The economic implications of illegal logging for the New Zealand forest sector

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Abstract

Illegal logging has a detrimental effect on sustainable forest management and wood products trade. These effects extend beyond the countries in which illegal logging occurs. In 2007 the Ministry of Agriculture and Forestry commissioned a study of the impact of eliminating illegal logging on the competitiveness of New Zealand wood products in domestic and foreign markets. This paper presents a summary of results from that study. Significant increases are predicted in the price and production of wood products in all countries that do not have suspicious harvests, particularly the United States, Canada, Finland, Sweden and Germany. Wood supply would decrease in countries with suspicious harvests, particularly Russia, China, Indonesia, Malaysia and Brazil. New Zealand's exports, particularly of logs, would be stimulated by higher prices and increased demand for radiata pine in foreign markets. Without illegal logging, log prices would be 11% higher in New Zealand, and harvests and log exports 1% higher. This in turn would increase returns to forest lands by 7.6% by 2020. Overall the New Zealand forest industry would gain NZ$264 million per year in increased revenue. This is similar to the estimated benefit to New Zealand of global tariffs on all wood products being eliminated.

Introduction

Illegal logging has gained considerable attention in recent years as a critical issue of sustainable forest management. Illegal logging has been estimated as accounting for 5% to 10% of global industrial roundwood production, 12% of the global softwood roundwood trade and 17% of the hardwood roundwood trade (Seneca Creek 2004). Conservation groups, the forest industry, governments, and international organisations have all begun initiatives to address this problem, with a variety of policies to combat illegal logging and stop imports of illegal wood products (Brack 2006).

Reflecting the growing concern regarding illegal logging the Ministry of Agriculture and Forestry commissioned a study, to estimate the economic impacts of illegal logging on the competitiveness of New Zealand wood products in domestic and export markets (Turner *et al*. 2007a)[1] The report is available online at http://www.maf.govt.nz/forestry/illegal-logging/trade-distortion-implications/index.htm. This paper summarises the results of that study.

Illegal logging involves a wide range of activities, which violate national and/ or international laws such as (Seneca Creek 2004): (i) harvesting without authority in designated parks or forest reserves, (ii) harvesting without authorization or in excess of concession permit limits (iii) failing to report harvesting activity to avoid royalty payments or taxes, and (iv) violating international trading rules and agreements.

[1] *The report is available online at http://www.maf.govt.nz/forestry/illegal-logging/trade-distortion-implications/index.htm*

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However non-governmental and governmental organisations tend to differ in their assessment of what constitutes illegal logging, with assessments often derived from anecdotal or circumstantial evidence (Curtin 2007). NGOs include issues such as whether forests are managed "sustainably" and whether royalties and fees have been levied at a fair market rate. Governmental organisations tend to focus on the extent that wood can be traced to an officially sanctioned logging operation. Given these issues there is considerable variation, as well as uncertainty, in estimates of the magnitude of the illegal logging and trade of forest products. Turner *et al*. (2007a) provides a detailed description of illegal logging in countries believed to have significant levels of illegal logging.

Surprisingly economic data on the effects of illegal logging are scarce; especially at the international level (Seneca Creek 2004, Li *et al*. 2008). The most comprehensive review on illegal logging and trade is Seneca Creek (2004), which derived estimates that generally fell between the extremes of the NGO and governmental sources. The study described here relied on a range of assessments to derive "low", "most likely", and "high" estimates; recognizing the potential limitations of each source. The Seneca Creek (2004) study was influential in the derivation of the "most likely" scenario due to its scope and widespread recognition (Table 1).

Illegal logging adversely affects important environmental services that come from forests (Bala *et al*. 2007). Illegal logging of Ramin (*Gonstylus spp*), a hardwood native to Indonesia and Malaysia, is reducing the habitat of the orangutan and Sumatran tiger (Jepson *et al*. 2001). Illegal logging also reduces government revenues from avoided royalties and taxes by about $US5 billion (NZ$7.5 billion) a year (World Bank 2002). An additional effect of the illegal log supply is the negative impact on the "wood is good" image (Seneca Creek 2004).

In Turner *et al*. (2007a) the economic effects of illegal

Table 1: Estimated rates of 2005 suspicious industrial roundwood harvests used in Turner et al. (2007a).

	Illegal Harvest Estimates (%)		
Country/ Region	Low	Most Likely	High
Africa WC[1]	20	30	40
Brazil	13	19	25
Other Latin America[2]	6	8	11
China	20	30	40
Indonesia	50	60	80
Malaysia	3	5	35
Other Asia[3]	12	17	23
Oceania[4]	50	75	80
Acceding EU[5]	7	10	13
Russia	10	18	40

[1]Gabon, Cameroon, Ghana and Liberia; [2]excluding Brazil; [3]excluding Indonesia, Malaysia, China and Japan; [4]Papua New Guinea and Solomon Is.; [5]Latvia and Estonia.

logging were estimated by comparing a "with illegal logging" scenario, with a "without illegal logging" scenario. This alternative made the same assumptions as the "with illegal logging" scenario, except that the supply of industrial roundwood was reduced by the "most likely" amount of illegal logging estimated in each country (Table 1). This representation assumes that "illegal" supply becomes unavailable at any log price, and represents a maximum potential impact of addressing illegal log supply.

The study was a desk based study using two economic models of forest products production, consumption, trade and prices. The first, an economic model of the international forest industry - the Global Forest Products Model (Buongiorno *et al*. 2003) - was used to view illegal logging in its full international context. This ensured estimates of the impact of illegal logging recognised the complex interactions among countries and industries in the global forest sector.

Estimates of price impacts from the Global Forest Products Model were used in a separate model of New Zealand radiata pine products, markets and competitors - the Radiata Pine Market Model (Katz 1988) - to develop more detailed estimates of the impact of illegal logging on the New Zealand radiata pine log and sawn timber sectors, investment in forestry, and hence forest inventory and area.

Both the Global Forest Products Model and the Radiata Pine Market Model use a spatial equilibrium structure (Samuelson 1952) to predict production, consumption, trade and prices of forest products. The two models differ, however, in country coverage, and product coverage and definitions. The Radiata Pine Market Model focuses on New Zealand radiata pine products, markets and competitors. The Global Forest Products Model has a broader country (180 countries) and product (fuelwood to wooden furniture) coverage, but less detail for New Zealand forestry and sawmilling sectors (Turner *et al*. 2008a). As with any models, the simulations developed cannot be taken as exact descriptions of the likely outcome of the scenarios studied (Brooks *et al*. 2001), in this case the elimination of illegal logging. The scenarios studied can, however, provide an indication of the likely direction and approximate magnitude of change that can be expected from elimination of illegal logging.

Global Impacts of Illegal Logging[2]

For the "most likely"[3] illegal logging scenario the predictions from the Global Forest Products Model show that in 2020 (Table 1), with the elimination of illegal logging, world industrial roundwood production would be 1.5% lower and the average log price 4.2% higher[4] (Tables 2 and 3).

As would be expected, countries with significant 'suspicious' harvests, such as Russia, China, Indonesia, Papua New Guinea, and Brazil experience decreased production of logs (Table 2), and also of processed products. Reduced competition from these countries means that countries with lower levels of 'suspicious' wood, including New Zealand, United States, Canada, Finland, Sweden and Germany, are predicted to experience higher production, export and prices for all their wood products.

The trade of industrial roundwood was affected more than production, due to the shift in harvesting from countries with high illegal logging to those without it. Exports of logs from Russia, Indonesia, Malaysia, and Papua New Guinea log exports decreased by 16% to 59%, while the United States, Germany, South Africa, Australia and New Zealand increased their log exports.

The elimination of illegal logging led to lower wood products production in countries with illegal wood supply, resulting in the corresponding world prices of all wood products being higher (Table 3). These higher prices flowed through to lower consumption of all wood products, both in countries with 'suspicious' harvests and in those without. Exports of sawnwood and wood panels by countries with

[2] *This section is based on material reported in "Turner, J.A., Maplesden, F.M., and Johnson, S. 2007. Measuring the impacts of illegal logging. Tropical Forestry Update 17(3): 19-22."*

[3] *Here we focus on the impact of eliminating the "most likely" level of illegal logging (Table 1). Turner et al. (2007a) describes the impact of eliminating "low" and "high" levels of illegal logging.*

[4] *All price changes are real, i.e., in constant purchasing power as of 2006.*

Table 2: Change in industrial roundwood production and trade in 2020 from eliminating 'most likely' levels of illegal logging

	Base Scenario			Change					
	Production	Import	Export	Production	Import	Export	Production	Import	Export
Country		(000 m³)			(000 m³)			(%)	
Africa	**49,077**	**694**	**7,818**	**161**	**78**	**-282**	**0.3**	**11.2**	**-3.6**
Nigeria	9,160	1	2	1	0	0	0.0	0.0	0.0
South Africa	18,738	1	3,088	1,047	0	828	5.6	0.0	26.8
North/ Central America	**797,163**	**5,833**	**29,450**	**18,904**	**447**	**2,748**	**2.4**	**7.7**	**9.3**
Canada	246,513	4,517	2,263	5,335	431	4	2.2	9.5	0.2
United States of America	530,691	1,162	27,126	14,402	1	2,748	2.7	0.1	10.1
South America	**202,601**	**52**	**2,266**	**-21,431**	**3**	**169**	**-10.6**	**5.8**	**7.5**
Argentina	7,421	9	12	-10	0	0	-0.1	0.0	0.0
Brazil	138,773	9	596	-20,181	0	-5	-14.5	0.0	-0.8
Chile	40,343	7	1,410	-889	0	174	-2.2	0.0	12.3
Asia	258,439	120,744	10,583	-26,469	2,022	-2,744	-10.2	1.7	-25.9
China	119,003	65,636	621	-15,315	-1,833	1	-12.9	-2.8	0.2
Indonesia	40,293	250	735	-5,851	21	-298	-14.5	8.4	-40.5
Japan	20,632	34,137	52	445	2,730	3	2.2	8.0	5.8
Malaysia	16,528	676	4,437	-2,714	66	-1,497	-16.4	9.8	-33.7
India	29,224	2,286	13	-1,551	6	0	-5.3	0.3	0.0
Oceania	55,809	93	19,875	496	0	-135	0.9	0.0	-0.7
Australia	28,572	81	4,342	1,207	1	902	4.2	1.2	20.8
New Zealand	23,901	5	12,698	1,048	0	660	4.4	0.0	5.2
Papua New Guinea	2,435	0	2,121	-1,286	0	-1,243	-52.8	0.0	-58.6
Solomon Is	856	0	791	-636	0	-616	-74.3	0.0	-77.9
Europe	**749,025**	**87,590**	**144,694**	**-7,240**	**-15,533**	**-12,678**	**-1.0**	**-17.7**	**-8.8**
EU25	414,871	80,203	30,604	16,326	-15,753	3,540	3.9	-19.6	11.6
Finland	57,814	31,889	357	3,664	-11,668	3	6.3	-36.6	0.8
France	37,974	1,036	2,181	1,041	0	89	2.7	0.0	4.1
Germany	40,639	486	13,024	2,362	0	1,877	5.8	0.0	14.4
Sweden	79,127	17,217	384	3,654	-3,695	2	4.6	-21.5	0.5
United Kingdom	9,457	418	18	262	188	0	2.8	45.0	0.0
Russian Federation	250,165	304	102,406	-24,564	0	-16,296	-9.8	0.0	-15.9
WORLD	**2,298,709**	**216,431**	**215,385**	**-35,005**	**-12,920**	**-12,920**	**-1.5**	**-6.0**	**-6.0**

Table 3: Change in world wood product prices1 from eliminating 'most likely' levels of illegal logging

	Base Scenario			Change					
	2010	2020	2030	2010	2020	2030	2010	2020	2030
Product		(NZ$/m³ or US$/t)			(NZ$/m³ or US$/t)			(%)	
Industrial roundwood	89	82	73	2.5	3.4	4.8	2.8	4.2	6.5
Sawnwood	276	261	244	3.9	6.0	8.9	1.4	2.3	3.6
Wood panels	487	472	463	4.8	4.0	7.6	1.0	0.8	1.6
Wood pulp	524	501	475	7.0	10.6	15.6	1.3	2.1	3.3
Paper	1015	989	971	6.0	6.3	7.9	0.6	0.6	0.8

[1] Prices are real, 2006 base year, free-on-board converted from US$ using US:NZ exchange rate of 1.49

Table 4: Change in New Zealand log and sawnwood production and prices1 in 2020 from eliminating "most likely" levels of illegal logging.

	Base Scenario		Change			
	Price	Production	Price	Production	Price	Production
Product	(NZ$/m^3)	(000 m^3)	(NZ$/m^3)	(000 m^3)	(%)	(%)
Sawlogs & small logs	58	12,356	0.7	33	1.3	0.3
Export logs	24	7,920	2.5	81	10.6	1.0
Peeler logs	55	1,549	0.7	5	1.5	0.3
Pulp & chip logs	6	4,506	0.4	25	5.9	0.6
Total roundwood	39	26,331	1.2	145	3.1	0.6
Sawnwood	404	5998	1.2	19	0.3	0.3
Sawmill margin[2]	118		-0.3		-0.3	

[1] Prices are real, 2006 base year, stumpage, free-on-board, or ex mill [2] operating margin is revenue minus fixed and variable operating costs.9

illegal wood supply were most affected (in percentage terms), reflecting the large proportion of production in countries with high levels of suspicious harvests.

In countries with high levels of illegal harvests and countries that process raw material from illegal harvests, comparative advantage in processing depends on both raw material and manufacturing costs. Countries that have low manufacturing costs, such as China and Indonesia, therefore remained competitive, even if they suffered a small reduction in competitiveness due to the fall off in illegal supply.

The reduction in global harvests associated with the elimination of illegal logging resulted in higher global forest stock (318 million m^3 or 0.1% higher in 2020), especially in countries with suspicious harvests. China's and Indonesia's forest stock increased by 1.0% and 1.4% respectively in 2020. In contrast, without illegal logging forest stock decreased in the United States, New Zealand and Sweden due to increased harvests. The predicted increase in global forest stock is likely to be too low because the Global Forest Products Model does not consider the positive effect of higher industrial roundwood prices on investment in sustainable management practices, and increased relative returns to forestry that would lead to conversion of agricultural and other land to forests.

Impacts on New Zealand[5]

The predicted significant changes to New Zealand's export markets due to the elimination of illegal logging suggest that there will be higher prices for species competing with New Zealand radiata pine in international markets. Projections from the Radiata Pine Market Model show that this will lead to increased demand and hence production and prices for radiata pine (Table 4).

The Radiata Pine Market Model results from the study found that the most significant change for New Zealand is an increase in volume, and prices for log exports, while sawnwood production and production of other wood products (wood panels, pulp, paper and secondary processed products) are less affected. This is because New Zealand sawnwood is used largely domestically and in Australia for structural products, where the proportion of wood products produced from illegal logs is relatively minor. Other markets (such as the United States mouldings market) also have a very low presence of illegal wood.

While the elimination of illegal logging leads to a global increase in the price of wood (Table 3), the final price effect for radiata pine is less than for the world because radiata pine is an imperfect substitute for wood from illegal sources. The price of New Zealand export logs is 10.6 percent higher, while the domestic log market shows a more modest 1.3 percent price rise. This difference is due to the limited increase in New Zealand exports of processed wood products.

The combined effect of these production and price changes is that New Zealand forestry and wood products sector producer revenues are higher. Significantly, the New Zealand forest industry as a whole would gain an annual equivalent revenue of NZ$264 million[6] per year. This impact is similar to the potential increase in producer revenue that would be realized with elimination of global tariffs on all wood products (Alberto Goetzl, Seneca Creek and Associates, and Joseph Buongiorno, unpub. data).

[5] *This section is based on material reported in "Turner, J.A., Maplesden, F.M., and Johnson, S. 2007. Measuring the impacts of illegal logging. Tropical Forestry Update 17(3): 19-22."*

[6] *Assuming a 10 percent discount rate, 2008 onwards.*

The Radiata Pine Market Model also predicts significant positive impacts on land value and plantation rates, stimulated by improved returns to forestry. Land values are predicted to increase by 7.6% (assuming a discount rate of 10%). The effect of this is that at the margin more land will be brought into forestry production.

Cautions on the Economic Models Used

As with all economic models, the accuracy of the predictions of the Global Forest Products Model and Radiata Pine Market Model depend on the data and the assumptions used. There are four areas of uncertainty in the models and analysis in this paper; (i) the model structure and parameter estimates, such as demand and supply elasticities, (ii) the model base-year data, (iii) the exogenous assumptions used to make projections, and (iv) the assumed magnitude of illegal logging.

Earlier versions of the Global Forest Products Model have been validated by comparing model predictions with actual data from 1980 to 2000. These showed that the model replicates the observed trends, if not the year to year detail (Buongiorno *et al*. 2003, Turner 2004). The behavioural characteristic of the Radiata Pine Market Model have previously been tested against historical data and policy experiments carried out to ensure results are realistic and internally consistent. The model parameters of both economics models have also been tested for consistency with economic theory.

The base-year production, consumption, trade and price data used in the Global Forest Products model are from FAO (2007). Although they contain inaccuracies, these are the only internationally comparable data. To address these inaccuracies, the base-year data are adjusted so that materials used in a country are consistent with the amounts of products manufactured and with *a-priori* knowledge of manufacturing techniques (Buongiorno *et al*. 2001, Zhu *et al*. 2006).

Exogenous assumptions, such as country economic growth, are used to make model projections. Uncertainty in these assumptions can be reflected by changing the scenarios. In the study by Turner *et al*. (2007a) assumptions relating to a critical influence on global wood supply, the export tax on Russian log exports (Turner *et al*. 2008b), were adjusted. For this study we have also used a base scenario drawn from a scenario developed in Turner *et al*. (2006), which compared Global Forest Product Model projections against expert opinion of trends to develop a robust base scenario.

Obviously the assumed changes in log supply due to illegal logging reported by Seneca Creek (2004) are not precise. Reflecting this, a range of values was used to represent the magnitude of illegal logging (Table 1).

Conclusions

Studies of the economic effect of illegal logging have shown that the elimination of illegal logging leads to significant increases in the price and production of wood products in almost all countries without illegal harvests (Seneca Creek 2004, Li *et al*. 2007, Turner *et al*. 2007a,b). The New Zealand forest industry as a whole could gain an annual equivalent revenue of NZ$264 million per year were global illegal logging eliminated. These studies suggest that an economic incentive therefore exists for legitimate producers in all countries to support measures to reduce illegal logging.

Beyond the direct economic benefits to the forest industry, illegal logging has potentially significant economic implications at the national level, in terms of lowering investment in forests and forest development. At the global level, illegal logging discourages forest investment that could help to address global deforestation and climate change (Turner *et al*. 2007a).

Reducing illegal logging could be achieved by a variety of measures, such as expanding wood certification, improving concession management, improved enforcement of forest laws, and sanctions for violators (McElwee 2004). Protecting parks and preserves, addressing corruption, clarifying tenure, reducing forestland conversion, and improving information systems would also help (Smith *et al*. 2003).

To be successful, however, policies must be widely adopted to ensure illegal supply is significantly reduced. Property rights for legitimate producers must be improved to enable them to capture the benefits from reduced illegal logging. The costs for legitimate producers must not increase more than those for illegal log producers. Otherwise, the cost differential would increase the incentive for illegal operators (Contreras-Hermosilla 2007).

Economic models of the forest sector, such as the Global Forest Products Model and Radiata Pine Market Model, can be used to assess the relative efficacy of the different policy measures being proposed to address illegal logging,

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