Supporting Information

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SI Text

Extrapolation of Data on Illegal Domestic Extraction for Commercial and Smallholder uses, and of Illegal Imports of Timber. Castren (1) is the only published study that compiled and analyzed estimates of illegal wood cutting and imports in Vietnam. Domestic illegal extraction in Vietnam for smallholders and industrial uses were estimated based on a study from the Forest Science Institute of Vietnam on wood consumption and flows in the Western highlands and southern region of Vietnam—the main centers of the wood processing industry. Based on NGO and official reports, it was shown that Cambodia was, at that time, the main source of illegal imports to Vietnam. Castren compiled four estimates of illegal imports from Cambodia to Vietnam in 1996–1997: (*i*) official figures of imports from the Vietnamese Ministry of Agriculture and Rural Development (given Cambodian regulations, all recorded timber imports from Cambodia were illegal), (*ii*) the study from the Forest Science Institute of Vietnam referred to above, (*iii*) an estimate by the NGO "Global Witness" based on a counting of trucks and rafts loaded with timber crossing the Cambodia–Vietnam border, which was extrapolated based on the number of crossing points and the length of the cutting season, and (*iv*) an estimate by an external consultant group as part of a World Bank-funded project on logging and forest regulations in Cambodia, based on an analysis of wood extraction, logging concessions and flows in the industrial sector. From all available sources of information, Castren also estimated wood imports to Vietnam from Laos and other minor source countries. Castren's figures thus combine multiple methods and estimates from the source and target countries of illegal trade. Domestic illegal extraction of commercial roundwood for 1997—estimated as the median of the figures from (1)—was extrapolated for previous and later years assuming a linear relationship with the evolution of wood prices on the domestic market. These prices were estimated for each year as the ratio of gross output of the forestry sector (in constant Vietnam Dong of 1994) divided by the volume of wood extraction recorded in official statistics (2, 3). Illegal imports of roundwood for 1997 was estimated by using the median figure from Castren (1). The ratio of illegal versus legal imports for this year—1.49—was assumed to remain constant over the period and was used to extrapolate through time an estimate of the illegal imports of roundwood. Domestic illegal extraction for smallholder uses (outside the commercial sector) was estimated by extrapolating the estimate for 1997 of Castren (1) following the rural population density.

Inaccuracies in the FAO Data for 1987–1997 for the Estimation of Illegal Imports. For the period 1987–1997, two sources of inaccuracies in the FAO data would have led to an underestimation of illegal imports by the input–output balance method. First, trade data for the 1980s were inaccurate because of the isolation of Vietnam at that time and confidentiality of trade statistics. Data from other sources suggest that FAO figures of domestic roundwood production are accurate (2–4), but exports figures were underestimated. For this period, FAO statistics record a yearly maximum of 438,000 m^3 of roundwood exports. Timber export, however, was a large source of income for the Vietnamese government during the postwar decades and were estimated at $\approx$1.4 M m^3 y^{-1} during the second "5 year plan" (1981–1985) (Ogle, Blakeney and Hoang Hoe, 1998, cited in ref. 5). Wood exports in 1991 were estimated at $\approx$1.5 M m^3 (6). After the export ban of 1992, it is likely that at least some illegal exports of roundwood remained.

Second, because of poor quality infrastructures and discrepancies between the capacity of the extraction and processing sectors, some of the roundwood extracted was stocked rather than directly used (7). Part of this stock deteriorated and thus contributed to the overestimation of the part of domestic supply actually used in the processing sector. Part of the stock was used in later years, therefore reducing the illegal imports in the following years. For these reasons, the negative values of illegal imports obtained from input–output balance for the period 1987–1997 were deemed to be erroneous and the extrapolations of published estimates of illegal imports were regarded as more realistic for that early period. For the 1998–2006 period, these problems are absent and the input–output-balance method was used to estimate illegal imports of timber. For the 1998–2003 period, when the extrapolation of published estimates were most accurate, the two datasets are consistent, with averages of 1.6 and 1.9 M m^3 y^{-1}. During this period, harvesting quotas in natural forests were stabilized, stocks were probably exhausted, and the exports of furniture and other wood products were just taking off. After 2003, the two datasets show less consistency, reflecting the limits of our extrapolation of 1997 figures. In sum, the illegal component of the displacement was calculated based on the extrapolation of published estimates of illegal timber trade for 1987–1997 and the input–output balance afterward (Fig. 2*E*).

Estimation of SPWP Exports. Furniture is the main SPWP exported by Vietnam (8). Furniture exports in weight were obtained from ref. 1 for 1995–1997 and from the United Nations COMTRADE database for 2000–2006. Based on an unpublished estimate by Pham Manh Cuong (Ministry of Agriculture and Rural Development of Vietnam) on Vietnamese data, we used a conversion factor of 145 kg/m^3 to calculate RWE of furniture exports. Figures were interpolated linearly for 1998–1999 and extrapolated for the years before 1995 by using the same growth rate as for 1995–1996.

Methodological Assumptions for the Calculation of Displacement. The main data are the FAO time series of forest products production and trade. FAO data on forest area and deforestation have been criticized, mainly for issues related to cross-country standardization, changes in forest definitions through time and varying methods of extrapolation (9). But forest area and deforestation data are not used in this study, and FAO data on forest products for Vietnam are not subject to the above problems. RWE conversion factors (Table S4) were held constant throughout the period, assuming that gains in processing efficiency were compensated by the decrease in the diameter of logs due to the depletion of natural forests and the increased use of fast-growing plantations (10). It is likely, however, that, even by taking these factors into account, the conversion factors improved slightly between the 1980s and 1990s in Vietnam, among others because residues were used more efficiently than in the past (1). Fuelwood has been excluded from this analysis. It is only traded locally (11), and therefore fuelwood imports cannot represent a direct source of displacement. Because of its low value, it is also unlikely to compete with other commercial uses of wood and generate indirect displacement. Fuelwood harvests remained stable throughout the period at $\approx$25 M m^3 y^{-1} (11–13), and therefore are unlikely to have influenced the

balance between supply and demand of forest products for other uses.

The production of processed wood products in Vietnam (*PPr* in Eq. **1**) was calculated as the sum of the production of sawnwood, veneer sheets, plywood, particle boards, medium-density fiberboards (MDF), mechanical wood pulp, chemical wood pulp and semichemical wood pulp. Chips and particles were excluded as they mostly come from wastes and are intermediate products for manufacturing paper, paperboards and particle boards. The quantity of imports of processed wood products was calculated as the sum of the legal imports of sawnwood, veneer sheets, plywood, chips and particles, particle boards, insulating boards, hardboards, MDF, mechanical wood pulp, chemical wood pulp, semichemical wood pulp, paper and paperboard and recovered paper. Imports of secondary processed wood products are negligible (<5,000 m^3 based on COMTRADE data).

Discrepancies between trading partners reports are not reliable indicators to estimate illegal timber trade (14). In Vietnam, data on bilateral trade flows are classified and FAO estimates are only available for the 2000s. Most illegal timber imports into Vietnam cross the borders by terrestrial roads from Cambodia and Laos and are reported on neither side (8, 15). Discrepancies between domestic production and consumption of forest products may constitute a reliable indicator of illegal timber trade provided that statistics of wood production, processing and imports are accurate (14). FAOSTAT holds the only complete and publicly available time series on wood production and trade in Vietnam, which is not member of ITTO and does not publish detailed statistics on this topic. All illegally imported logs were assumed to enter the legal processing industry, and illegal imports of processed wood products were assumed to be negligible. The wood-processing sector benefits from legal and fiscal incentives, so that the former assumption is reasonable. Laos and Cambodia, the main sources of illegal wood imports to Vietnam, have banned all exports of roundwood, but not of processed wood products, so that imports of processed wood were more likely to be recorded (legal), and illegal imports thus consisted mainly of roundwood (8, 15, 16). In the case of Vietnam, secondary or indirect leakage due to global equilibrium effects on wood prices were not calculated. But they are likely to be low because total wood exports—including processed wood—from Vietnam have not decreased after roundwood export ban policies. Moreover, neighboring countries—mainly Laos and Cambodia—have increased their extraction to supply Vietnam but not decreased their exports to other countries.

Domestic illegal extraction for commercial uses was assumed to follow the evolution of prices, whereas illegal imports were assumed to follow legal imports. These two methods were used to reflect different processes. The high increases in imports were due to the combination of increasing demand, degradation and scarcity of forests in Vietnam and abundant forest resources in neighboring countries. These factors affect similarly legal as well as illegal imports. The scarcity of forests in Vietnam made illegal cutting at home depend more on prices increases to cover the increasing extraction costs. After 2003, the new Forest Law strengthened penalties for illegal activities in forests, however, according to official reports, illegal extraction for smallholder as well as commercial uses remained important (17). Furthermore, a reduction of illegal extraction for commercial uses might have increased the displacement, whereas a similar reduction by smallholders would have increased the unharvested fraction of wood increment, therefore having neutralizing effects on the ratio of displacement on unharvested wood increment.

Methodological Assumptions for the Calculation of Wood Increment in Vietnam's Forests. For tree plantations, an average figure of MAI of 10 $m^3\ ha^{-1}\ y^{-1}$ and a rotation time of 10 years were used (18). Other estimates for plantations in Vietnam vary between 6 $m^3\ ha^{-1}\ y^{-1}$ (1) and 15 $m^3\ ha^{-1}\ y^{-1}$ (19). The most common genuses are respectively *Eucalyptus* (32% to 60% of tree plantations, mostly *E. camaldulensis*), *Pinus* and *Acacia* (mostly *A. auriculiformis*) (20, 21). Worldwide, figures of MAI for *E. camaldulensis* vary from 10 to 30 $m^3\ ha^{-1}\ y^{-1}$; for *Pinus* species, from 8 to 50 $m^3\ ha^{-1}\ y^{-1}$; for *A. auriculiformis*, from 6 to 20 $m^3\ ha^{-1}\ y^{-1}$ (21, 22). Our MAI estimate accounts for the poor level of management of Vietnam's plantations. Average rotation lengths worldwide are 12 years for *E. camaldulensis*, 15 years for *A. auriculiformis*, and ≈30 years (16–50) for various *Pinus* species (22). For rotation length, our estimate corresponds to the situation of Vietnam, where scarcity of raw material combined with the farmers needs for fast returns cause plantations to be often exploited very young, sometimes after only 6–7 years (20, 23, 24)."Trees Outside Forests" (TOF), called scattered trees in Vietnam, have been planted since 1960 following a longstanding tradition encouraged by the government (25). The number of trees planted each year was reconstructed from various sources (2, 19, 25–27). The annual numbers of scattered trees were converted to equivalent area by considering 2000 trees initially planted for 1 ha (12, 26). Growth in scattered tree plantations was calculated by using the same parameters as for other tree plantations (1, 12), i.e., a MAI of 10 $m^3\ ha^{-1}\ y^{-1}$ and a rotation time of 10 y. By using these parameters, a managed area of forest plantation can yield 10 $m^3\ ha^{-1}\ y^{-1}$ on an annual basis after 10 y of maturation. Scattered trees planted in a given year, with the same growth rate, provide 100 $m^3\ ha^{-1}$ after 10 y on a one-time basis. This is because, for forest plantation, we used the total area of plantation in each given year whereas, for scattered trees, we used the area of newly planted trees in each given year. Although most of these trees provide mainly fuelwood and wood for household uses, it was estimated that 25% of the wood from scattered trees feeds the industrial sector (28).

Rubberwood volumes produced from old rubber plantation were available for 2001–2006 from the Association of Natural Rubber Producing Countries (ANRPC, www.anrpc.org) and for 1991 from Balsiger et al. (29), and were interpolated and extrapolated to other years assuming the same proportion of rubber area harvested. Based on Gilmour et al. (28), we estimated that 25% of the rubberwood was used as fuelwood and was therefore excluded.

For natural forests, the parameters used yield an average MAI declining from 0.57 to 0.51 $m^3\ ha^{-1}\ y^{-1}$. This can be considered as conservative, given that an average figure of 1 $m^3\ ha^{-1}\ y^{-1}$ for southeast Asian natural forests is commonly used (30). Our parameter value reflects the degraded condition of Vietnamese forests, and the high proportion of young forest regenerated from fallows. Note that although the net natural forest cover increased only since 1992–1993, many regenerated forests are older, and correspond to plots left for fallows before that time, and that were not cleared again in the 1990s. The logging wastes in situ parameter—20% of the extracted wood—is much lower than parameters used for carbon assessments (10, 31)—often two or three times the volume harvested—because our calculations of stock destroyed accounts only for commercially exploitable wood, whereas the latter estimates account for all of the biomass.

Parameters for Low and High Estimates of Displacement and Wood Increment. For RWE conversion factors, low and high values were found in the literature (Table S4) and used to generate low and high estimates of processed production, imports and exports. For domestic illegal extraction, we used as upper limit the estimate of 1 million $m^3\ y^{-1}$ for 1997 of total illegal cutting (5), which, by using the proportions of Castren (1), represents 435,000 m^3 of domestic illegal extraction for commercial uses instead of 410,000 m^3 in our most reliable estimate. This high estimate was

used to calculate a low figure of illegal imports. For the alternative estimate of illegal imports by using extrapolation of 1997 data (1), low and high estimates were also calculated. The highest value for 1997 was poorly substantiated and the median was therefore regarded as an upper bound. The Global Witness estimate, based on field observations, was more credible and was used to generate a low estimate of baseline illegal imports for 1997 of 460,000 m^3. Based on this and the low and high RWE conversion factors, we generated high and low estimates of the proportion of illegal/legal imports of wood, by using the high RWE conversion factors to generate a low proportion of illegal imports and vice versa. A high displacement was estimated by using a high value of logging wastes of 50%, corresponding to the highest value provided in Blanchez (18), that for Cambodia.

For the annual increment in commercially harvestable wood and its unexploited fraction, low and high estimates were also calculated. On the one hand, we used low and high values of different categories of forest area based on Meyfroidt and Lambin (32), with the standard MAI.

On the other hand, we used the initial area values, with alternative parameters (1): either a low MAI of 6 and 6.6 $m^3\ ha^{-1}\ y^{-1}$, respectively, for planted and TOF, or a high MAI of 1.5, 1 and 0.5 $m^3\ ha^{-1}\ y^{-1}$, respectively, for rich, medium and poor natural forests. The MAI of 15 $m^3\ ha^{-1}\ y^{-1}$ for plantations (19) was not used, because it assumes that all plantations are successful. For each year, we used the highest and lowest of these estimates. We did not combine low and high area and MAI figures because they both mostly capture an uncertainty in the density of natural vegetation land and a gradual transition between fallow and forest with commercially exploitable growing stock. Low and high unharvested fractions were calculated by using the above-described low and high parameters for domestic extraction.

For some parameters used to calculate wood increment, such as rotation time of plantations, proportion of timber wood in TOF and rubberwood, no reliable high and low estimates were available.

Interpretation of Low and High Estimates of Displacement and Wood Increment. Because of important uncertainties in forest area and MAI, low and high estimates of annual unharvested wood increment have a large range (Table S3). For the late 1990s, the low estimate of annual wood increment is decreased by the low estimate of MAI for plantation forests of 6 $m^3\ ha^{-1}\ y^{-1}$. Although, for the 1980s and early 1990s, this figure is a reasonable alternative to the 10 $m^3\ ha^{-1}\ y^{-1}$ estimate given the poor management of plantations, it is not a realistic figure for Vietnam's plantations during the late 1990s and the 2000s. The high estimate of annual increment is increased mainly by the high estimate of forest area from the FIPI data (32). This high estimate of natural forest area include many young forests that regenerated since the early or mid-1990s, for which a MAI of 0.4 $m^3\ ha^{-1}\ y^{-1}$ is overestimated. The high estimate of plantation area includes plots recorded by officials from Vietnam's government or by smallholders as aforested or reforested (32), but where planted trees did not survive. Our discussion was therefore mainly based on the most reliable estimates rather than on the large range given by the low and high estimates of annual increment.

1. Castren T (1999) *Timber Trade and Wood Flow Study—Country Report Vietnam* [Regional Environmental Technical Assistance 5771 Poverty Reduction and Environmental Management in Remote Greater Mekong Subregion (GMS) Watersheds Project (Phase I)].
2. Ministry of Agriculture and Rural Development (2002) *Statistics of Agriculture and Rural Development 1996–2000* (Agricultural Publishing House, Ha Noi).
3. General Statistical Office (2004) *Statistical Yearbook* 2004 (Statistical Publishing House, Ha Noi).
4. General Statistical Office (2000) *Statistical Data of Vietnam Agriculture, Forestry and Fishery 1975–2000* (Statistical Publishing House, Ha Noi).
5. McElwee P (2004) You say illegal, I say legal: The relationship between 'illegal' logging and land tenure, poverty, and forest use rights in Vietnam. *J Sustain Forest* 19:97–135.
6. Poffenberger M, Nguyen HP (1998) *Stewards of Vietnam's Upland Forests*, Poffenberger M, ed (Asian Forestry Network).
7. Lang C (2002) *The Pulp Invasion: The International Pulp and Paper Industry in the Mekong Region* (World Rainforest Movement, Uruguay).
8. EIA-Telapak (2008) *Borderlines: Vietnam's Booming Furniture Industry and Timber Smuggling in the Mekong Region* (Environmental Investigation Agency—Telapak, London).
9. Grainger A (2008) Difficulties in tracking the long-term global trend in tropical forest area. *Proc Natl Acad Sci USA* 105:818–823.
10. Enters T (2001) *Trash or Treasure? Logging and Mill Residues in Asia and the Pacific* (FAO, Bangkok, Thailand).
11. Ministry of Forestry (1992) *Vietnam Fuelwood and Energy Sectoral Review* (FAO, Bangkok, Thailand).
12. Prime Minister of the Government of Vietnam (2003) *Viet Nam Forestry Development Strategy 2006–2020* (Socialist Republic of Vietnam, Ha Noi).
13. FAO (1997) *Review of Wood Energy Data in RWEDP Member Countries* (FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand).
14. Johnson S (2003) Estimating the extent of illegal trade of tropical forest products. *Int Forest Rev* 5:247–252.
15. Global Witness (1999) *Made in Vietnam—Cut in Cambodia: How the Garden Furniture Trade Is Destroying Rainforests* (Global Witness, Washington, DC).
16. Schloenhardt A (2008) *The Illegal Trade in Timber and Timber Products in the Asia-Pacific Region*, Research and Public Policy Series No. 89 (Australian Institute of Criminology, Canberra).
17. Phuc TX, Sikor T (2006) *Illegal Timber Logging in Vietnam: Who Profits from Forest Privatization Connected with a Logging Ban?* (Presented at "Survival of the Commons: Mounting Challenges and New Realities," the Eleventh Conference of the International Association for the Study of Common Property, Bali, Indonesia, June 19–23, 2006), available at http://dlc.dlib.indiana.edu/archive/00001994/.
18. Blanchez J-L (1997) *Forest Resources and Roundwood Supply in the Asia Pacific Countries: Situation and Outlook to the Year* 2010 (FAO, Rome).
19. FAO (1999) *Asia-Pacific Forestry Sector Outlook Study: Volume I—Socio-Economic, Resources and Non-Wood Products Statistics* (FAO Regional Office for Asia and the Pacific, Rome).
20. Tran Xuan Thiep (1996) *Reports Submitted to the Regional Expert Consultation on Eucalyptus—Volume II*, White KK, ed (FAO Regional Office for Asia and the Pacific, Bangkok, Thailand).
21. FAO (2001) *Global Forest Resources Assessment* 2000, FAO Forestry Paper 140 (FAO, Rome).
22. FAO (2003) *Planted Forests Database (PFDB): Structure and Contents*, Planted Forests and Trees Working Paper 25 (FAO, Rome).
23. Midgley S, Pinyopusarerk K, Harwood C, Doran J (1997) *Exotic Plant Species in Vietnam's eEconomy—The Contributions of Australian Trees* (Resource Management in Asia-Pacific Working Paper No. 4, The Australian National University, Canberra).
24. Bien NN, Tuan NV, Nghia BC, Thoai TQ (2006) *Why Do Farmers Choose to Harvest Small-Sized Timber?—A Survey in Yenbai Province, Northern Vietnam.* (International Development Research Center, Ottawa).
25. De Jong W, Sam DD, Hung TV (2006) *Forest Rehabilitation in Vietnam: Histories, Realities and Future* [Center for International Forestry Research (CIFOR), REHAB Project, Bogor, Indonesia].
26. FAO (1995) *Forest Resources Assessment 1990: Tropical Forest Plantation Resources* (FAO, Rome).
27. Sikor T (1998) in *Stewards of Vietnam's Upland Forests*, ed Poffenberger M (Asian Forestry Network).
28. Gilmour DA, Nguyen VS, Tsechalicha, X (2000) *Rehabilitation of Degraded Forest Ecosystems in Cambodia, Lao PDR, Thailand and Vietnam: An Overview.* (International Union for Conservation of Nature Asia, Bangkok, Thailand).
29. Balsiger J, Bahdon J, Whiteman A (2000) *The Utilization, Processing and Demand for Rubberwood as a Source of Wood Supply* (FAO, Rome).
30. Kim Phat N, Knorr W, Kim S (2004) Appropriate measures for conservation of terrestrial carbon stocks—Analysis of trends of forest management in Southeast Asia. *Forest Ecol Manage* 191:283–299.
31. Sohngen B, Brown S (2004) Measuring leakage from carbon projects in open economies: A stop timber harvesting project in Bolivia as a case study. *Can J Forest Res* 34:829–839.
32. Meyfroidt P, Lambin EF (2008) Forest transition in Vietnam and its environmental impacts. *Glob Change Biol* 14:1319–1336.
33. ITTO (2007) *Annual Review and Assessment of the World Timber Situation* (International Tropical Timber Organization, Yokohama, Japan).
34. United Nations Economic Commission for Europe/FAO (2005) *European Forest Sector Outlook Study 1960–2000-2020. Main report* (United Nations, Geneva).
35. Sun X, Cheng N, White A, West RA, Katsigris E (2004) *China's Forest Product Import Trends 1997–2002: Analysis of Customs Data with Emphasis on Asia-Pacific Supplying Countries* (Forest Trends, Washington, DC).
36. Chunquan Z, Taylor R, Guoqiang F (2004) *China's Wood Market, Trade and the Environment* (Science, Monmouth Junction, NJ).
37. Katsigris E, et al. (2004) The China forest products trade: Overview of Asia-Pacific supplying countries, impacts and implications. *Int Forest Rev* 6:237–253.

Table S1. Components of the forestry sector in Vietnam, 1987–2006

	Roundwood production			Wood exports			Wood imports		
							Legal		
Year	Legal	Illegal	Processed wood production	Roundwood	Processed wood	SPWP	Roundwood	Processed wood	Illegal (consolidated)
1987	5,404	269	1,738	30	90	0	0	33	48
1988	5,094	269	1,810	83	237	0	0	24	36
1989	4,932	269	1,876	121	339	1	0	23	35
1990	4,669	269	2,438	438	21	1	0	38	56
1991	4,846	300	2,514	345	5	3	0	50	74
1992	4,464	354	2,520	59	516	6	0	101	150
1993	4,349	326	2,283	46	805	13	0	208	309
1994	4,387	341	2,316	16	402	28	0	241	359
1995	4,802	336	3,960	49	733	61	0	382	568
1996	4,877	371	3,552	50	702	130	1	430	641
1997	4,557	410	3,108	27	620	189	2	439	655
1998	4,326	443	5,845	16	582	265	6	917	1,086
1999	3,525	495	6,910	35	856	341	8	932	2,918
2000	4,183	428	6,969	35	856	417	8	932	2,385
2001	4,183	468	5,325	11	1,528	444	37	1,507	648
2002	4,183	455	6,461	15	1,646	667	54	1,549	1,783
2003	4,937	473	6,064	15	1,646	972	54	1,549	615
2004	5,237	476	7,066	24	3,397	1,472	125	3,232	1,252
2005	4,713	490	8,191	24	3,399	2,000	125	3,238	2,887
2006	5,070	500	8,549	10	4,955	2,625	203	5,096	2,785
Total, 20 y	92,738	7,743	89,494	1,448	23,333	9,636	623	20,921	19,291
Avg, 20 y	4,637	387	4,475	72	1,167	482	31	1,046	965

All data in RWE volume ('000 m^3).

Table S2. Displacement of wood extraction in foreign countries and annual increment in commercially exploitable growing stock in Vietnam's forests, 1987–2006

	Displacement ('000 m^3)			Increment in growing stock ('000 m^3)	
Year	Total	Policy-induced leakage	Demand-driven displacement	Total	Unexploited
1987	97	0	97	7,193	−177
1988	73	0	73	7,529	521
1989	69	0	69	7,880	1,057
1990	113	0	113	8,623	2,106
1991	148	0	148	9,022	2,246
1992	300	300	0	9,462	3,070
1993	621	565	55	9,935	3,705
1994	721	721	0	10,443	4,142
1995	1,140	926	215	10,989	4,188
1996	1,287	1,287	0	11,683	4,743
1997	1,315	1,315	0	12,438	5,838
1998	2,411	2,330	81	13,420	6,872
1999	4,630	2,759	1,871	14,090	8,615
2000	3,990	2,334	1,657	14,992	8,825
2001	2,630	2,560	70	15,939	9,730
2002	4,063	2,497	1,566	16,986	10,791
2003	2,661	2,508	153	17,961	10,846
2004	5,531	2,599	2,932	19,010	11,531
2005	7,500	2,835	4,665	19,740	13,195
2006	9,702	2,889	6,813	20,417	13,597
Total, 20 y	49,001	28,423	20,578	257,572	125,443
Avg, 20 y	2,450	1,421	1,029	12,879	6,272

All data in volume in forest (RWE volume × 1.2) ('000 m^3).

Table S3. Low and high estimates of displacement of wood extraction in foreign countries and of unexploited annual increment in commercially exploitable growing stock in Vietnam's forests, 1987–2006

	Displacement ('000 m^3)		Unexploited increment ('000 m^3)	
Year	Low	High	Low	High
1987	79	125	−1,065	6,342
1988	58	94	−548	6,653
1989	56	89	−193	6,792
1990	74	158	548	7,435
1991	97	207	499	7,143
1992	238	390	1,130	7,539
1993	485	813	1,574	7,764
1994	579	945	1,812	7,835
1995	900	1,475	1,654	7,580
1996	1,009	1,666	1,955	7,924
1997	1,028	1,703	2,781	8,914
1998	1,102	3,743	3,532	9,963
1999	3,137	6,602	4,978	11,856
2000	2,493	5,816	4,860	12,365
2001	1,500	3,894	5,428	12,654
2002	2,617	5,863	6,161	13,776
2003	1,326	4,107	5,899	13,898
2004	3,825	7,899	6,314	14,654
2005	5,636	10,575	7,749	16,391
2006	7,623	13,419	7,927	16,866
Total, 20 y	33,864	69,583	62,996	204,346
Avg, 20 y	1,693	3,479	3,150	10,217

All data in volume in forest (RWE volume × 1.2) ('000 m^3).

Table S4. Parameters for the conversion of wood products quantities (original units into brackets) to roundwood equivalent volume (RWE) in m^3

Type	Most reliable estimate	Alternative values	
		Low	High
Sawnwood, m^3	1.80*	1.46‡¶	1.97‖
Plywood, m^3	2.30*	—	2.13‖
Veneer, m^3	1.90*	—	2.50‡
Particle board, m^3	1.45†	1.40§	1.50‡
MDF (fiberboard), m^3	1.80‡§	1.40§	—
Mechanical wood pulp (T)	3.00‡	—	3.70§
Chemical wood pulp (T)	4.00‡	3.70§	—
Semichemical wood pulp (T)	3.30‡	—	3.70§
Chips and particles, m^3	1.80‡	1.60§	—
Wood charcoal (T)	6.00‡	—	—
Paper (T)	2.80‡	—	—

Sources: *, refs. 33 and 34; †, average between refs. 35 and 36; ‡, ref. 35; §, ref. 36; ¶, ref. 37; ‖ ref. 10.