ANALYSIS

The role of domestic timber markets in tropical deforestation and forest degradation in Ecuador: Implications for conservation planning and policy

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Abstract

Studies about the impact of the timber trade on tropical forests have often oversimplified process complexity and underestimated regional variability. This study shows that forest degradation and clearing in Northwest Ecuador between 1983 and 1992 was closely linked to commercial logging. A key finding is that domestic demand is critical for shaping timber extraction and, hence, forest degradation and deforestation in this region. Low timber prices for roundwood and sawnwood at the origin, which are bolstering unsustainable forest extraction, have not been affected by market liberalization. This suggests that conservation initiatives that target international trade linkages may only be partially successful, even when they do what they are intended to do. Results suggest that market-based incentives are more likely to produce the desired results if they target and support timber producers directly. These findings are also relevant for other regions where domestic markets are a significant drive for deforestation and where local markets are supplied through the activities of small-scale, labor-intensive primary producers. Also, by emphasizing areas where logging is a dominant force, meso-level studies, like this one, not only help to more accurately estimate the impact on local forests, but also identify major resource flows and the factors promoting or hindering sustainable use, and those affecting the effectiveness of policy options. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

Growing concern over the fate of tropical forests and the impact of their degradation on regional and global processes has generated considerable discussion about the social and economic factors shaping their use and the alternatives to promote their conservation. Two themes that have attracted particular attention are the relationship between commercial logging and tropical deforestation and forest impoverishment...
and the policy options available to promote sustainable forest management (SFM). In the first case, research shows that commercial logging can be a facilitating factor (Burgess, 1993; Barbier et al., 1995; Pearce et al., 1999) or a direct cause of deforestation and forest impoverishment (Sierra and Stallings, 1998; Nepstad et al., 1999). Burgess (1993), for example, estimated that between 1981 and 1985, 99% of the area deforested in six timber exporting countries in Africa corresponded to previously logged forests. Complete forest removal was facilitated by improved accessibility (through logging roads), increased land values, and lower clearing costs. FAO estimated that 70% of the deforestation in the world occurred in this way in the 1980s (Marshall, 1991). Sierra and Stallings (1998), on the other hand, showed that 70% of the area deforested in western Ecuador was caused by commercial logging not followed by agricultural expansion, and suggested that this pattern could also apply to other areas in Latin America. Nepstad et al. (1999) estimated that logging severely damages between 10 and 15,000 km² of forest in the Brazilian Amazon every year.

In the second case, policy and conservation planning in the past two decades have emphasized the role international markets and international market signals (e.g., prices) could play in promoting a reversal of these trends and fostering SFM (e.g., Perez-Garcia and Lippke, 1993; Barbier, 1995; Barbier et al., 1995; Dauvergne, 1997; Nittler and Nash, 1999). According to Dauvergne (1997), for example, the five most important conditions to promote SFM are stable world timber prices, market’s preference for timber produced with sustainable management approaches, unrestricted access to export markets, unrestricted timber exports, and compensation for past non-sustainable management costs. Two key assumptions underlie this approach to conservation planning. The first one is the assumption that timber production is primarily linked to the international timber trade. This means that efficient incentives for conservation can be encouraged through specific elements of international markets (e.g., regulations on the origin, the species, the management practices, price incentives, etc.), supported by a mix of standard regulatory practices (e.g., management plan requirements, concessions, etc.) and fiscal tools (e.g., taxes, fees, etc.). The second assumption is that primary timber producers (i.e., those actually extracting the resource) are capable and willing to act in response to these incentives and, most of all, to price signals. This, in turn, presumes a given scale of operations, with a high level of formality, and access to markets, information, and financial and human resources.

However, the apparent failure of key international conservation initiatives (e.g., the Tropical Forestry Action Plan, the International Tropical Timber Agreement, the United Nation’s Statement of Forest Principles) and the dispersion of protective initiatives (Eastin et al., 1992; Durning and Carole, 1993; Hardaway et al., 1995; Rice et al., 1998) are an indication that more research is needed about the factors promoting or hindering sustainable use of forest resources. Even apparently successful programs based, for example, on green certification schemes, rely on niche markets (i.e., with willingness to pay for a specific origin) that should be expected to absorb only a fraction of the timber extracted from natural forests (Barbier et al., 1994; Kiker and Putz, 1997). A critical problem with the first assumption is the lack of attention on the potential role of domestic timber markets in tropical deforestation. Various studies indicate that domestic consumption is a key component of the overall timber trade (Uhl and Guimaraes-Vieira, 1989; Vincent, 1990, 1992; Burgess, 1993; Barbier, 1995; Barbier et al., 1995), but a formal (i.e., statistical) connection between this sector and forest clearing has yet to be established. Estimates of the share of total timber production that is consumed domestically are generally high, varying from 60% (Vincent, 1990) to 85% (Burgess, 1993). Table 1 shows the share of total production consumed by the domestic sectors of five Southeast Asian producer countries by wood subsector. In all, a large percentage of total production is consumed locally, with the only exception of plywood. In Brazil, Uhl and Guimaraes-Vieira (1989) estimated that less than 20% of the sawmill production centered in the Brazilian Amazon was bound to international markets, with the difference consumed locally or regionally. In general, because not all countries
export timber but consume timber, domestic timber trade should be expected to play a critical role in explaining deforestation and should, hence, be a critical component of policy considerations. Attention to local timber markets is also necessary because domestic demand for timber in all tropical developing countries in general, and in their urban centers in particular, will increase faster than the international demand for timber, primarily concentrated in developed countries, due to faster population and income growth. Furthermore, international markets are expected to promote better management practices by sending the “right signals” to producers, primarily through higher local roundwood prices. However, there is limited empirical evidence to establish what present and future values make SFM attractive to producers (Pearce et al., 1999). Indeed, Browder (1987) found that trade liberalization for mahogany in Brazil, and higher timber prices and, arguably, a high social discount rate, only accelerated logging and exports.

The second assumption also presents some problems, the most important of which is, at least in large areas of Latin America, that commercial timber is primarily extracted by large numbers of small-scale, mostly informal, timber producers (Uhl and Guimaraes-Vieira, 1989; Redclift and Goodman, 1991; Razetto, 1995; Salazar et al., 1998; Sierra and Stallings, 1998). These producers are rarely linked to national and international timber markets, constituting only the first step in a relatively long production chain (Sierra and Stallings, 1998). This production system seems to be prevalent in the rain forests on the pacific side of tropical South America in Colombia and Ecuador, and in some areas of the Brazilian and Peruvian Amazon. Razetto (1995), for example, reported that 75% of the timber volume used by the wood industry in Venezuela, Colombia, Ecuador, Bolivia, and Peru was extracted by small-scale producers and then sold to medium and large-scale wood-processing firms. In these countries, as in most tropical countries, forest plantations are very limited. Hence, demand is met through the logging of natural forests.

This study examines the relationships between timber trade and tropical deforestation and forest degradation and the implications for forest conservation policy and planning by addressing these two shortcomings in the analysis of commercial timber production in Ecuador. To do this, this study first establishes an empirical link between deforestation and commercial logging and between commercial logging and domestic and export timber markets (Section 2). Once this relationship is established, attention turns to the policy implications of these findings (Section 4). The geographical focus is Northwest Ecuador, where most of the timber consumed by the country’s wood industry originates. Commercial logging is also the region’s most important economic activity (Sierra and Stallings, 1998). This level of geographic detail is necessary to recognize within-country variability in the origin of the timber (e.g., from plantations or natural forests) and clearing not related to logging (i.e., driven by agricultural expansion). Deforestation of the trop-

<table>
<thead>
<tr>
<th>Product</th>
<th>Production</th>
<th>Imports</th>
<th>Exports</th>
<th>DCa</th>
<th>DC/P%b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawnwood</td>
<td>20 459.0</td>
<td>953.0</td>
<td>8297.1</td>
<td>12 161.9</td>
<td>59.4</td>
</tr>
<tr>
<td>Plywood</td>
<td>10 045.0</td>
<td>22.0</td>
<td>9120.9</td>
<td>924.1</td>
<td>9.2</td>
</tr>
<tr>
<td>Veneer</td>
<td>633.9</td>
<td>7.3</td>
<td>335.8</td>
<td>298.1</td>
<td>47.0</td>
</tr>
<tr>
<td>Processed timber</td>
<td>31 137.9</td>
<td>982.3</td>
<td>17 753.8</td>
<td>13 384.1</td>
<td>43.0</td>
</tr>
<tr>
<td>Roundwood</td>
<td>68 827.0</td>
<td>1538.5</td>
<td>22 366.0</td>
<td>46 461.0</td>
<td>67.5</td>
</tr>
<tr>
<td>Total</td>
<td>99 964.9</td>
<td>2520.8</td>
<td>40 119.8</td>
<td>59 845.1</td>
<td>59.9</td>
</tr>
</tbody>
</table>

a Domestic consumption = Total production – exports.

b (Domestic consumption/Production)*100.
2. The role of domestic timber consumption in the deforestation of Northwest Ecuador: research approach

2.1. Evaluating the relationship between deforestation and commercial logging in Northwest Ecuador

Detailed information about forest cover change for the period 1983–1993 was obtained for a 6000 km² area where a disproportionate share of the industrial tropical timber in Ecuador originates (Fig. 1). Forest cover in 1983 was obtained from a mosaic of aerial photography. Areas with 30% or less of forest coverage were considered deforested. The 30% or less of forest coverage was assumed to compensate for small patches of deforested areas in those areas classified as forests (which could have resulted from natural forest dynamics or pioneer farming). Forest cover for 1993 was obtained from a mosaic of LANDSAT TM5 images. Visual interpretation of 1993 imagery defined two major land use classes: forests and non-forests. The non-forest category included completely deforested areas (i.e., areas where the current land use was not forest) as well as a significant area of heavily degraded forests. Heavily degraded forests were considered deforested because of significant reductions in biomass and changes in forest composition and structure. This definition is sensitive to the impact of logging because even the extraction of small volumes of timber per unit of area can have substantial impact on forests (Snook, 1996; Mardsen, 1998; Pelissier et al., 1998; Pearce et al., 1999). The forest category, on the other hand, included old secondary forests and recently logged forests where extraction concentrated on fine hardwoods and could not be identified through satellite imagery.

The level of impact of commercial logging on forest structure (for those areas that had not been converted to another use) was characterized through 31, 0.5 hectare (250 × 20 m) plots where all the stumps indicating logging were mapped and measured. All the remaining trees with diameter at breast height (DBH) of 10 cm or more from a list of 20 selected valuable timber
species were also mapped and their height and DBH measured. These plots were located at random on a map with four conditions: the site selected had to be within a 1-km corridor along rivers and roads (the maximum distance at which logging took place in the region), its initial point had to be located between 200 and 300 m.a.s.l., the site had to have been identified as deforested in the 1993 land-use map, and the site had to be completely outside of plots used by local households for commercial or subsistence agricultural or agroforestry uses. If the site chosen did not comply with one of these conditions, a new site was selected.

In addition, to separate the deforestation caused by logging from that caused by agricultural activities, a detailed analysis of land-use patterns was carried out in one community, the Playa de Oro Commune. In this community, with a total area of 6932 ha, half of the household plots were mapped and compared to the area deforested. The area under agricultural or agroforestry uses was assumed to be twice the area mapped as household plots. This information was compared to and complemented by the results of another study (Kernan, 1996) that provided similar information on land-use patterns for another community in the region.

2.2. Evaluating the relationship between commercial logging in Northwest Ecuador and timber trade

The links between the deforestation in Northwest Ecuador and the timber trade were examined through a regression model illustrating the effect that changes in the demand for tropical woods in Ecuador have in the extraction of timber from Northwest Ecuador. Timber extraction volumes were estimated from government records as actual timber transported out of the region, plus a 60% official assumption of not-accounted-for timber mobilization. This approach is consistent with the methodology used in cross-national studies estimating the role of logging in deforestation in tropical countries (e.g., Amelung and Diehl, 1992).

The first part of the model proposes that total timber consumption is the sum of the consumption by all the subsectors of the Ecuadorian wood sector that obtain wood from the study region. Thus,

\[ NWECWOOD_t = VENCON_t + CONCON_t \] (1)

where \( NWECWOOD_t \) is the total timber production from Northwest Ecuador, \( VENCON_t \) is the consumption by the veneer subsector, and \( CONCON_t \) is the consumption by the construction subsector, in six-month periods \( t \), in m\(^3\).

In Ecuador, only veneer (\( VENCON_t \)) production is based almost completely on the extraction of high-value roundwood from natural forests. The construction subsector (\( CONCON_t \)) consumes 60% of the sawnwood produced from natural forests in Ecuador, one-third of which originates in Northwest Ecuador. The difference is met with timber from exotic species plantations, such as eucalyptus and pine. Other wood subsectors do not rely on timber from natural forests. Most of its production is also based on exotic species such as eucalyptus and pine (e.g., particle boards) or on imports (e.g., paper) (ITTO/INEFAN, 1993). Overall, at least 63% of the sawnwood and almost all roundwood consumed in Ecuador is obtained from tropical rain forests (ITTO/INEFAN, 1993).

Also, the relationship between logging in Northwest Ecuador and the demand for wood products is represented by:

\[ NWECDEF_t = x + x_1 NWECWOOD_t \] (2)

where \( NWECDEF_t \) is the estimated deforested area by commercial logging in Northwest Ecuador in six-month periods, \( t \), between 1985 and 1992, in ha, based on total volume of timber extracted in that period (or volume/timber available ha\(^{-1}\)) and \( NWECWOOD_t \) is as defined in Eq. (1).

Hence, Eq. (1) can be restated as:

\[ NWECDEF_t = x + x_1 VENCON_t + x_2 CONCON_t \] (3)

Only veneer consumption could be estimated
reliably from data available. Veneer extraction provides, however, a good surrogate for the importance of commercial extraction in the deforestation observed in Northwest Ecuador. Northwest Ecuador supplied nine-tenths of the roundwood consumed by the veneer industry in the late 1980s and early 1990s (ITTO/INEFAN, 1993). In 1992, approximately half the total timber volume extracted from Northwest Ecuador was destined to veneer plants. Moreover, based on the productive arrangements with local producers and its own productive capacity, the veneer industry is the only wood subsector capable of extracting timber independently from weather conditions or the extraction of other types of timber. During the rainy season, when road construction is difficult, local producers supply veneer firms using local rivers. During the dry season, veneer firms supply their own raw materials by building up roads into forested areas. In fact, extraction of other types of timber, and sawnwood for the construction and manufacturing subsectors in particular, is contingent on the veneer industry building or maintaining access roads into Northwest Ecuador. With few exceptions, veneer firms built the entire road system in the study region and to the south of it. Even some roads built by the State are often maintained with their financial support.

Furthermore, the production of the veneer industry is destined for national and international markets. This relationship is expressed by:

\[ NWECDEF_t = \alpha + \alpha_1 VENEXP_t + \alpha_2 VENDOM_t \]  

(4)

where NWECDEF\(_t\) is the total timber consumption in Ecuador, VENEXP\(_t\) is the exports of veneer products, and VENDOM\(_t\) is the domestic consumption of veneer products, in six-month periods \(t\), in m\(^3\).

Yearly data for VENEXP and VENCON were available for the period 1980–1992. The assumed link between deforestation and exports is also supported by the fact that roundwood exports were banned in Ecuador for most of the study period examined here. Even after this ban was lifted, in 1989, roundwood exports remained relatively insignificant (Salazar et al., 1998). Export commodities originating in natural forests were often in the form of manufactured (i.e., plywood) and, primarily, semi-manufactured products (e.g., veneer sheets).

3. Results

3.1. The impact of commercial logging on the forests of Northwest Ecuador, 1983–1992

Based on government records, it was estimated that between 1983 and 1992, 2 255 146 m\(^3\) of timber were extracted from Northwest Ecuador. In the same period, 86 107.5 ha of forests were cleared in this region. Based on the official average for commercial timber available in the region’s forests, 37 m\(^3\) per ha (ITTO/INEFAN, 1993), this required putting under production a cumulative area of approximately 60 950 ha of natural forests. Hence, at the regional level approximately 70.1% of the area deforested (i.e., 60 950/86 107 * 100) could be explained by timber extraction alone. These estimates, however, should be considered as conservative for several reasons. First, statistics for sawnwood production do not account for waste during sawing by local farmers, which, on the average, has been estimated to be 45% of the initial roundwood volume (ITTO/INEFAN, 1993; Salazar et al., 1998). Second, the estimate of the volume of commercial timber available per hectare used here is higher than the average of timber extracted from tropical closed forests overall, 5–35 m\(^3\) per ha (ITTO/INEFAN, 1993), and than average estimated commercial volume for Ecuador overall, 15 m\(^3\) per ha (FAO/UNEP, 1981). Third, it is not clear whether the volume lost within the region when veneer roundwood is processed is accounted for in these statistics, since at the time this timber product is transported out of the region it is in the form of veneer/plywood sheets. In Ecuador, the volume ratio between veneer roundwood and veneer is approximately 2–1.

The analysis of land use patterns in the Playa de Oro Commune confirms this conclusion (i.e., that timber production is not a by-product of clearing for agricultural land). In this Commune, only 15.6% (or 3% of the commune’s area) of the
area deforested was used for agroforestry or agriculture, including fallow lands (Table 2). This is consistent with the findings by Kernan (1996), suggesting that it constitutes a common pattern in this region. Kernan found that in the nearby community of Pichiyacu, approximately 23% of the area deforested was used for agriculture or agroforestry (the area surveyed was 3121 ha). In these two communities, the remainder constituted heavily degraded forests that had been logged for various types of timber and in which only hunting took place in a consistent manner. Data collected during this study shows that in these areas an average of 21 trees per ha had been logged (Table 3). In this study, no attempts were made to estimate the overall impact of logging, including the felling of other trees and clearing, but it is widely accepted that between 50 and 75% of the forest canopy is opened during selective commercial logging through tree felling and road construction (Amelung and Diehl, 1992; Burgess, 1993).

Table 2
Land use in the Comuna Playa de Oro, 1993–1994

<table>
<thead>
<tr>
<th>Land use type</th>
<th>Area (ha)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deforested</td>
<td>204.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Managed for subsistence or commercial production</td>
<td>1118.5</td>
<td>16.2</td>
</tr>
<tr>
<td>Timber extraction</td>
<td>1323.0</td>
<td>19.2</td>
</tr>
<tr>
<td>Total deforested</td>
<td>5600.3</td>
<td>80.8</td>
</tr>
<tr>
<td>Low or no intervention forests</td>
<td>6923.3</td>
<td>100.0</td>
</tr>
</tbody>
</table>

* Does not include 257.1 ha of areas covered by water.

The results of the regression model Eq. (4) indicate that veneer production plays an important role in forest clearing in Northwest Ecuador (Table 4), explaining more than half of the variability, which is also roughly equivalent to the share of the timber production consumed by this sector. More importantly, regression results show that within consumption sectors domestic veneer consumption is the only factor significantly related to increases or drops in commercial logging and deforestation in Northwest Ecuador. This is explained by geographical production trends in the last two decades. By the early 1980s, most of the remaining natural forests below 600 m.a.s.l. were restricted to Northwest Ecuador. To the south, forest remnants exist only in a few small reserves, none of which exceeds 400 ha in size, and in the mountains of Mache-Chindul (10–

Table 3
Impact of commercial logging on selected tropical species in Northwest Ecuador

<table>
<thead>
<tr>
<th>Type of logging</th>
<th>Sample size</th>
<th>Average number of trees (ha(^{-1}))(^a)</th>
<th>Average number of trees logged (ha(^{-1}))(^b)</th>
<th>Average % logged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primarily for sawnwood Average</td>
<td>10</td>
<td>88</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Primarily for roundwood Average</td>
<td>16</td>
<td>68</td>
<td>19</td>
<td>22</td>
</tr>
<tr>
<td>Overall average</td>
<td>26</td>
<td>91</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>Natural forests</td>
<td>5</td>
<td>118</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

* Total number of trees of 20 valuable species with DBH>10 cm.

* Includes only trees cut for extraction and not trees felled as a consequence of this.
20,000 ha). As a result, Northwest Ecuador’s share of the country’s timber production increased from 21.5% in 1985 to 41.6% in 1991, with a high of 46% in 1990 (ITTO/INEFAN, 1993). This share increased to 70% by 1997 (H. Cabrera, Director, Forestry Directorate, pers. com., 1997).

Interestingly, trade liberalization during and after the study period seems to have had only limited impact on local markets and resource extraction patterns. Up to 1989, roundwood exports were banned in order to promote domestic manufacturing and increase value added. The result was depressed local roundwood and sawnwood prices and excessive harvest rates and waste during felling and sawing (ITTO/INEFAN 1993; Magill, 1994; Southgate and Whitaker, 1994). ITTO/INEFAN (1993) estimated that waste during sawing amounted to between 45 and 60% of the original timber volume. Because timber sawn inside the forest, so that it could be moved to collection points, often needs refinishing before reaching final markets, the actual loss is probably higher. In the case of veneer (high-value) roundwood, low prices mean, for example, that undersized trees (i.e., less than 45 cm in diameter at breast height) are felled and used for planks, railroad ties, and the like. A concerted response was to liberalize trade, which was rapidly done after 1989. With these changes it would have been expected that roundwood and sawnwood prices at the origin rise to meet or approach international levels, promoting investment in efficient management practices and more appropriate harvest rates. However, prices for these two types of commodities remained well below international levels (Fig. 2) while both production and consumption increased significantly (Fig. 3). Domestic timber consumption increased by 44% between 1982 and 1992, and is expected to increase an additional 45% by the year 2005 (ITTO/INEFAN, 1993).

That this is not a temporary but a structural condition is shown by the fact that it has not changed after almost a decade of trade liberalization. In 1997, for example, high-value roundwood and high-value sawnwood sold for US$ 47 and US$ 125 per m³, respectively, compared to US$ 135 and US$ 240 for similar commodities in the international market (Salazar et al., 1998). In contrast, international and domestic prices of manufactured commodities remained high in both periods (Fig. 2). For the local wood industries, supplying mostly domestic consumers, price equalization would have meant an unnecessary removal of the subsidies extracted from local tim-

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Fig. 2. Domestic and international price evolution for various segments of the timber industry in Ecuador.
ber producers. Salazar et al. (1998) estimated that veneer firms and sawmills were paying on the average only between 46 and 25%, respectively, of the international price of equivalent timber, while informal producers had returns of approximately US$ 13.75 to 3.8 per m³ of high-value roundwood and US$ 12.7 US per m³ of high-value sawnwood. The low opportunity costs of labor and relative resource abundance in the region meant that even low prices were sufficient to encourage labor-intensive logging by small producers who extract approximately 77% of the timber volume in Northwest Ecuador (46% as sawnwood and 31% as roundwood). These producers supply almost 90% of the roundwood consumed by the veneer industry and 20% of the timber used by the other wood industries in Ecuador. The difference (27%) is extracted by medium to large-scale logging firms relying on capital-intensive logging methods (e.g., building roads, using skidders and pack-a-backs).

4. Implications for forest conservation planning and policy

Several authors have suggested that the best option to promote SFM is unrestricted trade, reinforced by secure property rights on forest-lands. More recently, the growth of commercial opportunities based on niche markets has been advocated as a complementary measure to bolster SFM (Dauvergne, 1997; Nittler and Nash, 1999). These two views are reflected in the literature that relates directly to Ecuador (e.g., Southgate and Whitaker, 1992, 1994; ITTO/INEFAN 1993; Magill, 1994; Salazar et al., 1998) and in Ecuador’s recent forestry policy. These propositions arise from the widely accepted view that free trade would bring commodity prices to levels that better reflect the social and environmental costs of timber production. International prices are assumed to be a reasonable approximation to these costs, or at least to be better than local prices under trade restrictions. Secure tenure rights make investment in sustainable management practices more attractive (i.e., reduce the social discount rate) and boost efficiency by increasing competition within the wood sector.

However, the previous analysis casts doubts on the role policies hinged on trade liberalization and niche markets can have on promoting SFM. The problem is not so much with the underlying assumptions, but with whether the expected conditions (e.g., right prices and management schemes) can be met with an emphasis on international trade and niche markets. As this study illustrates for Ecuador, domestic and not international trade...
is the primary force behind the deforestation of the last remnants of natural forests on the Pacific side of the Andes. The small scale, the labor intensity and the mobility of extractive operations also means that other alternatives, such as restricting credit, banning logging in natural forests, or establishing reserves, are not likely to be more effective. An example of this limitation is the 1996 and 1997 bans on logging in natural forests imposed by the Ecuadorian government. Their results were poor at best, being able to reduce the timber volume normally produced by only 20% (H. Cabrera, pers. com., 1997). Furthermore, as shown above, domestic and international prices for wood manufactures have been similar with and without trade restrictions, yet unsustainable resource management at the origin is still the norm. Unsustainable management occurs because those extracting the resources lack long-term incentives to reduce harvest rates or to invest in more efficient, less wasteful technologies.

This contradiction is possible because in small economies like Ecuador’s, a few firms are often enough to saturate markets and to exercise monopoly power. This means that certain segments of the local production chain may remain isolated from the larger economy, resulting in local distorted prices, often similar to the opportunity cost of labor. Indeed, as the recent economic crisis in Ecuador shows, the current structure favors the higher levels of the production chain. When end prices drop, primary producers (i.e., the lower levels) absorb a disproportionately high share of the loss, and when prices rise, they only recoup a disproportionately small share of the gains. For example, as a result, of Ecuador’s currency devaluation in 1999 veneer producers saw the price of plywood drop on the average by 31.0%. The price they paid for their raw materials to primary producers in Northwest Ecuador, however, dropped by 58.6% (both in US$) (Paulina Baca, Proyecto SUBIR, Ecuador, pers. com., 2000). This condition even affects the viability of international certification programs because the additional cost of certification reduces even more the already low economic returns to producers. A report by Nittler and Nash (1999) illustrates the potential conflicts. In Bolivia, complying with certification means an additional production cost of more than US$ 1 per m³. This means a reduction of 26 to 7% of the current average returns that small-scale producers receive from commercial logging in Ecuador. In theory, these increases would only be a small fraction of the returns if international pricing is applied. For this to happen, however, local producers would need to access directly international markets because intermediaries and manufacturers have good reasons to keep local raw materials at low prices. The increased cost of SFM or, more importantly, the equalization of domestic and international timber prices would erode the high financial benefits they receive from primary producers. Hence, firms with access to markets are likely to make the necessary changes only to comply with the quality demands of international trade. There is no financial reason to do this for domestic markets. This assumption is also supported by the report of Nittler and Nash (1999). Certification schemes have expanded rapidly in Bolivia in the last decade, but have been adopted primarily by large extraction programs (the smallest certified exploitation is over 60 000 ha) and those that had export interests. Small producers, often informal, are unlikely to willingly incur these additional costs, at least not if the returns do not increase proportionally, nor can governments or forestry organizations force them to do it.

This suggests that in order to promote widespread SFM it would be necessary to: (1) support local producers to have direct access to international markets and financial resources, and (2) to foster consolidation among small producers to reach a scale of operations appropriate for SFM. In the first case, direct access to international markets would force up the price of timber directed to domestic markets, thus promoting lower harvest rates and investment in sustainable extraction schemes and plantation development. This move would not, however, hurt local consumers since they have already been paying international level prices. It would erode the returns to intermediaries and manufacturers because domestic consumers would prefer imports if higher prices are applied. In the second case, since most production is currently isolated and small scale, policy and
programs need to favor consolidation into larger scale schemes that would favor SFM.

In this light, it seems that in countries like Ecuador, where small producers are responsible for most of the timber logged while lacking access to external markets, and where domestic markets consume the lion’s share of the volume extracted, it is critical that policy and forest conservation programs aiming for SFM support directly the communities that are involved with commercial logging. Policy and programs also need to target what has long been seen as a weakness of community-based entrepreneurship: the lack of human and financial resources needed to carry out sustainable extraction of timber and non-timber resources (Dickinson et al., 1996). Local users can establish and implement efficient rules for the use of ecological systems and to monitor their impact when: (a) the benefits are perceived to be greater than the costs, and (b) communities have the legal authority to implement these rules (Ostrom, 1998). The latter condition is key for defining both the ability of the owner of the resource to capture a sufficient fraction of the stumpage value and the level of uncertainty about future gains from conservation. When forests are not scarce, production of timber and non-timber tropical forest commodities have attached low output variability risks. During this time, uncertainty is mostly related to market instability and threats to local access to and control of resources (an in-depth discussion of these issues is beyond the scope of this work). Since forest dwellers in Ecuador and elsewhere are increasingly consolidating tenure conditions and their right to exclude others, the critical issue seems to be the returns that they receive from their productive activities.

A word of caution, while domestic consumption seems to be enough to drive forest clearing to the maximum possible, exports should not be discounted even in countries that have not been traditional timber exporters. In the case of Ecuador, wood exports were expected to grow between 200 and 400% in the period 1993–2003 (ITTO/INEFAN, 1993). From the industrial demand side, the potential for growth is already in place, as there is excess installed capacity in sawmills and veneer plants, which work at 60 and 77% of their capacity, respectively (ITTO/INEFAN, 1993). Veneer exports already increased by 268% between 1982 and 1993. Major factors in export growth will be the consolidation of the Andean Market and the increase of world prices for tropical round- and sawnwoods. Venezuela, for example, is a potential growing market that has been troubled by the lack of raw materials for its sawmills. As the Asian crisis eases up, demand for tropical timber should also be expected to rise. At the same time, timber supply from traditionally producing areas is expected to drop. The “spotted owl effect”, for example, affects the supply from the North American Northwest, particularly important for Japanese markets. Supply from Sabah and Sarawak in Malaysia has also dropped due to lower extraction rates and higher export taxes (Burgess, 1993; ITTO/INEFAN, 1993). In some areas, such as the Philippines, Ghana, and Ivory Coast, the more accessible lowland forests were almost depleted by the end of the 1980s (Repetto, 1988).

5. Conclusions

It is beyond the scope of any study to examine each and every one of the factors affecting commercial logging patterns and their relationship to deforestation and forest impoverishment. This study concentrated on the role domestic markets have in this process in Ecuador. For more than two decades, this country has resorted to various forestry policy mechanisms, from reforestation subsidies to logging bans, to try to promote some type of SFM, but results have been more than inadequate. In recent months, a policy shift has taken place with a strong reliance on free trade, certification schemes, and tenure considerations. Such an approach is consistent with most international forestry initiatives, which are based on an assumption of large-scale operations primarily oriented toward supplying the international timber market.

A key finding is that logging in the natural forests of Northwest Ecuador is strongly affected by changes in the demand for raw materials in the Ecuadorian wood sector in general, and by do-
mestic consumption in particular. Indeed, domestic consumption is likely to be large enough to produce widespread deforestation and forest impoverishment. In addition, the structure of the local market affects the ability of the government to implement policy. Because only a fraction of the timber is logged by formal or semi-formal units, traditional approaches to regulate the forestry sector (i.e., concessions, management plans, fees and taxes) are inefficient. Trade restriction, such as log export bans and value added promotion, which have in some cases been advocated as an incentive for SFM (Rice et al., 1998), are also unlikely to modify the structural conditions that give rise to unsustainable logging. In the absence of viable compulsory mechanisms to promote SFM, market incentives seem to be the only alternative. However, incentives based on international trade without local considerations are unlikely to produce the desired results for at least two reasons. First, local timber intermediaries and manufacturers supplying domestic and international markets benefit by having low timber prices. Second, small-scale producers do not have access to international markets nor the ability to capture value added. For these reasons, it is imperative that forestry policy and programs are directed at setting desirable market conditions (i.e., increase the prices producers receive) and to facilitating the adoption of SFM schemes at the level of local producers.

Hence, viable alternatives require two conditions: (1) to enhance local producer’s access to international markets, with preference on certified schemes, bypassing intermediaries and manufacturers, and (2) to facilitate financial mediation to provide the capital and institutional resources needed to develop and implement SFM activities and to foster and robust competitive markets. The availability of capital and managerial training opportunities for local producers is key for the implementation of SFM schemes. Local experiences in the region, often subsidized by local and international organizations, seem to indicate that this is possible, but widespread adoption requires larger changes and the involvement of a large producer population. Southgate and Whitaker (1994) also suggest that in addition to forestry initiatives, non-forestry initiatives encouraging the building up of non-environmental wealth is necessary to reduce the pressure on natural forests.

What can be learned from Ecuador is also relevant for other regions where domestic markets are a significant driver of deforestation and where small-scale producers are a key part of the productive system. Recent trends suggest that commercial logging is likely to grow rapidly in Latin America. Indirectly, this study also shows that there is a large regional and even within-country variability in the environmental conditions and human agency associated with commercial logging and deforestation. It is reasonable to assume that diverse resource use strategies result from the interaction of local conditions (e.g., differential resource endowments, labor availability, transportation conditions, etc.) with external stimuli (e.g., market conditions). Hence, a context-specific understanding is needed for identifying incentives that can be efficiently applied so that all the sectors involved in the process find it beneficial to engage in SFM. Too much emphasis on a small number of areas leads to erroneous scenarios of global or regional patterns when the wrong assumptions, derived from other impact areas, are applied to all regions or countries without distinction.

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References


