikely to arrest deforestation trends. Keeping forests under alternative property regimes, including state, common property and restricted individual private property, may be better options for governments in the region. However, effective methods to prevent forest destruction on lands held under these property regimes must be devised.

A. *Unrestricted individual property rights to forest lands*

Proponents of individual property rights in forested frontier areas argue that secure tenure arrangements should induce a more rational rate of exploitation of natural resources and a reduction in deforestation rates.⁶ According to this viewpoint, there are several reasons that justify this conclusion. First, individual property rights to lands of differing agricultural potential should lead settlers to concentrate productive efforts where they are most likely to be most profitable and sustainable in the long-term. Second, settlers with secure long-term rights should be more likely to

⁵ Farming activities can also occasion substantial external damages such as siltation and leakage of harmful chemicals.

⁶ See, for example, Southgate and Whitaker (1992).

keep standing forests because they are certain to capture future income streams derived from the exploitation of forest products and services. They will also bear the costs of local long-term damages from forest clearing. Third, once they obtain secure formal title, settlers do not need to continue to clear land to enforce their informal property claims. These arguments have been formalized in a model by Mendelsohn (1994), according to which increasing certainty about property rights should reduce deforestation rates.⁷

There are various reasons why these motivations are likely to be insufficient to significantly slow down deforestation in the Latin American context.⁸ First, migratory flows to the frontiers continue to be large and, in many areas, demand for land far surpasses the amount suitable for long-term agricultural exploitation. This is reflected in the growing share of deforestation that is taking place in areas with easily degradable soils. In addition, prior knowledge by settlers or government officials about the quality of soils and their long-term potential for agriculture is often incomplete.

Second, the bulk of the settlers in frontier areas are usually poor and exhibit high discount rates. Therefore, they are not likely to value the long-term private benefits of keeping forests intact. Even the local long-term costs of removing trees is likely to be of little concern to people with high discount rates.

Third, the available evidence suggests that the timber and non-timber values of the standing forest yields low private profitability compared to alternatives associated with removing the forest cover (Southgate, 1997). A detailed comparison of alternative land uses in Costa Rica showed that under most realistic scenarios, clearing forests for agriculture and livestock activities is more profitable for private farmers (Kishor and Constantino, 1993). This conclusion seems to be also valid in most frontier areas of the Amazon basin. A corollary to this point is that settlers may be more likely to deforest their land in favor of cattle pasture if they are secure in their ownership and can count on making a livelihood through livestock in the long-term. Conversely, an insecure tenure situation may actually prevent deforestation, since most settlers would not convert forest to pasture if they thought they would lose access to the land in a relatively short time period.

Fourth, while removing the forest cover does play an important role in strengthening a settler's claim over a given land area, it also achieves other important goals. Demonstrating that the land can be used in the short-run for agricultural and livestock activities increases the likelihood that other settlers will populate the region. This, in turn, promotes greater commercial flows that will reduce marketing costs and justify public and private investments in transport infrastructure. Roads are often followed by the presence of government institutions, including those dedicated to securing property rights to land, as well as a larger pool of potential investors interested in land investments (Schneider, 1995).

⁷ A recent model by Otsuki (1997) demonstrates that increasing tenure security on forested lands may not lead to diminished deforestation if there are strong migratory pressures and weak land rights institutions.

⁸ The discussion of some of these arguments is drawn from Kelly (1996).

This cycle of increasing integration of remote areas into the formal economy offers the potential for land price appreciation and significant capital gains for initial settlers (Mueller et al., 1994; Mueller, 1997). Sales of land can occur at different stages of this cycle (Lena, 1991; Alston et al., 1996). Revenues from these sales can be used by settlers as starting capital for new migration ventures, to intensify agricultural production in remaining lands, or to purchase livestock (Lena, 1991; Schneider, 1995). Hence, the purpose of forest clearing usually goes beyond increasing tenure security.

Finally, even if secure property rights could reduce deforestation incentives, it is not clear that in most forested frontier areas of Latin America, governments have the capacity to assign and enforce these rights at a reasonable cost. It is likely that in many forested areas the costs of titling programs and establishing enforcement institutions would be large in relation to the social benefits. These investments become profitable only when population densities and the economic activity in a zone reach a certain level that can justify establishing a government presence and initiating formal tenure security measures.

Existing accounts of the deforestation/colonization cycle in the Brazilian Amazon do not indicate that deforestation rates fall when government agencies move in to clarify and establish definitive property rights (Alston, et al., 1996; Schneider, 1995; Mueller et al., 1994; Mueller, 1997; Lena, 1991). Typically, forests are gradually removed to plant food crops and sell valuable timber products. Eventually, falling fertility leads to converting crop land to pastures for livestock. Whether property rights are secure from the beginning of the cycle, as in government-sponsored colonization schemes, or only in the later stages, when most of the land has been converted to pasture, incentives for removing the tree cover seem to continue even after the issue of land title.

At least three reasons explain this phenomenon. First, the income-generating possibilities offered by standing forests are usually limited, especially once the most valuable logs are removed. Second, cleared land in frontier areas is almost always worth more than forested land (Mueller et al., 1994; Paveri, 1997). Third, activities like establishing pastures and raising cattle are often more attractive to settlers (de Janvry and García, 1992). As market links are developed, demand for grazing lands increases and offers settlers the possibility of obtaining large capital gains. Further, in areas with limited access to capital markets, investing in livestock is a practical method of accumulating savings and providing insurance for future emergencies. Among the production alternatives at the frontier, cattle are attractive because their sale price tends to be more stable than that of other crops, and ranching reduces the agronomic risks of production. Besides, livestock can “transport itself” to market, an important advantage in areas with poor infrastructure. Compared to most other income-earning alternatives, cattle raising requires little labor and keeps the land “occupied,” and safe from expropriation or payment of high land taxes. In addition, government policies in several countries — including Brazil, Ecuador and some Central American nations — have often supported cattle raising with cheap credit and other fiscal incentives (Binswanger, 1991).

There is little empirical evidence linking deforestation to individual property rights and other variables at the microlevel in Latin American countries. One of the few empirical clues to the influence of property rights on deforestation patterns at the frontier is offered by an ongoing research project

managed by members of the International Food Policy Research Institute (IFPRI) in the Brazilian Amazon. The project administered a detailed survey in 1994 and 1996 to 150 small to medium-scale households in two colonization projects in two states of the western Brazilian Amazon (Acre and Rondonia).⁹ Sites were selected so as to include areas of varying soil quality, access to infrastructure, and time since initial settlement of the plots. IFPRI researchers estimated systems of Tobit regressions¹⁰ to explain changes in land use, i.e., forest removal, planting annual and perennial crops, and establishing pastures.

Preliminary results suggest that greater tenure security is not associated with diminished deforestation activities. On the contrary, the data indicate that definitive title holders removed significantly more forest than did those without title (Witcover and Vosti, 1997).¹¹ Of course, the results need to be interpreted with care since they are only preliminary and it is still unclear whether they can be extended to other areas.¹² However, these results confirm recent findings from an alternative source in six sites in the state of Pará (Brazil), where no significant effect of land title on clearing was detected.¹³

The evidence from Brazil is contradicted by a recent study among Tawahka communities of eastern Honduras by Godoy et al., (1997) (see Box 2). This study uses econometric methods to explain clearing of old-growth rainforest in 1995. The authors use residence duration as a proxy for strength of property rights. The results show that the longer households have lived in a village, the less likely they are to clear old-growth forest, in part because they have more secure rights to their land. By contrast, new residents have to clear more land to open up farming areas and establish land rights. In addition, households that were able to borrow — usually a sign of access to formal title to land — cut less primary forest than households that did not obtain credit. Unfortunately, the results of the study are not conclusive due to the absence of explicit tenure information.

A recent study of land management issues in Guatemala qualitatively reviews the effects of property rights institutions on resource use (World Bank, 1995) (see Box 3). The authors conclude that excessive forest clearing is a problem found in all tenure types, including public, private and cooperative. The study finds that economic and social pressures yield stronger incentives for forest exploitation and conversion than incentives induced by tenure. In an environment where short-term returns to agriculture are high, strong individual property rights do not seem to affect the rate of destruction of natural forests.

⁹ The questionnaire of the 1994 survey appears in Witcover and Vosti (1996) and the preliminary results in Witcover et al., (1996).

¹⁰ SURE was used to take into account the simultaneity of land use decisions.

¹¹ Holders of definitive titles also exhibited a tendency to place more of their already cleared land into pasture, at the expense of annual and perennial crops (Witcover and Vosti, 1997).

¹² IFPRI researchers are still refining the analysis of tenure categories and attempting to obtain price and soil quality information which could also be important determinants of deforestation patterns.

¹³ Findings of research conducted by Lee Alston, Gary Libecap and Robert Schneider as reported in Pfaff (1997).

BOX 2: Land tenure regimes and deforestation in the Petén, Guatemala

A recent World Bank study (1995) set out to explore the impact of land tenure regimes on forest exploitation in the Petén region of Guatemala, an area where forest removal has been occurring at a rate of about 1.5% per year. It is estimated that in the mid-nineties, over 60% of the Petén's area had been deforested as a result of a rapid immigration of slash and burn farmers, extensive ranchers, commercial loggers and the establishment of road infrastructure by the government and oil companies.

The study found four major tenure regimes in the Petén: public, municipal (or "*ejidal*"), cooperative and private. On national lands, which cover 76% of the Petén's land area, there is a de facto open access situation due to the government's minimal control over resource users under its ownership. Municipal *ejidos* were created to serve as areas to concentrate agriculture and settlements so that the rest of the Petén could be set aside for forest cover. However, *ejidos* have faced the same management problems as national lands, since municipalities exercise little control over *ejido* land. The few *ejidos* that have remaining forest areas are left uncontrolled and unmanaged, and illegal extractions and land clearing take place frequently.

Farming cooperatives were set up in the 1960s and 1970s with the support of the government under a policy to settle the Petén. However, the cooperatives have remained isolated, with little access to roads or agricultural and social services. This lack of significant development has driven them to exploit valuable timber products. Loggers have channeled most of these products out of cooperative lands, greatly benefitting from the cooperatives' lack of knowledge about the precious wood market. Remaining forests under cooperative control are in danger because financial returns from agriculture and forest clearing are higher than the returns from long term forest management.

Private property in the Petén is characterized by ranching by elites and farming by poor migrants. Both groups exhibit an excessive removal of the forest cover because returns from agriculture are higher than returns from forest management. Also, protecting valuable timber is costly for both groups, as the government is unable to control timber poaching and the costs of private policing are high.

The World Bank study concludes that regardless of the tenure regime in place, economic conditions provide a stronger incentive for forest exploitation and conversion than incentives induced by secure tenure. The study points out three major reasons that explain excessive deforestation for all tenure modalities: (1) the returns from agriculture and natural timber harvesting are higher than sustainable forest management; (2) settlers have high discount rates; and (3) the inhabitants of the Petén lack knowledge about sustainable resource use.

In addition to the evidence reviewed, studies from across the region suggest that public policies have contributed to weakening the effects of formal private property on sustainable forest use. Traditional policies that required land clearing to obtain title have been strong promoters of deforestation. For owners holding titles, land and income taxes have promoted productive uses and discouraged forest protection. In addition, providing cheap credit, marketing subsidies and road construction have all increased the profitability of agriculture and ranching activities. To make matters worse, policies establishing that trees (i.e., "*vuelo*") are public resources standing on private lands have encouraged excessive forest exploitation. Such policies have artificially reduced private efforts to manage forests

sustainably while inducing rapid conversion to uses that are often less valuable from a social standpoint.

More empirical research needs to be conducted before the deforestation/property rights linkage is properly understood. However, preliminary findings suggest that assigning individual property rights does not seem to provide an easy solution to the problem of excessive deforestation.

BOX 3: Determinants of deforestation by Indigenous communities in Honduras

A recent study among the Tawahka, an indigenous community of the Honduran rainforest, examines the household determinants of decisions to cut old-growth forest. The Tawahka live in five settlements along the Patuca river in eastern Honduras, living off of swidden cultivation and intensive agriculture along river banks. They plant a variety of products including cacao, beans, bananas, plantains, maize and rice.

The study is based on a survey conducted in 1995 among 101 households, 88% of the total Tawahka population. In the year of the survey, 49% of Tawahka households cut old-growth forests to plant crops. Forests were primarily cleared for rice cultivation, a crop used mainly for subsistence need. Usually, less than 10% of the crop is marketed.

The information collected suggests that households of cutters and non-cutters display a similar household size of seven members. Cutters obtained a higher share of their income from farming activities and exhibited a shorter residence duration in their villages. Households that did not remove forest cover had more education, earned a higher share of their income from non-farm jobs and borrowed more from outsiders.

A Tobit model was employed to explain the area of old-growth rain forest removed per household. Results indicated that residence duration (an indicator of more long-standing rights of property to land) lowers forest clearance. The longer households have lived in a village, the less likely they are to clear forest, probably because they have more secure usufruct rights to their land. However, the lack of information on whether households formally owned their plots does not allow drawing firm conclusions about the relationship between property rights and deforestation.

The results also confirmed the existence of an inverted-U relation between income and deforestation. Higher levels of education and wealth are associated with lower forest clearing activities. In addition, greater crop yields and access to credit lowered deforestation rates. The results indicate that wealthier households have greater access to credit, technical assistance and off-farm work. Thus, policy interventions to increase educational levels and access to agricultural services (e.g., extension and credit) are likely to reduce deforestation pressures.

B. ***Public property of forest lands***

If privatizing forest lands is not the best strategy to reduce the rate of forest cover removal, alternative tenure regimes to individual private property need to be explored. An obvious alternative is to keep forested lands under public control. Examples of public forests that are well managed can be found in countries such as Canada, where 90% of forested lands are publically owned, and in Europe, where at least 40% is public. What these countries have done is privatize the silvicultural activities in their forests rather than the land ownership. Thus, forest management and exploitation is contracted out by the State to private companies, NGOs or community groups and supervised by State institutions. Although the past performance of Latin American states in protecting their property interests in forests has not been encouraging, there is some progress in this direction, as witnessed by the new Forestry Law in Mexico that grants forest protection to private concessions (Paaveri, 1997).

Forests under public ownership have been traditionally managed under two broad regimes. First, governments have designated protected areas, banning all private use of forest resources. Second, limited and temporary user rights have been assigned to other agents. This is the case of timber concessions, where grants are made to private parties for the primary purpose of extracting logging resources. This is also the case of extractive reserves, in which user rights are granted to specific communities to primarily use the non-timber products of the standing forest. Another alternative has been implementation of forest management projects involving NGOs, local communities and public agencies.

Protected areas

Protected areas (such as parks and natural reserves) are usually managed by government agencies. Theoretically, establishing a protected forest area is the most secure way to arrest deforestation where social and biological values are high. In practice, however, the success rate of Latin American governments in safeguarding protected areas is poor. Encroachment of parks and reserves has been documented in many countries (López, 1994) and the continued invasion of many protected areas has been fueled by the lack of alternative sources of livelihood for migrating families. Often, parks and reserves occupy vast territories that cannot be adequately guarded by agencies with inadequate human and financial resources. The absence of effective enforcement for protected areas may be leading to perverse results, since illegal settlers who have no possibility of acquiring legal title have greater incentives to mine natural resources.

Recent experience suggests that protected forests can best be managed when agencies limit protected areas to those that can actually be policed with available funds. While a case can be made for expanding the funds dedicated for protection of sensitive areas, most Latin American governments face severe fiscal pressures that make it unlikely that substantial increases will be forthcoming in the short term.

Nevertheless, some success in increasing the effectiveness of protection efforts has been found in developing buffer zones around parks. These zones can be used by local communities to obtain non-timber products and services. In some cases, enforcement costs have been reduced by sharing responsibilities with governments and organizations at the local level. However, involvement of local populations in management of protected areas is not appropriate in all cases. A recent World Bank evaluation concluded that successful involvement of local interests in forestry and conservation management can be difficult when (a) conflicts over forest resources are particularly intense, (b) forest resources are abundant relative to a small dispersed population in the forest vicinity, (c) powerful interests at the national level are opposed to policy reform or to decentralization of authority and (d) extreme social inequalities at the local level reinforce the control of forest benefits by local elites (Banerjee et al., 1995).

Logging concessions

An alternative method to managing forest lands is to grant leases to private concessionaires for the exploitation of logging and other resources during a specified period of time. It is frequently argued that if leases are given for a sufficiently long period of time, then the management of forest resources should incorporate long-term considerations and promote a more rational use of timber and non-timber products and services (Panayotou, 1989). In addition, where they have been implemented, logging concessions have usually been granted along with a management plan to exploit the forest in a sustainable fashion, allowing for forest regeneration. However, these plans have been criticized because they focus too narrowly on promoting the growth of timber products, while ignoring the intricate interrelationships between flora, fauna and other resources that govern the growth of tropical forests (Berry, 1995).

The experience with large-scale logging concessions in Latin America is mixed. Many cases of destructive logging have been documented, as concession holders have found little resistance to ignoring management plans. Poor results are attributed to short-term leases, poor government supervision, corruption and lack of technical knowledge about the best possible logging practices (Panayotou, 1989; Berry, 1995; Motta, 1992). Even in those countries where long-term concessions have been granted, institutional instability and the fear that logging permits may be revoked have led to a short-sighted mode of exploitation (World Bank, 1995).

In most instances, regeneration activities and sustainable practices are ignored because they impose short-term costs to logging concerns while promising uncertain private benefits. The political power of the logging industry has often thwarted attempts at enforcing strict regulations, as illustrated in the cases of Guatemala (World Bank, 1995) and Bolivia (Hardner and Rice, 1997). In countries where strict requirements have been imposed, as in Colombia, loggers have opted to evade excessive costs by exploiting forests illegally (Berry, 1995). In some cases, concessions have been granted without consulting the traditional forest-dwelling communities living in those areas and some lands have even been doubly titled to both the local dwellers and the concessionaires, causing severe conflicts (Paveri, 1997).

Logging concessions have been blamed for accelerating deforestation. In most cases, access roads built by the logging companies have facilitated the penetration of slash and burn farmers into previously unreachable areas. Concession holders often do not have the capacity and/or the interest to stem the flow of settlers (World Bank, 1995).

New approaches to logging concessions are needed to eliminate their deleterious effects on forest resources. In many countries, this may require declaring a moratorium on issuing new concessions until institutions are strengthened and a better understanding is gained of the complex dynamics of tropical forest growth. A new concessions strategy should also include a greater involvement by local dwellers. They are often more effective managers and protectors of the forests, as has been recently shown in the case of concessions run by Pizano S.A. in Colombia (see Hardner and Rice, 1997).

Extractive reserves

In recent years, the establishment of extractive reserves has received support from NGOs and governments interested in promoting sustainable forestry. The idea that local communities can obtain significant income-earning opportunities was bolstered by estimates of the value of non-timber products in the Peruvian Amazon (Peters et al., 1989) as well as growing interest in eco-tourism. As a result, public forest lands in Latin America have increasingly been managed by specific communities who are granted user rights.¹⁴ Extractive rights have been also allowed in buffer zones around protected areas in Integrated Conservation/Development Projects (ICDPs) (Wells and Brandon, 1993). Proponents of these schemes argue that they involve local communities in managing the forest for the long-term, thus increasing their incentives to stave off outsiders.

Recent reviews of the experience with extractive reserves reveal a number of problems. These arrangements have often failed because of the continued low value of virtually all non-timber forest products and services (Southgate, 1997). This is not surprising given that the optimistic valuation of non-timber products and services by Peter et al., (1989) did not take into account the price impacts that would result if there were a major increase in extractive activity (Southgate and Clark, 1993). In addition, few sites offer any real potential for tourism development. For example, the extractive reserves created by the “Seringueiros” of Brazil, and carried on by the Pilot Program for the Protection of Brazil’s Tropical Forests in 1992, have faced difficulties because of the diminishing market value of traditional forest products such as latex and Brazil nuts, as well as difficulties in organizing a dispersed population with little cooperation experience (Hardner and Rice, 1997). A further problem is that the users’ rights are limited to extracting non-timber products, which are generally of lower value in the marketplace. If these rights were extended to extracting timber products (under a good forestry management plan), such reserves might be more successful (Paveri, 1997).

¹⁴ However, transferring legal use rights to forest dwellers and local communities simply recognizes the rights of these de facto users.

Placing a value on the region's forest products and services is a much needed endeavor that has only recently gained the attention it deserves. Social and environmental values are extremely important but it is generally the economic incentives that will determine whether an area is deforested or not. When a standing forest can compete economically with agricultural or grazing uses, it is more likely to be preserved because it will be equally or higher valued. Whether its products are timber, non-timber, aesthetic, biological, social or environmental, a recognized value assigned to these would encourage forest preservation. There need to be strategies, policies and instruments that promote such valuation and support those who recognize it on their properties, be they public, private or communal. Owners would be less likely to deforest their properties if their forest products had a recognized economic value that could compete with other potential uses (Paveri, 1997).

Sustainable forest management

Joint attempts to sustainably manage forests for wood and other products by NGOs, local communities and governments have often fallen short of their stated goals. Dourojeanni (1997) reviews a sample of attempts at forest management for wood production in Latin America and concludes that the majority have failed. These failures seem primarily to be a result of a lack of economic profitability, pressures by settlers for land, and poor administrative management in state-run forests.

C. *Alternative tenure arrangements*

Frustration with the disappointing results of managing forest lands as public property suggests that governments should explore alternative tenurial arrangements. Possible alternatives include securing common property rights as well as establishing the legal framework to allow for restricted individual rights. New tenure regimes should be designed for specific situations and adapted to changing conditions (Foster and Stanfield, 1993).

Common property

Neoclassical economists have long opposed arrangements that give groups communal property rights to agricultural lands. The argument goes that without clear individual rights, production and work incentives are diffuse and individuals tend to exert a less than optimal work effort. However, recent research suggests that these arguments do not extend to managing common resources — such as forest lands — where conservation motives are also important.

Recent evidence on the success of traditional and indigenous arrangements for the management of natural resources have demonstrated that individual rights are not always superior to common

property rights¹⁵ (Quiggin, 1993). Common property rights are efficient when they allow members to capture economies of scale or scope that would not be possible with individual rights (Quiggin, 1993; Chopra and Gulati, 1997). López (1997a) argues that in certain circumstances, a shift from common property to private property may lead to large environmental and efficiency losses. Chopra and Gulati (1997) have recently found in India that a decrease in land under common property regimes accelerates environmental degradation and causes a migration from rural to urban areas. Recent research efforts have focused on determining under what circumstances common property rights can be an efficient institutional arrangement. According to Ostrom (1990), conditions are best in small and stable communities, where individuals interact repeatedly to pursue the collective interest. In these settings, cooperation in the management of common resources is likely, particularly if individuals exhibit a strong concern for the future and possess the autonomy to create and enforce their own rules. Quiggin (1993) argues that common property management is efficient when performed by cohesive groups, characterized by family ties, traditions of mutual assistance, and an absence of sharp disparities in wealth.

Common property regimes have been shown to work well in preserving forests and other common resources in some long-established communities in Latin America (Foster and Stanfield, 1993). This may partly reflect the greater knowledge and awareness researchers have of the importance to indigenous groups of forest land for environmental maintenance (Rudel and Horowitz, 1993). A well known case is that of the Kuna Yala indigenous reserve in Panama. A strong political organization and favorable legal treatment have kept about 80 percent of the territory in largely undisturbed primary forest (IUCN, 1996). In eastern Ecuador, between 70 and 90 percent of the primary forest cover has been kept intact in lands held under traditional customary rights without legal titles, mostly because of the success of community management regimes and the absence of settler pressure (Rudel, 1995).

Despite the success of some communities in managing forests as common resources, these regimes have been shown to be fragile to disturbances from outside (de Janvry and García, 1992). Rapid population growth, greater integration into the market economy and technological changes may weaken common property institutions and lead to open-access regimes. This is illustrated by the case of the Amerindian reserves created in Northwestern Brazil in the 1980s under the *Polonoroeste* projects. Protection against squatters and illegal logging and mining has failed because of the high profits that outsiders can obtain from these activities and the difficulties associated with guarding vast areas (Wachter, 1992).

Common property regimes for managing forest resources seem to work best in areas facing low migratory pressures and where such an administration reaffirms the long-standing customary rights of access and forest use by local communities. In such areas, governments should strengthen these regimes by providing formal rights, assisting with border demarcation, and preventing encroachment from outsiders. In many countries, this requires recognizing land claims of indigenous and other

¹⁵ Common property is defined as the exclusive joint ownership and use of resources, and the prevention of outsiders from using those resources.

ethnic communities. Governments must also realize that “formal” tenure rights may be less “secure” than already established “informal” tenure rights in traditional communities. In other words, titling programs that promote “formal” tenure may actually increase insecurity by undermining the security provided by existing informal systems. In addition, it should be recognized that such institutional arrangements may not be best suited to the conditions of an active frontier.

Restricted individual rights

Recent proposals designed to address unsustainable resource use have included the development of new tenure modes that allow restrictions on private property (Bowles et al, 1996; Atmella, 1995). Restrictions usually refer to how the natural resources in the titled area can be managed. Restricted individual rights may be useful to protect forests in lands both currently held by private parties and those still under state control.

In lands currently held by the private sector, new legal instruments are being designed to promote a more sustainable use of natural resources. These instruments include easements and conservation agreements. Easements facilitate the establishment of permanent restrictions on resource use on private lands. Such restrictions are often recorded in a public registry. However, easements still allow proprietors to retain ownership of their land and the right to use it for certain purposes. In Costa Rica, easements have been used in recent years to preserve patches of forest on private lands (Atmella, 1995). Nevertheless, despite their effectiveness, establishing easements requires certain conditions that are not always easy to meet.

Conservation agreements are temporary binding agreements that restrict the use of resources. Usually, such an agreement commits the owner to managing his land according to specific terms in exchange for periodic payments. It should also be recognized that some legal instruments, like easements, are derived from the common law system, and may not necessarily be possible under civil law applications without modifications in the national legislation (Bowles et al, 1996). As with easements, conservation agreements require effective monitoring and enforcement mechanisms, in addition to the funding necessary to make payments to owners.

In forest lands held by the state, deforestation is, to a great extent, a result of the race by many competitors — i.e., poor migrants, ranchers, loggers, and land speculators — for rights of access (López, 1997). On such lands, a strategy of granting restricted private rights may help to halt this race and allow a more sustainable use of forests. Such a strategy could involve a pre-emptive privatization of public forest lands. This would establish certain restrictions on resource use as well as create strong legal provisions to prevent encroachers from obtaining rights to these lands.

In order to implement a process of privatizing public forest lands, governments would need to classify such areas into at least two broad groups. The first would comprise lands with agricultural potential — these would be transferred to farmers without resource use restrictions. The second group should include forested lands without agricultural potential, and would be transferred to private agents with

restrictions to safeguard the forests. Governments should keep under public management some tracts that exhibit particularly high social or biological values.

Public lands with agricultural potential could be auctioned off in large tracts to the highest bidder. Such a measure would maximize government revenues from privatization, although it may exert a negative impact on the poor by effectively barring access to new lands for migrants. On the other hand, distributing such lands to poor settlers may have a positive equity effect and diminish pressure on remaining forest lands. In either case, the agricultural potential of land that has already been cleared should be maximized before committing new lands to deforestation, whether in public or private hands.

Lands without agricultural potential may be transferred to private interests under new property arrangements to ensure that the forests will be protected. However, legal instruments must be in place to guarantee that holders of restricted property rights can be made liable if they renege on their promise to manage forests or sell off to logging, ranching or mining interests. A promising possibility is to favor agents that are interested in keeping standing forests, such as NGOs or communities that live off of forest resources. Transferring restricted property rights to such organizations may work better than public ownership in cases where community associations or NGOs can more efficiently police forest borders. However, in many cases it is likely that they will need to seek funding from national and international sources to enforce their rights.

Another possible way to facilitate protecting forests in private lands is to grant long-term leases with provisions that allow only limited extractive uses. Long contract periods would ensure that leaseholders would value long-term benefits and promote sustainable use. The use of leases with clear forest management provisions would strengthen their enforcement by government agencies. The success of private efforts to sustainably manage forests would hinge to a great extent on the strength of migration pressures. If the latter remain unabated, it is unlikely that even the most committed NGOs can keep settlers off their land. Therefore, measures to transfer rights to private and non-profit interests need to be complemented with policies that create income and employment opportunities elsewhere. This may be partly achieved by transferring to poor populations those remaining public lands that have agricultural potential.

Finally, governments have within their power to legislate how rural and forested lands are to be used. For example, Brazil has a law that obligates rural land owners to maintain 20% to 80% of their land in natural vegetation, with the percentage varying according to the region (Dourojeanni, 1997). Most if not all of the region's current forestry laws include restrictions on tree cutting and require permits for any type of forest use. These laws apply to both public and private owners. However, despite such restrictions, the laws have not inhibited (and in many cases appear to be the cause of) more deforestation (Paveri, 1997).

Complementary tax measures

A variety of tax-related measures may be used as a complement to promote sustainable resource use. Alternative land uses may be promoted or discouraged with a scheme of land taxes favoring forests. For example, areas under natural forests could be subjected to low land taxes while those used for pasture or agricultural uses could be taxed at higher rates. In addition, easements and conservation agreements could be promoted by granting lower tax rates or land valuations to any areas committed to these regimes.

There are several practical difficulties with proposals to diminish deforestation incentives based on land tax policies. First, in order to be implemented they require the operation of an effective land tax, a feature that is still absent in most Latin American countries. The development of land taxes in the region has been hampered by both political opposition from landed interests and by high administrative costs (Jaramillo, 1997). Second, varying tax rates according to land use requires strong monitoring institutions which are generally lacking in the region. Third, application of such taxes require a fundamental change in the philosophy and legal framework of traditional land use policy in Latin America, which has favored productive activities and discourages 'unproductive' use.

Other tax policies that may be used to discourage deforestation are income tax deductions for donations of land for conservation uses (Bowles et al., 1996). Tax deductions can also be implemented for expenses incurred in protecting forests from destruction. Furthermore, income derived from sustainable forest use could be exempted from taxation. Central governments should also consider increasing the allocation of fiscal budgets to municipalities that make significant efforts to directly protect forests or by enacting local incentives for the private sector.

D. Conclusion

The experiences reviewed in this chapter suggests that establishing unrestricted individual property rights in frontier areas does not guarantee a better use of forest resources nor an end to deforestation pressures. The empirical evidence currently available does not allow solid generalizations about the link between deforestation and property rights, but micro evidence from Brazil and Guatemala indicates that establishing clear rights does not reduce land clearing activities. This seems to be fundamentally explained by the superior private profitability of alternative productive activities. Hence, alternative property regimes in forested areas seem to be necessary to discourage excessive removal of trees.

For the most part, Latin American governments do not, at present, have the means to enforce property rights to public forest lands. In long-established areas with a low population density and cohesive communities, common property regimes may be an efficient method of managing forest resources. However, these are not appropriate for active frontier areas, where new tenure regimes must be designed to discourage the expansion of settlements. A possibility is to transfer restricted property rights to private agents or NGOs. Selection of these agents may be made on the basis of

their capacity to preserve forest resources, including access to funding for safeguarding forest resources. Lower land taxes and favorable income tax treatment can also help induce more sustainable forest use.

Property rights policies alone cannot be the central element of a strategy to reduce deforestation pressures. Regardless of tenure policies, forest clearing is likely to persist if settled areas do not offer sufficient employment opportunities to potential migrants. Furthermore, deforestation trends will endure if government policies continue supporting land clearing by granting *ex post* property rights to settlers and increasing the private profitability of alternative, unsustainable land uses.

CHAPTER IV

POLICY RECOMMENDATIONS

The arguments developed in this document indicate that efforts to provide secure property rights should be an important part of any policies designed to reduce the pace of deforestation in Latin America. Granting more secure property rights should (a) increase the intensity of use of current agricultural land and generate more employment opportunities in settled areas, and (b) contribute to a more economically rational use of forest resources in frontier areas. The analysis presented here suggests that securing individual property rights is likely to be more important in settled agricultural areas. In forested areas, common property regimes and the design of restricted property rights institutions should facilitate sustainable management of forest resources by private parties.

The success of new tenure regimes in forested areas will hinge on reducing migratory flows from established rural and urban areas. Hence, tenure reforms alone are not likely to be sufficient to deal with deforestation problems in Latin America. Measures to strengthen property rights need to be accompanied by complementary policies. Most importantly, traditional macroeconomic and sectoral policies that have encouraged an extensive, unsustainable pattern of agricultural growth must be eliminated. In addition, policies that induce the settlement of areas better left under forest cover must be revised. Such policies have generally facilitated colonization (as in the case with road building) or encouraged unsustainable settlement (as in *ex post* titling, credit and marketing subsidies).

This chapter presents policy recommendations about property rights regimes aimed at reducing deforestation pressures. The recommendations are grouped into three categories. The first category presents more general policies that would affect all forested areas. The second group includes policies only dealing with land in established agricultural areas. The third category addresses policy recommendations just for forested and frontier lands.

A. ***Policies for all lands***

Latin American governments must establish clear zoning and land use planning policies designed to establish which lands are suitable for agricultural use and which are better left under forests or other uses (López, 1994). This requires completing comprehensive mapping and soil quality studies. In those countries where such soil and land use plans have already been drawn up, these need to be activated and used in decision making about land use. Making zoning and land quality information widely available may also serve to shift deforestation to undeveloped areas that have greater agricultural potential or to forests of lesser biological and social value. Land use conflicts may be reduced if planning precedes colonization and resource use activities. Zoning efforts may also facilitate planning decisions about the property right regimes allowed on each type of land. However, to be effective, zoning policies must be accompanied by effective instruments to implement them.

Most countries in Latin America must undertake efforts to strengthen government institutions that support property rights. In particular, the technical strengthening of cadastral and registry agencies needs to be urgently undertaken. Each country will have to adopt new regulations according to whether its political system is federal or unitary, but the end result will be the same. Only when these institutions are working sufficiently well will property rights have the effects derived from theory.

B. *Policies for agricultural areas*

In settled agricultural areas, two types of policies are important for reducing deforestation pressures elsewhere. First, tenurial policies are critical to strengthening individual property rights and stimulating agricultural intensification. Second, complementary policies are required to promote a more efficient pattern of land use and greater employment in agricultural activities. However, removing policy biases should precede efforts to strengthen property rights, in order to increase the likelihood that property rights measures have their intended effect.

Tenure policies that could contribute to reducing excessive land clearing include the following:

- (1) Promote the establishment of individual property rights over untitled agricultural lands. Efforts should focus on two fronts: established agricultural areas and undeveloped areas with productive potential. In the latter, transferring land titles to poor migrants may be justified with equity arguments and should reduce pressure on valuable forest lands. However, every effort needs to be made to prioritize giving title to those lands already cleared of forest rather than promoting further cutting of untouched forests, even if they are on potentially productive lands. In established agricultural areas, the poor success rate of many prior titling efforts must be overcome through strengthening titling institutions, implementing lower cost methods and other measures. Titling efforts need to be preceded by macroeconomic and sectoral reforms that promote a labor-intensive pattern of agricultural development. Such projects must be a part of long-term plans to increase the security of property rights in rural areas, including institutional strengthening of cadastral and registry agencies. To reduce titling costs, private sector services may be specially contracted for surveying and mapping. Subsidies that make titles affordable for poor farmers may prevent undesirable income distribution effects.
- (2) Eliminate barriers to land sales and land rentals. Many countries still restrict the sale or rental of farms given by governments in colonization or land reform programs. These restrictions produce informalities in land markets and have been shown to reduce the price of land. Most importantly, they limit the efficiency of land markets in ensuring that lands are owned by those who can use them most intensely and obtain the highest returns. In order for such transactions to function properly, however, government agencies and policies must be in place to monitor sales and rentals. Otherwise, land buyers will continue to purchase cleared areas from poor migrant settlers, who will in turn invade virgin forests (or Indian lands or parks), clear the forests, and then sell their plots once again to legitimate land buyers in a form of land speculation. Thus, a legal and technical capacity must exist to control land sales and rentals and their subsequent titling.

- (3) Remove tenurial policies that introduce risks to hiring rural labor. Dated legal provisions that grant tenurial advantages to farm workers, squatters or sharecroppers reduce the security of property rights and increase perceived labor costs. Removal of these provisions should increase labor utilization in farming activities. In addition, they may reduce obstacles to renting underutilized lands.

To ensure the success of the favorable effects of the tenure policies listed above, complementary policies must accompany any strengthening of individual property rights. This can be accomplished by the following means:

- (1) Modify macroeconomic and sectoral policies that stimulate inefficient uses of land, particularly those that generate little employment in areas with labor surpluses, such as cattle raising and mechanized agriculture. This implies maintaining the current policies that are not in favor of overvalued exchange rates nor credit subsidies. Favorable tax and tariff treatment for farmers growing mechanized crops should be eliminated.
- (2) Reform current labor market provisions to stimulate a more intensive use of labor in agriculture, including regulations that artificially increase the cost of hiring rural labor in farm activities.
- (3) Promote the development of appropriate credit sources for the smallholder sector in order to improve its response to increased tenure security.
- (4) Redirect public investment in infrastructure, research and extension for the benefit of smallholders to promote a pattern of agricultural growth that is labor intensive. These investments must be concentrated in areas where they are likely to have a greater effect on employment generation and on reducing deforestation pressures. Providing more infrastructure and technologies in frontier areas should be limited to prevent further increases in land values and continued migration flows.
- (5) Adopt complementary measures to increase employment generation in non-agricultural activities in both urban and rural settings.

C. *Policies for forested areas*

Tenure policies in forested areas also have an important role to play in reducing deforestation pressures. The policy agenda for this sector should include the following recommendations:

- (1) Eliminate the practice of requiring proof of land clearing in order to obtain legal title or credit in forested lands. Where legal norms still require land clearing to obtain title, these must be suppressed.
- (2) End support of formal and informal colonization efforts in areas without agricultural potential. This requires refusing to grant *ex post* legal title to settlers and stopping the practice of promising “agricultural” lands in forested areas to landless farmers. It also entails eliminating programs that support agricultural uses and road construction in such areas.

- (3) Defend and enforce protected areas. This may imply adjusting the size of protected areas to what may be effectively protected with available resources. In some cases, valuable biological resources may only be safeguarded by a substantial increase in park policing efforts. Where feasible, local communities should be involved in managing protected areas, including designating parts of the forest as extractive areas and promoting eco-tourism activities (but only when an area's protection category allows it.)
- (4) Design new tenure arrangements to preserve forest lands. The possibilities that should be considered include the following:
 - (a) Long term concessions for commercial logging should be subject to the availability of proven technologies for managing the forest, effective government supervision of management plans, and the protection of forest-dweller rights. Concessions to local forest dwellers should be promoted for reasons of equity and sustainability.
 - (b) Common property rights to forested lands can be an effective method of preserving forest resources where the population density is low and where the tenure regimes reaffirm local communities' long-standing customary rights of access and forest use. Governments should strengthen customary rights by granting title to indigenous communities and other traditional communities, and assist these groups in demarcating their borders and enforcing their rights against squatters.
 - (c) Property rights to the remaining public forest areas should be transferred to non-public interests in order to preempt the race for those rights. Such transfers should put in practice new legal instruments that permit restricted property rights. They must also be complemented with strong legal provisions to prevent encroachers from obtaining rights to these lands. Transfers should favor those landowners who display the capacity to protect the forests, including NGOs or communities that live off forest resources. These transfers may be carried out through long-term leases that include strict forest management provisions. Long contract periods would ensure that leaseholders would care about long-term benefits and use the forests sustainably.
- (5) Promote pilot efforts to enact local land taxes with higher rates for pasture and crop lands than for forest uses.
- (6) Support further research and analysis of case studies to improve understanding of the complex relationship between tenure status and land clearing, particularly in frontier areas.

Tenure issues are an important factor in the excessive clearing of forests in Latin America. The effects of securing property rights are better understood in agricultural areas, where empirical studies have found a strong effect of tenure security on agricultural output and income. However, the complexity of frontier dynamics does not allow for simple generalizations between property rights and tenure security in the remaining forest areas of the region. Therefore, many of the arguments developed in this study remain to be verified by further research.

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