

# The Cost of Illegal Logging in Central America. How much are the Honduran and Nicaraguan Governments losing?

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## Main Findings

- Direct annual fiscal/financial losses to the governments of Honduras and Nicaragua due to clandestine logging were estimated at \$11-18 million and \$4-8 million respectively. In discounted net present value (NPV) terms, these losses came to \$80-130 million for Honduras, and \$30-60 million for Nicaragua.
  - These calculations were based on estimates of clandestine timber production (roundwood equivalents) in Honduras of 125,000-145,000 m<sup>3</sup> hardwoods and 350,000-600,000 m<sup>3</sup> softwoods, and in Nicaragua 30,000-35,000 m<sup>3</sup> hardwoods, and 110,000-135,000 m<sup>3</sup> softwoods.
  - The NPV loss of national non-market values (excluding carbon retention) due to illegal logging was very provisionally estimated at \$62-124 million for Honduras, and \$55-110 million for Nicaragua. The NPV loss of global non-market values (essentially carbon retention) came to over \$300 million (and possibly over \$1 billion) for each country.
  - Other important but unquantified economic losses stem from the broader impacts of poor governance, including low per capita incomes, literacy levels and life expectancy; distortion of private investment flows away from high socio-economic return areas and towards shady and illegal investment areas (further encouraging corruption); the stimulus to undesirable legal/ institutional reforms; and loss of the domestic economic multiplier when illegal logging revenues are expatriated. So illegal logging impacts on the wider economy and can dilute the effectiveness of monetary & macroeconomic policies.
- Given the scale and distribution of the economic costs of illegal logging, there is a strong case for national self-interest to tackle it, and for the international community to assist host governments in their efforts.

## Introduction

This paper provides a synthetic analysis of the costs of illegal logging to the governments of Honduras and Nicaragua<sup>1</sup>. These calculations, found in greater detail in Del Gatto (2003) and Alcócer López (2003), should not be regarded as definitive calculations, but be seen as preliminary estimates. Since, by definition, there are no records of clandestine timber production, in a short study like this there is little option but to base the estimates on key informants and secondary data where they exist.

It is important at the outset to clarify the terms 'legal' and 'illegal' logging. Legal logging or forest management conforms to a set of national laws and standards or norms which regulate forest extraction, processing, transport and trade. It is therefore more than legally authorised extraction. There are essentially two main types of illegal timber production: 'legalised' and clandestine production. The former is timber which is fraudulently legalised at the stump (for example, by adding timber from an unauthorised area), in transport (in Nicaragua it is common for a transport permit to be used up to ten times) or in processing. The timber is accompanied by official documents, forest fees are paid, and it enters the official statistics as if it were legal. Clandestine timber, by contrast, has no papers, no official forest fees are paid, and it is unregistered. Bribing state forestry authority or local government officials forms an integral part of both legalised and clandestine timber. In official data there is therefore an overlap between legal and illegal logging, as shown in Figure 1, making it impossible to quantify genuinely legal production. All timber production takes place at a long point along this continuum between legality and illegality.

This paper is structured as follows. For each country, an estimate is made of the quantity of clandestine production. Secondly the more quantifiable and direct financial losses to the governments are estimated. We then consider some of the indirect and less quantifiable costs of illegal logging, including environmental and other non-marketed forest values.

## Direct Financial Losses to the Honduran Government

### Clandestine timber: how much?

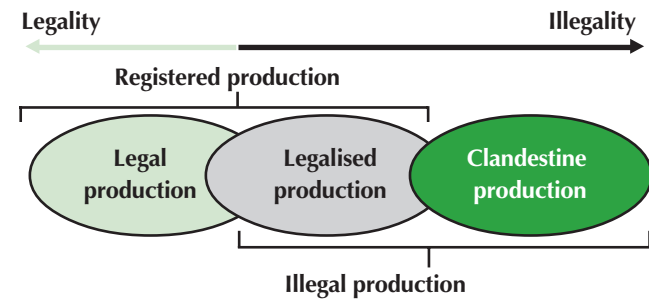
The calculation of national financial costs requires an estimate of the quantity of clandestine timber for each country. For Honduras, the results of an inspection survey of the quantity of timber used in processing plants (carried out in 1987) were available. Comparisons with official purchasing documents implied that only about 20% of hardwoods, and 50% of softwood (mainly *Pinus caribea* and *Pinus oocarpa*) production, were 'legal' or 'legalised' production. Based on the 1996-2000 period, official or registered annual roundwood production of hardwood is normally in the range 30,000-40,000 cubic metres (m<sup>3</sup>), while average softwood production is 610,000-820,000 m<sup>3</sup>. This resulted in initial estimates of 120,000-160,000 m<sup>3</sup> for clandestine hardwood production, and 610,000-820,000 m<sup>3</sup> for softwood.

To triangulate these estimates, a supply and demand analysis was carried out. The clandestine cut can be very roughly estimated as the residual of demand (D) less official supply plus imports (S+) in roundwood equivalents, where:

$$\begin{aligned} \text{Demand (D)} &= \text{national consumption} + \text{exports (registered} + \text{clandestine)} \\ \text{Official supply plus imports (S+)} &= \text{registered production} + \text{imports (registered} + \text{clandestine)} \end{aligned}$$



**Figure 1. The continuum between legal and illegal timber production**



Source: Del Gatto (2003)

Table 1 presents an estimation of the illegal logging residual of supply and demand based on the available data<sup>2</sup>, including from surveys of national timber consumption by small and large-scale processors (exports of processed wood products like furniture are included in this industrial consumption).

**Table 1. Supply and demand estimates of clandestine timber production in Honduras (000 m<sup>3</sup> roundwood equivalents)**

Demand and supply categories	Hardwoods 000 m <sup>3</sup>	Softwoods 000 m <sup>3</sup>
National consumption	165-175	530-685
Registered exports	-	400-450
Clandestine exports	-	20-90
Total (D)	165-175	950-1,225
Registered production	30-40	610-820
Registered imports	-	30-50
Clandestine imports	-	5-10
Total (S+)	30-40	670-855
Clandestine production = D - S+	125-145	280-370

<sup>1</sup>Due to the tendency for imports to be lower when registered national production is higher, and visa versa, the total supply is calculated adding the higher ends of the import ranges to the lower range end of the registered production figure, and visa versa.

For hardwood, total consumption was estimated at 165,000–175,000 m<sup>3</sup> roundwood. Deducting official production results in a clandestine production residual of 125,000–145,000 m<sup>3</sup>, about 75–85 per cent of total production. This falls within the earlier range. For softwood, a more comprehensive calculation is possible incorporating imports and exports. This resulted in an estimate of 280,000–370,000 m<sup>3</sup>, well below the earlier one. Key informants felt that it was reasonable to assume that clandestine production is between the higher end of the lower estimate and the lower end of the higher estimate. Allowing for rounding, this results in 350,000–600,000 m<sup>3</sup>, about 30–50% of total production.

### What's it worth?

The second stage was to estimate the economic value of this clandestine timber. Based on free on board (FOB) export values, the estimated gross value of clandestine hardwood production was US \$30–32 million, and the value of clandestine softwood production \$25–40 million<sup>3</sup>. Therefore the combined gross value of clandestine timber production in Honduras was estimated at \$55–70 million. This calculation indicates the scale of the problem,

but does not tell us how much is lost to the government, though clearly much of it represents a transfer from the state to the illegal private sector.

### How much state revenue is being lost?

There are state revenue losses at both central and local government levels. For hardwoods, the main loss is stumpage fees. Assuming all clandestine production was from national forest land, the quantity of each species was multiplied by official stumpage fees, resulting in an annual revenue loss of \$3.1–3.6 million. At the municipal level, the same quantities were multiplied by 1% of the sale price<sup>4</sup>, as established by the Municipalities Law, resulting in a loss of \$0.18–0.22 million.

For pine revenue losses, the calculation was more complicated since pine grows on a mixture of national, ejidal (municipality) and private land, and different forest fees apply according to tenure<sup>5</sup>, and whether there are auctions (on national forest land). Central government pine revenue losses came to an estimated \$3.0–5.1 million. The municipal level revenue loss, again based on a 1% sales tax<sup>6</sup> on timber from national and private forests, and the stumpage value of timber stolen from ejido forests, came to \$0.8–1.4 million.

**Table 2. Estimate of annual fiscal losses from illegal logging in Honduras (million US\$)**

Item	Hardwoods	Softwoods \$ million p.a.\$	Total
Central government: stumpage fees	3.1-3.6	3.0-5.1	6.1-8.7
Municipal fees and taxes	0.18-0.22	0.8-1.4	0.98-1.62
Income tax foregone	0.45-0.90	0.35-1.20	0.80-2.10
Total	3.73-4.72	4.15-7.70	7.88-12.42

The second main category of fiscal loss is foregone income tax collection. Illegal logging clearly generates much higher profit margins than legal forest management. A conservative estimate of profits is 15–30% of the gross value of production estimated earlier (\$8.5–10.5 million) – given the very low costs of illegal logging, profits are likely to be much higher than this. Where the illegal logger also processes clandestine timber, the income tax should be recouped along the processing and marketing chain unless the whole operation escapes detection. But when the clandestine logs are sold to other processors, the logger probably escapes paying income tax. There are also losses of income tax through under-declaration of furniture (or other processed products) production or exports. Therefore we assume here that 50% of the liable income tax is lost. At the average income tax rate (20%), this results in a loss of \$0.83–1.65 million<sup>7</sup> between hardwood and softwood production. As shown in Table 2, this results in a total annual fiscal loss of \$3.7–4.7 million for hardwoods, and \$4.2–7.7 million for softwoods, about \$8–12 million overall.

### The opportunity cost of 'wasted' public and external forest investment

Here we consider the opportunity cost to the country of wasted foreign and government expenditure in terms of achieving its

desired outcomes, most obviously progress towards more sustainable forest management (SFM). Another item of 'wasted expenditure' is the public money spent trying to tackle illegal logging – the costs of special operations, audits, legal proceedings and related administrative costs, etc.

From data on external support to the forest sector in the 1990s, an annual average of at least \$30 million in external grants and loans, as well as national public expenditure, was calculated. A considerable share of this was directed, for example, at developing community or local level SFM as part of Honduras' Social Forestry System. The results have been very disappointing. While the low effectiveness of public forest investment is due to a range of policy, market and institutional failures<sup>8</sup>, it can be argued that illegal logging results in a major negative incentive for SFM by depressing timber prices. The 'unfair competition' (lower costs and only marginally lower prices for illegal timber) with legal forest production makes legal production unprofitable (Box 1) and results in excess demand pressures on the resource. The problem is that there is no empirical basis for estimating to what extent illegal logging contributes to the failure of SFM, and the wastage of public forest investment. Based on expert opinion, we therefore assume this to be a modest 10–20%, resulting in an estimated annual loss of \$3–6 million.

### Total quantified financial loss

Figure 2 summarises the above calculations, as well as the equivalent calculations for Nicaragua (see below). The estimated annual financial or fiscal loss for Honduras was \$11–18 million, roughly equivalent to the annual budget of AFE-COHDEFOR (\$16 million in 2003), and the combined budgets of the National Institute for Child and Family (\$6 million), the National Institute for Women (\$0.5 million), the National Patronato for Infancy (\$3.2 million), and the National Provider of Basic Products (\$5.1 million). This is an annually recurring loss. The discounted (10%) net present value (NPV) is estimated in the range \$80–130 million<sup>9</sup>.

### Non-quantified financial losses

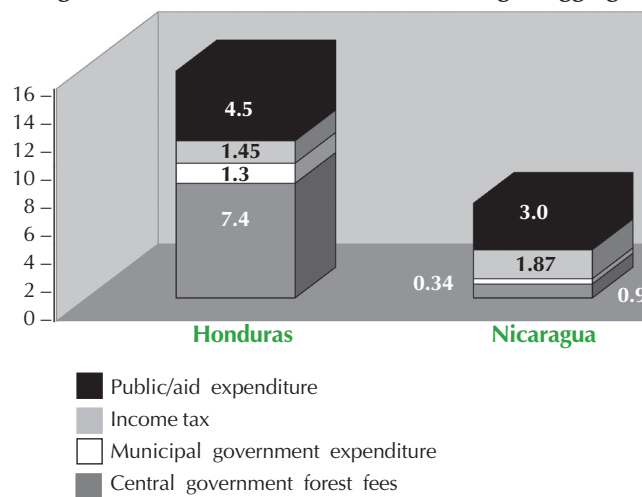
A number of other significant, but less quantifiable, financial losses were identified in Honduras (Del Gatto, 2003). These can be listed as follows:

- species falsification; for example, labelling mahogany as a species like *piojo* (*Tapirira guianensis*) results in a net stumpage fee loss of about \$23 per m<sup>3</sup>;
- the reduction of auction values or prices (see Box 2);
- loss of export levies or tariffs from a range of illegal actions including under-declared prices, grades and volumes; species falsification; and transfer pricing<sup>10</sup>
- non-payment of forest fees by timber merchants and private loggers through fraudulent use of community forestry rights, for example, by using 'non commercial licences' which do not pay stumpage fees on timber theoretically destined for community construction purposes;
- costs to the judiciary system, environmental 'fiscal' monitoring service, and police arising from illegal logging and its prosecution;
- higher wastage levels attributable to cheaper logs or timber.

### Box 1. The problems of COATLAHL Cooperative, Honduras (Del Gatto, 2003)

The recent history of COATAHL Cooperative, supplied by small community groups in the surrounding mountains, shows the gravity of the socio-economic impacts of illegal logging. Since the early 1990s, the number of affiliated groups has halved, and grassroots membership fallen by 75%. Although there have been other factors like administrative, conversion and storage inefficiencies, 'unfair competition' from illegal logging has played a major role. COATLAHL groups, given their production costs and only marginally higher sale prices than illegal production, have found it very difficult to compete. Increasing conflict and local insecurity is also discouraging long-term forest management in the area, for example, the timber of these communities is vulnerable to theft by armed bands. Former COATLAHL members have now switched to illegal logging in order to earn a livelihood; they have been effectively criminalised by the economic consequences of illegal logging itself, as well as over-complex regulations.

Figure 2. Annual financial loss due to illegal logging



## Direct Financial Cost to the Nicaraguan Government

### Clandestine timber: how much is it?

In the absence of a survey of illegal logging, the estimates of illegal logging in Nicaragua relied mainly on key informants, including those working in the timber marketing chain. The consensus estimate was 70–80% of official production was clandestine both for hardwoods and softwoods. Official roundwood production in 2001 was 43,830 m<sup>3</sup> for hardwoods, and 159,000 m<sup>3</sup> for softwoods, so the clandestine cut was initially estimated at 30,000–35,000 m<sup>3</sup> for hardwood and 110,000–130,000 m<sup>3</sup> for softwood.

As in Honduras, calculations were made of the residual from national demand and supply estimates, in this case taking only the midpoint of the production range (Table 3). These resulted in about 50,000 m<sup>3</sup> for hardwoods and 135,000 m<sup>3</sup> for softwoods. It can therefore

## Box 2. Reduction of pine concession auction revenues in Honduras (Del Gatto, 2003)

Just as illegal logging depresses domestic market values, it also reduces the auction values from softwood forestry concessions on national forest land received by AFE-COHDEFOR. During the mid-1990s, the Head of COHDEFOR, Lic Rigoberto Sandoval, was credited with having made serious efforts to improve forest governance, for example, reducing high level political corruption and field level 'bureaucracy corruption'. There was probably a lower incidence of illegal logging in the period up to his replacement in 1998. By contrast, there is considerable anecdotal evidence of a sharp decline in governance standards in the succeeding period (1998-2002), including an increase in corruption at all levels (Lazo, 2001).

Average auction prices over 1998-2000 (Lps.202/m<sup>3</sup> for a volume of 295,906 m<sup>3</sup>) were much lower than 1995-1997 (Lps.305/m<sup>3</sup> for 557,518 m<sup>3</sup>). Auction revenues fell by more than \$3 million per year. But it is difficult to establish how much of the difference in auction revenues was attributable to illegal logging *per se*, since there were other causes of the price reduction, like increased private sector pine production. Collusion between bidders, another problem of weak governance, may also have been significant. Such factors make it difficult to assign a specific 'illegal logging' loss.

be reasonably estimated that clandestine hardwood production is in the range 30,000-50,000 m<sup>3</sup>, about half the total production, and clandestine softwood production 110,000-135,000 m<sup>3</sup>, about 40-45% of total production. Key informants estimated that overall national roundwood production was in the range 350,000-400,000 m<sup>3</sup>, which is consistent with the above estimates. However, some key informants felt that the hardwood estimate was too low since it excludes frontier timber and 'illegal' home consumption by farmers.

### What's it worth?

Based on an average FOB roundwood export value of \$334 per m<sup>3</sup> for hardwood species, the value of clandestine hardwood production was estimated at \$10-17 million<sup>11</sup>. The gross value of clandestine softwood production can be estimated at \$9-11 million based on an average roundwood value of \$80 per m<sup>3</sup>. This results in a total value of clandestine production of \$19-28 million. This only shows the scale of the problem, not the economic loss to Nicaragua.

### How much state revenue is being lost?

As for Honduras, there are losses at both the national and municipal levels. At the national level, there are losses of 75% of the forest management tax<sup>12</sup>, a modest forest service tax, and income tax (similar assumptions were made as for the Honduran calculations). These losses sum

**Table 3. Estimate of annual fiscal loss from illegal logging in Nicaragua (million US\$)**

Demand and supply categories	Hardwoods 000 m <sup>3</sup>	Softwoods 000 m <sup>3</sup>
Carpentry workshop consumption <sup>a</sup>	53	0.1
Construction industry consumption <sup>b</sup>	8	142
Registered exports <sup>c</sup>	53	152
Total (D)	114	294
Registered production	44	159
Registered imports <sup>c</sup>	20	0.5

#### Notes

<sup>a</sup>Carpentry workshop consumption was based on surveys, funded by international donors, carried out in 2000 of the number of workshops and annual workshop throughput levels.

<sup>b</sup>Construction industry consumption was based on estimates by key informants in the construction industry and by the national Chamber of Construction.

<sup>c</sup>Hardwood exports and imports on official 2001 statistics, applying conversion ratio of 1.38 kg per board for hardwoods, and 0.77 kg per board foot for softwoods.

to \$1.3-2.4 million for hardwoods and \$0.6-1.1 million for softwoods, and a total of \$1.9-3.5 million per annum, as detailed in Table 4.

At the municipal level, there is the loss of 25% of the forest management tax and a 1% municipal tax on the sale value. The combined hardwood and softwood loss came to a modest \$270,000-410,000 per annum. The combined central and municipal government fiscal loss was in the range \$2.2-3.9 million.

### Opportunity cost of public and external forest investment

Annual donor and national investment in the forest sector is estimated at \$15-25 million. Applying the same 10-20% range for the contribution of illegal logging to the failure of SFM, and therefore the waste of public expenditure and donor funding, the estimated opportunity cost was \$2-4 million.

### Total quantified financial loss

The total annual financial loss to the Nicaraguan government was estimated at \$4-8 million. This is equivalent to the cost of housing about 3,600 people per year in 600 houses; or employing about 5,000 teachers who would help educate about 150,000 children; or providing technical assistance to 3,000 farmers. Figure 2 shows that the share of forest fees was much lower than Honduras, reflecting

**Table 4. Estimate of annual fiscal loss from illegal logging in Nicaragua (million US\$)**

	Hardwoods \$ million p.a.	Softwoods \$ million p.a.	Total \$ million p.a.
<b>National Level</b>			
75% of forest management tax	0.42-0.70	0.16-0.20	0.58-0.90
Forest service tax	0.04-0.06	0.05-0.06	0.09-0.12
Income tax (25%)	0.84-1.68	0.41-0.81	1.24-2.49
Total national level	1.33-2.44	0.61-1.07	1.91-3.51
<b>Municipal Level</b>			
25% of forest management tax	0.14-0.23	0.06-0.07	0.20-0.30
Municipal tax (1%) on sale price	0.05-0.08	0.02-0.03	0.07-0.11
Total Municipal level	0.19-0.31	0.08-0.10	0.27-0.41
<b>Combined national total</b>	<b>1.49-2.75</b>	<b>0.69-2.07</b>	<b>2.17-3.92</b>



differences in forest land tenure, whereas the loss of income tax was higher.

Again it is important to recall that this is an annually recurring loss; the discounted (10%) NPV was \$30–60 million<sup>13</sup>. As in Honduras, there are various other direct, but less quantifiable, financial losses from illegal logging and other fraudulent actions.

## Other Economic Costs

There are a number of less quantifiable economic costs to the country and society from illegal logging, listed by Contreras-Hermosilla (2002), Callister (1999) and others:

- loss of a range of environmental and other non-marketed values stemming from illegal logging as a cause of deforestation and forest degradation;
- economic losses due to poor governance: macro-economic analysis shows there is significant correlation between weak governance and per capita incomes, as well as infant mortality, literacy levels and life expectancy, making it difficult to implement other development programmes (Thomas, 2000);
- illegal logging depresses and distorts private investment flows in the economy away from activities with higher national social and economic benefits (like SFM), and towards investment areas characterised by rent-seeking and corruption;
- the tendency for legal and institutional reforms to further encourage rent-seeking investments when illegal logging and corruption are prevalent<sup>14</sup>;
- revenues from industrial scale illegal logging are more likely to be expatriated than spent in-country, resulting in loss of the economic multiplier effect;
- the loss of tourism if an area becomes dangerous, as has happened in the Honduran Mosquitia (although cocaine trafficking is a more powerful driver of this).

It is important to note from the above that illegal logging does not just affect the forest sector, but the whole economy. The financial flows associated with illegal logging add to the informal sector, encourage speculative (e.g., real estate) and shady or illegal investments. This dilutes the effectiveness of monetary and other macroeconomic policies and encourages further corruption (Nalin Kishor, World Bank, personal communication).

### Indicative estimate of the loss of non-market values due to illegal logging

Arguably the most important indirect costs of illegal logging are the ‘knock-on’ governance impacts and the loss of non-market values due to deforestation and forest degradation. Having said these costs are less quantifiable, a preliminary attempt is made here at an (illustrative) estimation of the loss of non-market values. As already mentioned, a very important indirect effect of illegal logging is to reduce the incentive for SFM and encourage clearance for alternative land uses<sup>15</sup>. A major recent United Nations Environment Programme report (UNEP, 2002) listed the expansion of agricultural land, over-harvesting of industrial wood, and *illegal logging* as the main causes of global deforestation. It is known that most deforestation is carried out illegally, and that corruption and illegal logging are rampant in Central America. A very conservative

estimate based on expert opinion is that 10–20% of broadleaf deforestation in Central America is caused by illegal logging<sup>16</sup>.

Non-market values of forests include a range of non-timber forest products (NTFPs) like medicines, firewood, roofing and craft materials, nuts, fruits, etc.; environmental services like water flow regulation and quality, carbon retention, and watershed protection (including soil protection, flood prevention, and reduced siltation of rivers, reservoirs and hydro-electric schemes); biodiversity values (e.g., for undiscovered pharmaceutical products); eco-tourism and recreation; aesthetic and existence values. Some of these values accrue more to international than national stakeholders, like carbon and existence values. There have been many economic studies of non-market values from tropical forests. A review of these studies by the renowned economist David Pearce (Pearce et al, 1999) found that, ignoring extreme estimates, there is a reasonable consensus around the following ‘central’ annual economic loss values:

- NTFP values: \$50 per ha
- Environmental or ecological values, excl. carbon: \$30 per ha
- Carbon retention: \$600–4,400 per ha<sup>17</sup>
- Eco-tourism and recreation: \$5–10 per ha
- Non-use or existence values: \$2–27 per ha

Taking the lower end of the carbon value range, the total non-market value for Central American broadleaf forest could be estimated at \$700–1100 per ha. This is still a modest estimate in comparison with some others; for example, a review by another well-known economist, Robert Constanza (1997), found a mean value for tropical rain forest conservation of \$1,543 per ha *excluding* food, ‘raw materials’ and recreation.

It is however very important to distinguish between national and global losses. Pearce concluded that a reasonable central estimate for the national non-market values *excluding carbon* was \$100 per ha, although this ‘average’ disguises large location-specific variation<sup>18</sup>. Annual broadleaf deforestation is estimated at about 3.5% (80,000–100,000 ha) in Honduras, and 2.4% (70,000–80,000 ha) in Nicaragua. Table 5 presents three calculations for each country based on different assumption scenarios and data.

The resulting estimated annual loss of national non-market values due to illegal logging, as presented in Table 5, was \$0.8–2 million for Honduras and \$0.7–1.6 million for Nicaragua. This is an annual loss in perpetuity. The NPV value<sup>19</sup> of the loss for *each year’s* deforestation due to illegal logging is estimated at \$6–15 million for Honduras, and \$5–12 million for Nicaragua, while the NPV of current and cumulative future deforestation due to illegal logging was \$62–124 million for Honduras, and \$55–110 million for Nicaragua<sup>20</sup>. Annex 1 provides more detailed calculations.

The proportion of global carbon loss attributable to Honduras and Nicaragua could be estimated on a population or area basis, but it would clearly be very small. It is more useful to estimate the economic cost to global society. This provides a maximum theoretical ‘willingness to pay’ figure by global society for conservation of broadleaf forests by the two countries. In order to err on the conservative side, the lower end of the estimated range for carbon retention (\$600–1,000) is used in Table 6. The NPV loss of global carbon values due to current and future illegal logging is estimated at \$371–1,237 million for Honduras, and \$332–1,107 million for Nicaragua. These calculations are presented in Annex 2.

**Table 5. Illustrative losses of national non-market values due to illegal logging**

Scenario	Honduras			Nicaragua		
	A	B	C	A	B	C
Deforestation: 000 ha	80	90	100	70	75	80
% cause illegal logging	10	15	20	10	15	20
Total annual loss						
\$ million	0.8	1.35	2.0	0.7	1.1	1.6
NPV one year's deforestation						
\$ million	6	10	15	5	8	12
NPV continued deforestation						
\$ million	62	93	124	55	83	110

\*This falls with the declining absolute levels of deforestation.

**Table 6. Illustrative losses of global carbon values due to illegal logging**

Scenario	Honduras			Nicaragua		
	A	B	C	A	B	C
Deforestation: 000 ha	80	90	100	70	75	80
% cause illegal logging	10	15	20	10	15	20
Annual non-market value \$/ha	600	800	1,000	600	800	1,000
Total annual loss						
\$ million	4.8	10.8	20.0	4.2	9.0	16.0
NPV one year's deforestation						
\$ million	35	79	147	31	66	118
NPV continued deforestation						
\$ million	371	742	1,237	331	662	1,103

\*This falls with the declining absolute levels of deforestation.

## Conclusions

With conservative assumptions, the annual direct financial losses to the governments of Honduras and Nicaragua due to clandestine timber production were calculated at \$11-18 million and \$4-8 million respectively. In discounted NPV terms, the financial losses come to \$80-130 million for Honduras, and \$30-60 million for Nicaragua. The annual gross economic value of clandestine timber was estimated at \$55-70 million for Honduras and \$20-30 million for Nicaragua; this money is not lost to the economy, but it indicates the scale of the problem. Much of it is transferred from the state to the illegal private sector.

It is important to note that current 'actual' losses understate the real loss to the governments, since they correspond to prices or values which are depressed due to high levels of illegal logging. For example, key informants in Nicaragua estimated that timber prices would be at least 20% higher without illegal logging; this would increase the annual financial loss from income and sales taxes in Nicaragua by over a million dollars. Thus if illegal logging can be brought under control, state revenue will increase significantly more than these estimates.

The estimation of the loss of non-market values due to illegal logging indicates that they are far in excess of direct financial losses, at least for tropical broadleaf forests - this is in line with a large environmental economics literature. The NPV of the loss of national non-market values due to illegal logging was provisionally estimated at \$62-124 million for Honduras, and \$55-110 million for Nicaragua, while the loss of global non-market values (essentially carbon retention) came to an NPV of over \$300 million (and possibly over a billion dollars) for each country. There are also a number of very important unquantified costs of illegal logging including:

- the impact of illegal logging on the quality of governance; poor governance correlates with low per capita incomes, literacy levels and life expectancy, and high levels of infant mortality;
- illegal logging and corruption tends to distort private investment flows away from high socio-economic return areas, and towards speculative and rent-seeking investments which dilute the effectiveness of monetary policies and help fuel further corruption;

- revenues from industrial scale illegal logging are more likely to be expatriated, resulting in loss of the domestic economic multiplier effect.

Given the scale and nature of these economic and financial losses, there is a clear case of national self-interest to tackle illegal logging. And with the global economic values at stake, there is also a powerful case for international beneficiaries to pay at least part of the costs of SFM or forest conservation. Environmental service payments can be a powerful incentive for legal and sustainable forest management.

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## Notes

- 1 In the interests of brevity, this paper does not describe the context, nature, dynamics and impacts of illegal logging, as these are covered in other papers located at [www.talailegal-centroamerica.org](http://www.talailegal-centroamerica.org).
- 2 There are various complexities of import and export data, for example, conversion of finished forest products to roundwood equivalents, problems of double-counting (since much of industrial consumption is exported), and how to estimate smuggled timber. The ban on hardwood log and lumber exports explains the absence of registered exports. While there is some evidence of export smuggling, the overall view is that clandestine exports and imports of hardwoods are in relatively small quantities. There could be more clandestine exports of softwood for construction purposes following natural disasters in recent years.
- 3 All values in US dollars unless otherwise stated. The hardwood species mix was based on a recent consumption survey of about 500 sawmills and workshops. For mahogany (*Swietenia macrophylla*) and cedar (*Cedrela odorata*), average FOB sawnwood export prices from recent years were used (\$900 and \$550 per m<sup>3</sup> respectively) and a conversion rate of 180 board feet per m<sup>3</sup> used, while for other species, the prices were based on those of the COATAHL Cooperative in La Ceiba (with appropriate conversion). For pine production, the average FOB sawnwood export price of recent years (\$140 per m<sup>3</sup>) was adjusted to its roundwood equivalent (200 board feet per m<sup>3</sup> roundwood).
- 4 Again using prices of COATLAHL Cooperative. These are in fact the prices used by the Municipality of La Ceiba when collecting its forest revenue.
- 5 For the central government calculation, national forest land fees were divided between foregone stumpage taxes on direct sales (33%), and auction revenue (67%), based on the official production breakdown. Average stumpage tax (Lps.155/m<sup>3</sup>) and auction prices (Lps.301/m<sup>3</sup>) were based on a 1997 study of forest taxation. For ejido and private land, the revenue loss is much less since the only charge is 40 Lempiras (about \$2.50) per m<sup>3</sup> for forest services established by AFE-COHDEFOR in 1996. A difficult assumption was how much clandestine timber comes from private and municipal land as opposed to national land, due to the large variation in foregone forest fees by tenure type. The assumption used was that clandestine production is distributed in the same proportion as official or 'legal' production – 47% from private forests, 36% from state forest land, and 17% from ejido land. Some observers think most illegal pine production is on national forest land since private landowners are less likely to want to 'cheat'. But tenure insecurity and forest policy uncertainties mean there is little incentive for long-term management by private owners. It was concluded that there is insufficient evidence to justify an alternative tenure distribution of clandestine pine production.
- 6 The average sale price in La Ceiba of Lps.4.2 (about \$0.25) per board foot was used.
- 7 In practice profit levels are much higher than 15%, so many operations would pay the 25% tax rate on annual profits exceeding about \$30,000. But against this, domestic sale prices are less than the FOB export prices used in the earlier calculation, and also it is likely that some tax will be paid on illegal timber forest products at some point in the marketing chain. Therefore it was decided to use the lower estimate.
- 8 These include policy and legal changes, tenure insecurity, institutional inefficiency and lack of motivation, lack of training and information, lack of coordination, and extra-sectoral policy factors like the promotion of agro-exports.
- 9 Even in 30 years time, when the benefits become negligible in present value terms, there would still be over 800,000 ha of broadleaf forest left in Honduras based on a current deforestation rate of 3.6%.
- 10 Under-priced sales to a subsidiary company in another country with lower tax levels or collection.
- 11 Assuming a conversion efficiency from roundwood of 30%. The softwood conversion efficiency is estimated at 50%.
- 12 This is equivalent to the more commonly used term 'stumpage charge', but this has a specific local meaning (a payment made by loggers to indigenous groups for the right to log) and so is avoided here.
- 13 With an annual deforestation rate of 2.4%, there would be almost 1.6 million ha of broadleaf forest left after 30 years.
- 14 A lax regulatory framework attracts less responsible international companies according to recent transition economy literature (Hellman et al, 2002). A characteristic of more responsible foreign direct investment is that it tends to avoid countries where illegalities and corruption are high.
- 15 Although it should be pointed out that lower timber prices can also reduce logging pressures (Kaimowitz & Angelsen, 1999).
- 16 It could be much higher; in Indonesia, for example, Global Forest Watch observe that illegal logging and corruption have doubled the rate of deforestation in the 1990s (Valerie Wauthier, Global Witness, personal communication).
- 17 This is the net carbon retention value after allowing for carbon retention by the subsequent land use. The bottom end of this range (\$600-1,000) refers to a change from open forest to agriculture or pasture; the middle of the range (\$2,000-3,000) represents conversion from closed secondary forest; and the top end of the range refers to the carbon loss from conversion of closed primary forest (\$4,000-4,400 per ha). The unit carbon value used was \$20 per tonne, which Pearce cites as a 'central value' from recent work on the economic damage from global warming (excluding catastrophic events). Recent work places this value at \$30-40 per tonne, but the lower figure is maintained to be conservative. When considering the carbon retention value of forests, it should also be recalled that deforestation is responsible for upwards of 20% of human-induced carbon emissions.
- 18 In practise there is clearly a huge variation in values, for example, they are much higher in areas with tourism value, or where vital watersheds are being protected close to urban areas.
- 19 All the Net Present Value calculations in this paper are based on a 10% discount rate.
- 20 It should be noted that these estimates exclude the non-market values of pine deforestation or degradation in the two countries, partly because these values are considerably lower, and deforestation is a less clearly defined phenomenon.

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ANNEX 1. ESTIMATION OF LOSS OF NATIONAL NON-MARKET VALUES DUE TO ILLEGAL LOGGING

**A. Honduras – national non-market values**

**(i) Estimated NPV loss due to one year's deforestation**

Scenario	A	B	C
Deforestation: 000 ha	80	90	100
% due to illegal logging	10%	15%	20%
Value \$000/ha	0.1	0.1	0.1
Value \$ million per year	0.8	1.35	2

**(ii) Estimate of NPV loss due to cumulative deforestation**

Scenario	A	B	C
% deforestation rate	3.2%	3.6%	4.0%
% due to illegal logging	10%	15%	20%
Value \$000/ha	0.1	0.1	0.1

Year	Scenario A			Year	Area	Area	Cumulative	Scenario A		
	\$ million	\$ million	\$ million		Remaining 000 ha	Deforested 000 ha	Deforested 000 ha	\$ million	\$ million	\$ million
1	0.8	1.35	2	1	2500	90	90	0.90	1.35	1.80
2	0.77	1.3	1.93	2	2410	87	177	1.77	2.65	3.54
3	0.75	1.26	1.87	3	2323	84	260	2.60	3.91	5.21
4	0.72	1.22	1.81	4	2240	81	341	3.41	5.12	6.82
5	0.7	1.18	1.75	5	2159	78	419	4.19	6.28	8.37
6	0.68	1.14	1.69	6	2081	75	494	4.94	7.41	9.87
7	0.65	1.1	1.63	7	2006	72	566	5.66	8.49	11.32
8	0.63	1.06	1.58	8	1934	70	636	6.36	9.53	12.71
9	0.61	1.03	1.52	9	1864	67	703	7.03	10.54	14.05
10	0.59	0.99	1.47	10	1797	65	767	7.67	11.51	15.35
11	0.57	0.96	1.42	11	1733	62	830	8.30	12.45	16.59
12	0.55	0.93	1.38	12	1670	60	890	8.90	13.35	17.80
13	0.53	0.9	1.33	13	1610	58	948	9.48	14.22	18.96
14	0.51	0.87	1.29	14	1552	56	1004	10.04	15.06	20.07
15	0.5	0.84	1.24	15	1496	54	1058	10.58	15.86	21.15
16	0.48	0.81	1.2	16	1442	52	1109	11.09	16.64	22.19
17	0.47	0.78	1.16	17	1391	50	1160	11.60	17.39	23.19
18	0.45	0.76	1.12	18	1340	48	1208	12.08	18.12	24.16
19	0.43	0.73	1.09	19	1292	47	1254	12.54	18.81	25.09
20	0.42	0.71	1.05	20	1246	45	1299	12.99	19.49	25.98
21	0.41	0.69	1.02	21	1201	43	1342	13.42	20.14	26.85
22	0.39	0.66	0.98	22	1158	42	1384	13.84	20.76	27.68
23	0.38	0.64	0.95	23	1116	40	1424	14.24	21.36	28.48
24	0.37	0.62	0.92	24	1076	39	1463	14.63	21.94	29.26
25	0.35	0.6	0.89	25	1037	37	1500	15.00	22.50	30.01
26	0.34	0.58	0.86	26	1000	36	1536	15.36	23.04	30.73
27	0.33	0.56	0.83	27	964	35	1571	15.71	23.56	31.42
28	0.32	0.54	0.8	28	929	33	1604	16.04	24.07	32.09
29	0.31	0.52	0.77	29	896	32	1637	16.37	24.55	32.73
30	0.3	0.51	0.75	30	863	31	1668	16.68	25.02	33.35
NPV-10%	5.88	9.92	14.69	NPV - 10%				61.85	92.77	123.70

**B. Nicaragua – national non-market values**

**(i) Estimated NPV loss due to one year's deforestation**

Scenario	A	B	C
Deforestation: 000 ha	70	75	80
% due to illegal logging	10%	15%	20%
Value \$000/ha	0.1	0.1	0.1
Value \$ million per year	0.7	1.13	1.6

Year	A \$ million	B \$ million	B \$ million
1	0.7	1.13	1.6
2	0.68	1.09	1.55
3	0.65	1.05	1.5
4	0.63	1.02	1.45
5	0.61	0.98	1.4
6	0.59	0.95	1.35
7	0.57	0.92	1.31
8	0.55	0.89	1.26
9	0.53	0.86	1.22
10	0.52	0.83	1.18
11	0.5	0.8	1.14
12	0.48	0.77	1.1
13	0.47	0.75	1.07
14	0.45	0.72	1.03
15	0.44	0.7	1
16	0.42	0.68	0.96
17	0.41	0.65	0.93
18	0.39	0.63	0.9
19	0.38	0.61	0.87
20	0.37	0.59	0.84
21	0.36	0.57	0.81
22	0.34	0.55	0.79
23	0.33	0.53	0.76
24	0.32	0.52	0.73
25	0.31	0.5	0.71
26	0.3	0.48	0.69
27	0.29	0.47	0.66
28	0.28	0.45	0.64
29	0.27	0.44	0.62
30	0.26	0.42	0.6
NPV-10%	5.14	8.26	11.75

**(ii) Estimate of NPV loss due to cumulative deforestation**

Scenario	A	B	C
% deforestation rate	2.20%	2.35%	2.50%
% due to illegal logging	10%	15%	20%
Value \$000/ha	0.1	0.1	0.1

Year	Area Remaining 000 ha	Area Deforested 000 ha	Cumulative Deforested 000 ha	A \$ million	B \$ million	C \$ million
1	3177	75	75	0.75	1.13	1.50
2	3102	73	148	1.48	2.22	2.96
3	3029	71	219	2.19	3.29	4.38
4	2958	70	289	2.89	4.33	5.77
5	2889	68	357	3.57	5.35	7.13
6	2821	66	423	4.23	6.34	8.46
7	2755	65	488	4.88	7.31	9.75
8	2690	63	551	5.51	8.26	11.01
9	2627	62	612	6.12	9.19	12.25
10	2565	60	673	6.73	10.09	13.45
11	2505	59	732	7.32	10.97	14.63
12	2446	57	789	7.89	11.84	15.78
13	2388	56	845	8.45	12.68	16.90
14	2332	55	900	9.00	13.50	18.00
15	2277	54	954	9.54	14.30	19.07
16	2224	52	1006	10.06	15.09	20.12
17	2172	51	1057	10.57	15.85	21.14
18	2121	50	1107	11.07	16.60	22.13
19	2071	49	1155	11.55	17.33	23.11
20	2022	48	1203	12.03	18.04	24.06
21	1975	46	1249	12.49	18.74	24.98
22	1928	45	1295	12.95	19.42	25.89
23	1883	44	1339	13.39	20.08	26.78
24	1839	43	1382	13.82	20.73	27.64
25	1795	42	1424	14.24	21.36	28.48
26	1753	41	1465	14.65	21.98	29.31
27	1712	40	1506	15.06	22.58	30.11
28	1672	39	1545	15.45	23.17	30.90
29	1632	38	1583	15.83	23.75	31.67
30	1594	31	1614	16.14	24.21	32.29
NPV - 10%				55.37	83.06	110.75

ANNEX2. CALCULATIONS OF LOSS OF GLOBAL NON-MARKET VALUES

**A. Honduras -global non-market values**

**(i) Estimated NPV loss due to one year's deforestation**

Scenario	A	B	C
Deforestation: 000 ha	80	90	100
% due to illegal logging	10%	15%	20%
Value \$000/ha	0.6	0.8	1
Value \$ million per year	4.8	10.8	20

**(ii) Estimate of NPV loss due to cumulative deforestation**

Scenario	A	B	C
% deforestation rate	3.2%	3.6%	4.0%
% due to illegal logging	10%	15%	20%
Value \$000/ha	0.6	0.8	1

Year	A \$ million	B \$ million	B \$ million
1	4.8	10.8	20
2	4.64	10.44	19.33
3	4.49	10.09	18.69
4	4.34	9.76	18.07
5	4.19	9.43	17.46
6	4.05	9.12	16.88
7	3.92	8.81	16.32
8	3.79	8.52	15.77
9	3.66	8.23	15.25
10	3.54	7.96	14.74
11	3.42	7.69	14.25
12	3.31	7.44	13.77
13	3.2	7.19	13.31
14	3.09	6.95	12.87
15	2.99	6.72	12.44
16	2.89	6.49	12.03
17	2.79	6.28	11.63
18	2.7	6.07	11.24
19	2.61	5.87	10.86
20	2.52	5.67	10.5
21	2.44	5.48	10.15
22	2.35	5.3	9.81
23	2.28	5.12	9.49
24	2.2	4.95	9.17
25	2.13	4.79	8.86
26	2.06	4.63	8.57
27	1.99	4.47	8.28
28	1.92	4.32	8.01
29	1.86	4.18	7.74
30	1.8	4.04	7.48

Year	Area Remaining 000 ha	Area Deforested 000 ha	Cumulative Deforested 000 ha	A \$ million	B \$ million	C \$ million
1	2500	90	90	5	11	18
2	2410	87	177	11	21	35
3	2323	84	260	16	31	52
4	2240	81	341	20	41	68
5	2159	78	419	25	50	84
6	2081	75	494	30	59	99
7	2006	72	566	34	68	113
8	1934	70	636	38	76	127
9	1864	67	703	42	84	141
10	1797	65	767	46	92	153
11	1733	62	830	50	100	166
12	1670	60	890	53	107	178
13	1610	58	948	57	114	190
14	1552	56	1004	60	120	201
15	1496	54	1058	63	127	212
16	1442	52	1109	67	133	222
17	1391	50	1160	70	139	232
18	1340	48	1208	72	145	242
19	1292	47	1254	75	151	251
20	1246	45	1299	78	156	260
21	1201	43	1342	81	161	268
22	1158	42	1384	83	166	277
23	1116	40	1424	85	171	285
24	1076	39	1463	88	176	293
25	1037	37	1500	90	180	300
26	1000	36	1536	92	184	307
27	964	35	1571	94	189	314
28	929	33	1604	96	193	321
29	896	32	1637	98	196	327
30	863	31	1668	100	200	334

NPV-10%                      35                      79                      147

NPV - 10%                      371                      742                      1237

**B. Nicaragua – global non-market values**

**(i) Estimated NPV loss due to one year's deforestation**

Scenario	A	B	C
Deforestation: 000 ha	70	75	80
% due to illegal logging	10%	15%	20%
Value \$000/ha	0.6	0.8	1
Value \$ million per year	4.2	9	16

Year	A \$ million	B \$ million	B \$ million
1	4.2	9	16
2	4.06	8.7	15.47
3	3.92	8.41	14.95
4	3.79	8.13	14.45
5	3.67	7.86	13.97
6	3.55	7.6	13.5
7	3.43	7.34	13.05
8	3.31	7.1	12.62
9	3.2	6.86	12.2
10	3.1	6.63	11.79
11	2.99	6.41	11.4
12	2.89	6.2	11.02
13	2.8	5.99	10.65
14	2.7	5.79	10.3
15	2.61	5.6	9.95
16	2.53	5.41	9.62
17	2.44	5.23	9.3
18	2.36	5.06	8.99
19	2.28	4.89	8.69
20	2.21	4.73	8.4
21	2.13	4.57	8.12
22	2.06	4.42	7.85
23	1.99	4.27	7.59
24	1.93	4.13	7.34
25	1.86	3.99	7.09
26	1.8	3.86	6.85
27	1.74	3.73	6.63
28	1.68	3.6	6.4
29	1.63	3.48	6.19
30	1.57	3.37	5.98
NPV-10%	31	66	118

**(ii) Estimate of NPV loss due to cumulative deforestation**

Scenario	A	B	C
% deforestation rate	2.20%	2.35%	2.50%
% due to illegal logging	10%	15%	20%
Value \$000/ha	0.6	0.8	1

Year	Area Remaining 000 ha	Area Deforested 000 ha	Cumulative Deforested 000 ha	A \$ million	B \$ million	C \$ million
1	3177	75	75	5	9	15
2	3102	73	148	9	18	30
3	3029	71	219	13	26	44
4	2958	70	289	17	35	58
5	2889	68	357	21	43	71
6	2821	66	423	25	51	85
7	2755	65	488	29	59	98
8	2690	63	551	33	66	110
9	2627	62	612	37	73	122
10	2565	60	673	40	81	135
11	2505	59	732	44	88	146
12	2446	57	789	47	95	158
13	2388	56	845	51	101	169
14	2332	55	900	54	108	180
15	2277	54	954	57	114	191
16	2224	52	1006	60	121	201
17	2172	51	1057	63	127	211
18	2121	50	1107	66	133	221
19	2071	49	1155	69	139	231
20	2022	48	1203	72	144	241
21	1975	46	1249	75	150	250
22	1928	45	1295	78	155	259
23	1883	44	1339	80	161	268
24	1839	43	1382	83	166	276
25	1795	42	1424	85	171	285
26	1753	41	1465	88	176	293
27	1712	40	1506	90	181	301
28	1672	39	1545	93	185	309
29	1632	38	1583	95	190	317
30	1594	31	1614	97	194	323
NPV - 10%				332	664	1107