

ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY II

WORKING PAPER SERIES

Working Paper No. APFSOS II/ WP/ 2013/ 37

**THE POTENTIAL IMPACTS OF FOREST PRODUCT
LEGALITY REGULATIONS AND REDD+ ON FOREST
PRODUCTS PRODUCTION AND TRADE IN THE
ASIA-PACIFIC REGION**

by

Frances Maplesden, Kaisone Phengsopha and Adrian Whiteman



**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS REGIONAL
OFFICE FOR ASIA AND THE PACIFIC**

Bangkok, 2013

INFORMATION NOTE ON THE ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY

The Asia-Pacific Forestry Sector Outlook Study (APFSOS) is a wide-ranging initiative to gather information on, and examine, the evolution of key forestry issues as well as to review important trends in forests and forestry. The main purpose of the study is to provide a better understanding of the changing relationships between society and forests and thus to facilitate timely policy reviews and reforms in national forest sectors. The specific objectives are to:

1. Identify emerging socio-economic changes impacting on forest and forestry
2. Analyze probable scenarios for forestry developments to 2020
3. Identify priorities and strategies to address emerging opportunities and challenges

The first APFSOS was completed in 1998, with an outlook horizon to 2010. During its twenty-first session, held in Dehradun, India, in April 2006, the Asia-Pacific Forestry Commission (APFC) resolved to update the outlook extending the horizon to 2020. The study commenced in October 2006 and is expected to be completed by September 2009.

The study has been coordinated by the Food and Agriculture Organization of the United Nations (FAO), through its regional office in Bangkok and its headquarters in Rome, and implemented in close partnership with APFC member countries with support from a number of international and regional agencies. The Asian Development Bank (ADB), the International Tropical Timber Organization (ITTO), and the United Kingdom's Department for International Development (DFID) provided substantial financial support to implement the study. Partnerships with the Asia-Pacific Association of Forest Research Institutes (APAFRI) and the Secretariat of the Pacific Community (SPC) supported the organizing and implementing of national focal points' workshops and other activities, which have been crucial to the success of this initiative. The contributions of many other individuals and institutions are gratefully acknowledged in the main APFSOS report.

Working papers have been contributed or commissioned on a wide range of topics. These fall under the following categories: country profiles, sub-regional studies and thematic studies. Working papers have been prepared by individual authors or groups of authors and represent their personal views and perspectives; therefore, opinions expressed do not necessarily reflect the views of their employers, the governments of the APFC member countries or of FAO. Material from these working papers has been extracted and combined with information from a wide range of additional sources to produce the main regional outlook report.

In general, working papers are moderately edited for style and clarity and are formatted to provide a measure of uniformity, but otherwise remain the work of the authors. However in this case the contents have been heavily edited; while all care has been taken, some errors may have been introduced as a result of editing and interpretation. Copies of these working papers, as well as more information on the Asia-Pacific Forestry Sector Study, can be obtained from:

Mr. Patrick Durst
Senior Forestry Officer
FAO Regional Office for Asia and the Pacific
39 Phra Atit Road
Bangkok 10200
THAILAND
Ph. (66-2) 697 4000
Fax: (66-2) 697 4445
Email: patrick.durst@fao.org

Executive summary

This report investigates the potential impacts of forest product legality regulations and REDD+ on forest products production and trade in the Asia-Pacific region. The project reviews trends in forest resources, production and trade in the Asia-Pacific region with a focus on countries affected by forest product legality regulations (the EU Timber Regulation and amendments to the US Lacey Act) and REDD+ initiatives. A modeling approach is used to quantitatively assess their potential impacts on production and trade in the Asia-Pacific region.

The analysis confirms expectations that REDD+ is likely to have significant impacts on log supplies from Asia-Pacific forests, but minimal effects on processed wood products. Given the assumptions used in the model, Asia-Pacific countries with significant production shortfalls due to REDD+ are able to access log supplies from other sources, reducing the impacts on processed wood products.

While conclusions cannot be drawn from the model results about the extent to which alternative sources of supply have been accessed from illegal and/or non-sustainable, non-REDD countries within the region, the results highlight the need for regional approaches in addressing deforestation emissions, i.e. forest governance and SFM practices need to be addressed in non-REDD countries in order that REDD+ may achieve reductions in deforestation emissions at the Asia-Pacific regional level.

Impacts of forest products legality restrictions on trade flows are found to be minimal and result in diversion of a proportion of Asia's secondary processed wood products from the EU and USA to other markets. The study concluded that more detailed modeling work would be required to quantitatively assess the impacts of FPL implementation with respect to leakage and that more accurate data is required on domestic consumption in China and India.

Introduction

Tropical forests have been the focus of international efforts to mitigate the effects of climate change, with deforestation and forest degradation in tropical countries accounting for a significant proportion of global CO₂ emissions. Deforestation and forest degradation are the largest sources of greenhouse gas emissions in most tropical countries in the Asia-Pacific region. Moreover, clearing tropical forests further destroys globally important carbon sinks that are currently sequestering CO₂ from the atmosphere and are critical to future climate stabilization. Although deforestation and degradation have multiple causal factors, illegal logging and related trade have contributed to high rates of deforestation and forest degradation, in addition to undermining the competitiveness of legally sourced wood products in international markets.

In response to international concerns about the role of tropical forests in climate change, an international scheme, REDD+, has been introduced to address global greenhouse emissions from deforestation and forest degradation by creating incentives to reward developing countries for reducing and bringing these emissions under control and for enhancing forest stocks. While still in its formative stages, REDD+ has the potential to significantly alter the economics of land management and the dynamics of the timber trade from the Asia-Pacific region. Recognising the potential environmental, economic and social consequences of illegal logging and associated trade, legislation has been introduced in several consumer countries with the aim of eliminating illegally harvested forest products or timber products derived from such wood, from supply chains. These trade-based measures have escalated the requirement for certified legal and sustainable wood products and are expected to impact wood products suppliers in the Asia-Pacific region, particularly in countries or localities where the risk of illegal logging is judged to be high.

This report investigates the potential impacts of REDD+ and forest products legality regulations on production, consumption and trade in the Asia-Pacific region. Trends in production and trade in the Asia-Pacific region are reviewed, with a focus on countries that will be affected by forest product

legality regulations, and REDD+ initiatives. A modelling approach is used to quantitatively assess the potential impacts of forest product legality regulations in the EU and USA, and REDD+ initiatives, on production and trade in the Asia-Pacific region.

Production and trade in the Asia-Pacific region

Trends in forest resources, production and trade have been comprehensively reviewed in a separate report available on request from the FAO Regional Office for Asia and the Pacific, Bangkok. Some of the important developments of relevance to this analysis are as follows:

- A significant proportion of tropical plywood production in the Asia-Pacific region has shifted from Japan and Indonesia to China, which is now the largest global tropical plywood producer. Production is typically based on tropical log imports and domestically grown poplar for core material. China's tropical plywood exports will be challenged by legality verification requirements in export markets. Significant volumes of imported peeler logs from the Asian region are from PNG and the Solomon Islands which are regarded by some sources as medium to high-risk in terms of illegally sourced material. (Forest Trends 2011c).
- China dominates global production of secondary processed wood products which comprise mainly furniture and flooring. Although rapid growth in furniture exports has underpinned production growth over the last decade, many manufacturers are refocusing on domestic, rather than export, markets and moving up the value chain. Lower-end furniture and wood products manufacturing is moving to lower cost producers in the Asian region.
- A significant proportion of the global trade in tropical primary wood products (logs, sawnwood, veneer and plywood) is within the Asia-Pacific region with the major log trade flows being from Malaysia, PNG, Solomon Islands and Myanmar to China and India. Many of the other Asian producer countries have some sort of log export restriction in place, notably Indonesia, Thailand, the Philippines, Lao PDR and Cambodia.
- Asian countries supply nearly 65 percent of global tropical sawnwood exports and absorb about 77 percent of global imports. Malaysia has diversified its export destinations to a number of countries, such as Middle Eastern markets, which have no significant restrictions or barriers to wood products imports.
- While Malaysia and Indonesia's tropical plywood exports have been predominantly to Japan, China's tropical plywood exports have been subject to trade measures in its major markets (EU and USA) and have also been affected by difficulties in supplying environmentally certified products due to the complexity of the supply chain, quality concerns and rising production costs.
- In contrast to Asia-Pacific's trade in primary processed wood products, which is mainly intra-regional, exports of secondary processed wood products from the region are predominantly from China, and to a lesser extent Viet Nam, to the US and EU market destinations, although Japan is also an important market.
- Although EU countries have traditionally been major destinations for tropical wood products, total tropical sawnwood imports by EU countries have halved since 2007, and EU-27 imports totaled 2.1 million m³ in 2011. These imports are mostly remanufactured into high value furniture, joinery and flooring products which are consumed in EU markets. A growing trend has been a decline in EU imports of tropical primary products, including tropical sawnwood, and a corresponding rise in imports of finished products, particularly from Asian suppliers.
- In contrast to primary product imports which are dominated by Asian markets, the USA and EU region dominate world imports of secondary processed wood products. Wooden furniture

is the most important import item by value and dominated by imports from the USA, the largest country importer, which were valued at \$13.1 billion in 2011 and accounted for 24 percent of world imports. The EU region accounted for nearly 40 percent of the world's value of wooden furniture and parts imports in 2011, with Germany, France and the UK the major consumers although the UK is the largest importer of furniture from outside the EU. Most wood furniture imports by European countries were from Asia, with strong growth in 2010 and 2011 from China, Viet Nam, Indonesia and Malaysia.

Illegal trade in the Asia-Pacific region

A significant volume of cross-border trade within the Asia-Pacific region is suspected to be unrecorded and not legally sanctioned. Some of the common major drivers of illegal cross-border trade flows include financial incentives for forest land conversions, significant price disparities between domestic and export markets, regional demand pressures for wood raw material (particularly from China, Viet Nam and Thailand), poor governance capacity in State institutions to monitor logging activities in legally designated zones and particularly in remote frontier zones, and corruption among government officials. The magnitude of unrecorded cross-border trade is difficult to determine but is suspected to be large in many of the Asia-Pacific supplying countries. The major suspected illegal cross-border trade flows in the region are from Lao PDR to Viet Nam, Thailand and China; Myanmar to China and Thailand; and Cambodia to Viet Nam and Thailand.

Despite a government ban on the export of roundwood from Indonesia, logs are reportedly smuggled out via Malaysia and Singapore for processing in other neighbouring countries, with the possibility of fraudulent documentation disguising the country of origin (EIA 2010; Global Timber 2013, Responsible Research 2010, Chatham House 2013). Illegal logging (i.e. harvesting in contravention of the applicable legislation in the country of harvest) in Indonesia is extensive and estimated to cover 40 percent to 88 percent of roundwood production (Chatham House 2008; Seneca Creek 2004). Industrial inefficiency and overcapacity, particularly in the plywood industry, has been a contributing factor. Even at the lowest estimate, the extent of illegal logging suggests that a significant proportion of Indonesia's recorded wood products exports may be regarded as "suspicious". However, efforts are under way at the national level to combat illegal logging and it appears that some progress has been made, although Human Rights Watch (2009) suggests that operations to crack down on illegal logging have done little to bring legal accountability to the sector. A two-year suspension of new forest-clearing concessions was announced in 2010 as part of a climate-change partnership between the Government of Indonesia and the government of Norway that aims to reduce GHG emissions from Indonesian forests. Climate-change concerns are being integrated into Indonesia's forest-related institutions and a national strategy for REDD+ is being implemented in stages, including through the large-scale funding of REDD+ pilot projects.

Substantial volumes of illegal timber are suspected to enter the market in Thailand, both as imports from neighbouring countries (Myanmar and Lao PDR) or as a consequence of illegal logging within Thailand, despite a ban on logging in natural forests since 1989. In the 1990s, Thai industry was reported to be heavily involved in the over-exploitation of Myanmar forests along the Thailand border. In the 2000s, significant illegal cross-border timber trade was reported along the Myanmar border with Yunnan province in China, following cease-fire agreements along the Sino-Myanmar border (Forest Trends 2011a). In early 2006, the Chinese and Myanmar governments agreed to stop illegal cross-border timber trafficking, resulting in significant, although not total, reduction in illegal cross-border trade. Although recorded wood products trade between Myanmar and Malaysia is minimal, Forest Trends notes that some Myanmar trade is suspected to be directed through Malaysia to other destinations, particularly Thailand, where certificates of origin are mislabelled as being of Malaysian origin (Forest Trends 2011a; Forest Trends 2011e). It is unclear how much illegal timber leaves Thailand for end-use elsewhere, although much of the natural furniture production is exported and semi-processed wood products are exported to China and Viet Nam, where they are re-processed and exported to EU and US markets. Although China is particularly likely to be a destination for sawnwood smuggled out of Thailand, manufactured products which are officially recorded as exports to the EU, Japan and the USA might account for a greater quantity in terms of export value.

For two decades, Viet Nam has been known as a processing hub for illegal timber – particularly timber originating from Cambodia, Indonesia and, more recently, Lao PDR. There have been reports of Viet Nam imports of sawnwood from Lao PDR being re-routed directly to China. Although the Government of Lao PDR prohibits the export of logs and sawnwood harvested from natural forests, timber harvested from development areas (i.e. hydropower, roading and agricultural land clearances), which have been estimated to comprise 82 percent of the harvest volume, tends to be associated with illegality (Forest Trends 2011b; Forest Trends 2011d). Sawnwood exports of around 1 million m³/annum far exceed the national annual allowable cut or the national level quotas which are currently around 150 000 m³/annum. Forest Trends (2011d) contends that estimates of the value of Lao PDR wood products exports do not include wood exported directly by provincial governments outside of the regulatory framework, timber exported for debt repayments or timber bartered for infrastructure development. In response to exposés and related campaigns, a substantial proportion of the outdoor furniture made in Viet Nam for distribution mainly in the EU is made from wood raw material is certified as legal and from sustainably managed sources.

In Papua New Guinea, a large proportion of export-oriented production of logs is regarded as “suspicious”, with most exports destined for China. Much is suspected to be associated with corruption and violation of local communities’ rights (Forest Trends 2011d). The high grading of premium species (and the leaving of other commercial, but less-valuable, species, which should be removed for silvicultural reasons), and re-entry to ‘closed’ logging areas, is not permitted but is reported to be taking place (ITTO 2011). A lack of transparency in the forest sector – including the absence of an adequate national forest inventory; controversies associated with the selection of concessionaires; the virtually complete absence of field monitoring; and questions arising from the calculation of revenues and from incomplete and delayed remittances to landowners – has contributed to concerns about the legality credentials of PNG’s exports. In the Solomon Islands, the rate of harvesting has far exceeded the sustainable capacity of the merchantable forests, and most projections estimate that these forests will be exhausted within the next decade. The timber industry has been surrounded by controversy involving logging-related conflicts with local communities, widespread destructive logging practices by multinational companies, widespread illegal logging and allegations of corruption at all levels of government (Chatham House 2013b). As such, much of the export volume (overwhelmingly to China) is regarded as “suspect”. The government currently lacks the administrative capacity and resources to address the challenge of reducing the degradation and exhaustion of the forests and identifying alternative sources of income.

The Lacey Act and EU Illegal Timber Regulation and their potential impacts on forest products production and trade in the Asia-Pacific region

Background on EU FLEGT and the EU Timber Regulation

Recognising the potential environmental, economic and social consequences of illegal logging and trade, the EU adopted the EU FLEGT Action Plan in 2003 with the objective of increasing the capacity of producer countries to control illegal logging, while reducing the trade in illegal timber products between these countries and the EU. The EU FLEGT Action Plan provides a number of measures to exclude illegal timber from EU markets, to improve the supply of legal timber and to increase the demand for responsible wood products. Sustainable consumption and green consumerism have become dominant market drivers in EU markets, with emphasis on ensuring supplies of legal and/or sustainable wood products.

Voluntary Partnership Agreements (VPAs) with timber exporting countries have been important elements of the EU’s strategy to combat illegal logging. These agreements have included the design of legality assurance systems to identify, monitor and license legally produced timber and ensure that only legal timber is exported to the EU (European Union FLEGT 2013). A VPA has been developed and agreed with Indonesia and VPAs are under negotiation with Malaysia and Viet Nam. In Viet Nam

controlling the legality of the relatively high volume of timber imports is regarded as a potential challenge (Nguyen Ton Quyen et al. 2011). Asia-Pacific countries in the information/pre-negotiation phase of VPAs with the EU are Cambodia, Lao PDR, Myanmar, Papua New Guinea, Solomon Islands and Thailand (European Union FLEGT 2013).

Public procurement policies, which account for a significant volume of the national consumption of wood products in some EU Member States, have been introduced in several EU Member States, although there are significant differences in the detailed legality and sustainability requirements of different policies. Timber trade associations have also been influential in encouraging private sector procurement policies to ensure purchase of legal and/or sustainably produced wood.

The EU Timber Regulation is another piece of legislation supporting the EU FLEGT Action Plan and is a response to demands from a number of EU Member States and various stakeholder groups to prohibit the sale of illegal timber in the EU and to concerns of FLEGT partner countries to have a level playing field for timber trade with the EU. It came into force in March 2013, and puts a traceability obligation on traders throughout the supply chain to identify the operators or the traders who have supplied the timber and timber products; and, where applicable, the traders to whom they have supplied timber and timber products; and requires companies to implement a “due diligence” system to minimise the risk that timber they sell was harvested illegally. The Regulation covers a broad range of timber products, including solid wood products, flooring, plywood, and pulp and paper. The Regulation applies to both imported and domestically produced timber and timber products. It is legally binding on all 27 EU Member States, which are responsible for laying down effective, proportionate and dissuasive penalties and for enforcing the Regulation (EC 2012).

The Regulation is causing some concerns among EU stakeholders about how the law will be applied and about the associated administrative and bureaucratic burdens and among tropical exporters who perceive an additional cost burden which will reduce their competitiveness. However, proponents suggest that the new legislation will increase demand for wood products and set a level playing field, increasing awareness of legal and sustainable timber and leading to responsible purchasing by stakeholders. The EU Timber Regulation is escalating the requirement for certified legal and sustainable wood products, and VPA-licensed wood products, with certification becoming a central issue to marketing of tropical wood products in EU markets.

Background on the US Lacey Act

On 22 May 2008, the US Lacey Act was amended with the intent of extending its application to include illegally harvested timber. The amendment makes it illegal to import, export, transport, sell, receive, acquire, or purchase in interstate or foreign commerce, any plants or products made from plants - with limited exceptions - that were harvested or taken in violation of a domestic or foreign law. The Act gives the government the power to fine and jail individuals and companies that import timber products harvested, transported or sold in violation of the laws of the country in which the timber was originally harvested (USDA 2013).

An important principle of the Lacey Act is that the burden of proof is on the US government to demonstrate that the violators knew or should have known of the underlying violation. The amended Act includes new import declaration requirements that require information on the tree species of imported wood products and the name of the country where the timber was harvested. However it does not require the importer to have all of the information necessary to be certain of the legal origin of the wood. Instead the importer must collect information that, depending on what it suggests about the origin of the wood, should prompt further inquiry by the importer to assure its legality.

Although to date, the number of prosecutions of importers imposed by the US government has been negligible, the high profile case involving Gibson Guitar Corp. of Nashville, Tennessee, has demonstrated that demand-side forest legality policies can be effectively enforced by national governments. US Federal agents raided Gibson facilities twice since 2009 for allegedly importing

wood that violates the Lacey Act, in this case imports of ebony from Madagascar and rosewood from India. Following claims by Gibson officials of government overreach by Gibson officials, in 2011 a bill was introduced (the “RELIEF” Act) to further amend the Lacey Act to limit application to certain plants and plant products, reduce penalties for first offences, introduce changes to reviewing and reporting, provide funding for the implementation of plant declaration requirements, and establish standard certification processes for plant and plant products. Furthermore, the amendments would not apply with respect to plants that were imported before 11 May 2008, when the Lacey Act amendments were put in place. However, following claims by NGOs that this would undermine efforts to reduce illegal logging (Koenig 2012), the vote was pulled from the floor schedule, with no time for a rescheduled vote given. In 2012, the U.S. Department of Justice announced that it had reached a criminal enforcement agreement with Gibson Guitar Corp., resolving the two investigations into allegations that Gibson violated the Lacey Act by purchasing and importing illegally harvested wood materials into the United States from Madagascar and India. This has been the first major set of investigations to be publicly resolved under the new amendments to the Lacey Act (WRI Insights 2012; Black 2012).

Proponents suggest that the Lacey Act and other demand-side policies have already changed practices in the tropics, putting political and financial pressures on producer countries to enact their own strict laws against illegal logging (Elias 2012). China and Viet Nam have been suggested as examples in the Asia-Pacific region, with China working to improve enforcement of its existing laws and Viet Nam taking more serious measures to prohibit illegal logging and associated trade (Lawson and Macfaul 2010). The Lacey Act is also suggested to have the potential to change ongoing investment choices, with investors’ expectations that any illegally logged products will not be saleable to the USA encouraging appropriate practices (Elias 2012).

Potential impacts of the EU Timber Regulation and US Lacey Act on production and trade

Modelling approach

The impacts of the EU Timber Regulation and the US Lacey Act have been examined using a modelling framework to simulate production and trade in selected wood products to 2025¹. A base scenario was specified to provide baseline data against which the impacts of forest product legality regulations could be measured. Estimates of production and trade for (1) a baseline scenario and (2) a scenario reflecting the impacts of forest product legality regulations (full implementation/enforcement of the Lacey Act and the EU Timber Regulation) were simulated using the Global Forest Products Model (GFPM). This tool has been widely used to investigate issues involving global forest products markets. The scenario of forest product legality regulations assumed additional freight costs to US and EU importers and additional chain of custody and wood costs, as a result of reduced illegality, to major Asia-Pacific exporters. The GFPM was further modified to include secondary processed wood products for this scenario.

There are, however, a number of limitations in the GFPM which restrict the extent of the analysis of results. These limitations are in addition to possible inaccuracies in the base data on global production and trade². The model, for example, does not differentiate between softwood and hardwood (tropical and temperate) wood products and therefore assumes that they are direct substitutes, and does not differentiate production from plantations and natural forests. In addition to wood products sourced from Russia and Eastern Europe, tropical hardwoods are the dominant source of illegal imports and particular “at risk” species are not able to be identified in this version of the model. This version of

¹ A full description of the Global Forest Products Model, the parameters and assumptions used in this study, and the results of the baseline and alternative scenario simulations are available from the FAO Regional Office for Asia and the Pacific, Bangkok.

² The calibration of the Global Forest Products Model base year data addresses some of the inaccuracies in the data

the model also assumes that implementation of FPL only impacts Asian exporters, whereas all countries exporting tropical wood products are likely to be affected by these regulations. Developments in FPL implementation in other significant importing countries e.g. Australia (Parliament of Australia 2012) have also not been considered in these simulations, whereas they are likely to affect Asia-Pacific regional trade within the time frame specified.

Notwithstanding these limitations, the results presented here should be viewed as indicative of a range of values that could be expected for the different scenarios and their underlying assumptions rather than as actual forecasts of production and trade.

Results

Table 1 shows a summary of the simulated impacts of forest product legality (FPL) regulations in the EU and USA on production of wood products (logs, sawnwood, plywood, particleboard, fibreboard and secondary processed wood products) in the USA, Asia and the EU.

Table 1: Summary of changes in wood products production with FPL implementation, by product and region

Product	Region	Base ¹ (1000 m ³)	Changes from Base with FPL implementation ² (%)
Logs	USA	375,136	0.01
	Asia	315,048	-20.40
	EU	104,259	0.52
Sawnwood	USA	94,073	1.11
	Asia	130,920	-3.31
	EU	39,746	-0.96
Plywood	USA	8,865	2.04
	Asia	42,455	0.53
	EU	3,241	0.51
Particleboard	USA	25,283	-0.12
	Asia	10,666	0.41
	EU	20,582	0.00
Fibreboard	USA	8,541	-0.03
	Asia	27,028	0.40
	EU	7,897	0.00
SPWP	USA	NA	NA
	Asia	20,443	-12.69
	EU	NA	NA

¹ Average annual production 2006-2025

² Percentage change in average annual production, 2006-2025, for forest products legality legislation, compared to the base case

These results indicate that the full implementation of FPL regulations results in significant changes from the base case with respect to log and secondary processed wood products production in the Asia-Pacific region while changes from the base case in other wood products are minimal. Production of SPWPs in the Asian region declines by about 2.6 million m³, with most of the decline occurring in China. Asia's production of logs in this scenario declines by 64.3 million m³, with China's production declining significantly (by 32 percent).

Table 2: Summary of changes in net trade with FPL implementation, by product and region

Product	Region	Base Imports (1000 m ³)	Base Exports (1000 m ³)	Base Net Trade ¹ (1000 m ³)	Net trade with FPL implementation (1000 m ³)	Changes from Base Net Trade with FPL implementation ² (%)
Logs	USA	2,079	10,254	8,176	6,979	-14.63
	Asia	32,891	23,192	-9,699	-9,699	0.00
	EU	11,265	10,838	-427	-426	0.02
Sawnwood	USA	35,103	3,165	-31,937	-32,933	3.12
	Asia	10,966	7,446	-3,520	-3,506	-0.40
	EU	15,494	6,754	-8,740	-8,609	-1.50
Plywood	USA	6,587	370	-6,217	-6,155	-1.63
	Asia	1,656	14,128	12,472	12,623	1.21
	EU	4,234	1,597	-2,637	-2,923	10.86
Particleboard	USA	9,206	370	-8,836	-8,864	0.32
	Asia	1,345	1,251	-94	-94	0.00
	EU	3,359	3,783	424	424	0.00
Fibreboard	USA	2,524	492	-2,032	-2,034	0.12

	Asia	2,117	2,987	-1,162	-1,163	0.04
	EU	2,904	3,417	513	513	0.01
SPWP	USA	5,744	NA	-5,744	-4,067	-29.20
	Asia	NA	20,443	14,699	13,782	-6.24
	EU	9,460	NA	-9,460	-7,481	-20.91

1 Average annual net trade for the period 2006 to 2025, assuming no trade policy interventions.

2 Percentage changes in average annual net trade for the period 2006-2025, for forest products legality implementation, compared to the base case.

NA= not available

Although Asian primary wood products trade flows – both exports and imports - are substantial, most of the trade is intra-regional, with exports to the EU and USA comprising an insignificant proportion of Asia's total exports. Consequently, it would be expected that the impact of forest product legality regulations in the USA and EU on net Asian trade in primary wood products would be minimal. Table 2 provides a quantitative measure of the impacts of FPL implementation on net trade. As expected, changes in Asian net trade as a result of forest product legality regulations are relatively insignificant for all primary wood products (logs, sawnwood and plywood).

Although US imports of logs from the Asian region are negligible, the FPL regulations result in a reduction in US log exports, with log imports remaining unchanged at comparatively insignificant levels. The comparative reduction in US log exports under this scenario can be attributed to a significant drop in imports of processed wood products which results in increased domestic demand for logs and other primary wood products to manufacture SPWPs domestically. Changes in EU net log trade are insignificant.

The USA is a significant importer of sawnwood, although imports from the Asian region are negligible. US sawnwood imports (mainly from Canada) increase in the FPL scenario, reflecting an increase in demand for sawnwood in domestic SPWP manufacture, as US imports of SPWPs decline. EU imports of sawnwood are relatively unaffected in the FPL scenario, with net trade dropping by 1.5 percent (131 000 m³), a relatively insignificant proportion of total EU sawnwood consumption. As expected, the Asian sawnwood trade is relatively unaffected by FPL because a significant proportion of the trade is intra-regional.

The Asian region exports and consumes a considerable volume of plywood, although exports are relatively unaffected by implementation of the FPL. The change in net trade under this scenario (150 000 m³) is insignificant in comparison to Asia's total exports and consumption (approximately 44 million m³ in the base scenario). US plywood imports contract marginally (with net trade declining by 1.21 percent) and EU plywood net trade increases by nearly 11 percent (although this represents both a 5.0 percent decline in exports and a 4.9 percent rise in imports). However, the net trade changes in the USA and the EU represent a relatively small proportion of overall plywood consumption (0.3 percent and 3.8 percent respectively). The impacts of FPL implementation on other panel products (particleboard and fibreboard) are also insignificant.

FPL implementation has notable impacts on SPWP net trade from the Asian region which declines by nearly 1 million m³ (Table 2). Although not shown in this table, this reflects the substantial trade in SPWPs from China to the USA and EU destinations which are significantly reduced under this scenario. China's SPWP exports are, however, partly compensated by an increase in exports to other destinations. Similarly, SPWP exports from other major Asian suppliers (Malaysia, Viet Nam and Indonesia) decline following FPL implementation, by 12.9, 17.5 and 14.4 percent respectively. The proportion of Asia's exports of SPWPs to other destinations compared with total exports to all destinations rises from 69 percent (the base case) to 78 percent following FPL implementation. As expected, this scenario has significant impacts on US and EU imports, which decline by 29 percent and 21 percent respectively.

Discussion

These results indicate that, given the assumptions used in this scenario, FPL implementation is likely to have minimal impacts on primary wood product trade flows (logs, sawnwood and plywood) from the Asian region, with negligible volumes being removed from trade. These results are expected, given the insignificant volumes exported to the USA and EU countries compared with total production and trade. The FPL scenario results in approximately 1 million m³ of SPWPs being removed from net trade while 13.8 million m³ of net trade is ostensibly compliant with FPL regulations or exported to other destinations. FPL implementation does result in some shift in Asia's trade to non-FPL importing countries (i.e. other than the USA and EU countries). About 36 percent (6.5 million m³) of Asia's SPWP production is exported to the EU and USA following FPL implementation compared with 55 percent in the base scenario.

One of the objectives of this project has been to determine whether FPL implementation will achieve its stated aims in ensuring production and trade of legal and sustainable timber, in this case within the Asian region. Assuming Asia's average annual exports of SPWPs to the USA and EU under the FPL scenario are "legal and sustainable", and assuming a 4:1 conversion rate of logs to SPWPs, FPL implementation assists in ensuring that 26 million m³ RWE out of a total log production of 250.8 million m³ is from legal and sustainable sources. However, nearly 90 percent of Asia's log production is not affected by implementation of these regulations suggesting that overall, the direct impact of FPL on production of legal and sustainable wood products from the Asian region will be small. However, the indirect impacts of FPL have not been considered in the model and may be significant.

Implementation of FPL will also be associated with costs of compliance for both exporters and importers, and ultimately to EU and US consumers. These costs will be applied to all imports and therefore raises the question of the cost effectiveness of the regulations for EU and US consumers, given the insignificant proportion of total imports which will be non-compliant. The cost effectiveness for Asian exporters will be dependent on whether the regulations will positively benefit those producers demonstrating minimal risk of illegal supply, and the extent to which producers will be given increased market access without imposition of significant new additional costs. Previous econometric analyses of the impacts of illegal logging have suggested that the illegal trade in wood products has resulted in reduced global wood product prices and reduced the overall competitiveness of the legal wood products trade (Li *et al.* 2008, Turner *et al.* 2007, Seneca Creek Associates 2004). However, in the FPL scenario the competitiveness of Asian exports of legal wood products will depend on the extent to which increases in global prices from removing illegal trade will compensate for the imposition of additional trading costs for legal wood products suppliers.

Another risk associated with increased costs of compliance but not considered in this analysis is that legal wood products from Asian (and other) suppliers may become less competitive with substitute materials (e.g. steel, plastics) in price sensitive markets, an issue which is amplified by price becoming a more important determinant of product competitiveness since the global economic downturn and on-going recessionary conditions, particularly in EU markets (Maplesden *et al.* 2013). A further risk for Asian exporters is that all tropical hardwoods may be perceived as high risk (of being from illegal sources) by importers, thereby reducing demand for legal Asian wood products. Although analysis of these issues is beyond the scope of this study, they highlight the need for larger investments in marketing the benefits of legal wood products and information dissemination on the new regulations as a means of boosting existing efforts to improve forest governance, and efforts towards SFM, in Asian supplying countries.

The modelling results show that FPL implementation results in diversion of a proportion of Asia's SPWP exports from the EU and USA to other destinations (although these destinations are not identified in the model). This indicates the possible risk of "leakage" – shifting of markets for illegal timber to less stringent buyers (not subject to FPL regulations) elsewhere (most likely major wood markets such as China and India). However, more detailed modelling work than has been carried out in this project will be required to quantitatively assess the impacts of FPL implementation in the EU

and USA with respect to leakage. Importantly, more accurate data is required on domestic demand growth for wood products in China and India in addition to more up-to-date estimates of the extent of the illegal cross-border trade.

REDD+ and its potential impacts on forest resources, production and trade in the Asia-Pacific region

Background on REDD+

REDD+ (Reducing Emissions from Deforestation and forest Degradation) is an international mechanism framed by the international negotiations on climate change to provide economic assistance to developing countries to reduce greenhouse gas emissions by protecting and restoring their forest carbon stocks. The concept of REDD+ is for developed countries to provide financial incentives to developing countries to reduce national deforestation, conserve and sustainably manage their permanent forest estates, and increase forest cover through reforestation and afforestation. Thus, REDD+ has the potential to simultaneously mitigate climate change (through carbon capture and storage), conserve biodiversity, protect other ecosystem goods and services, increase income for forest owners and managers, and help address issues of forest governance.

REDD+ is still under negotiation within the official UNFCCC process. The REDD mechanism still remains unclear although it is proposed that market-based funding mechanisms such as carbon trading, and private sector involvement, could be introduced. However, it has been well recognised that the building blocks of a transition to a market-based carbon trading mechanism would need to include effective national-level targets (reference levels or baselines); robust measuring and monitoring of emissions reductions below baselines; a well-designed mechanism for linking forest credits to emissions trading schemes (including access to additional funding from the private and public sectors as carbon finance grows); and strong governance (including the clarification and securing of land tenure rights and strengthening of institutional capacities of national, regional and local institutions). The financial mechanisms for providing assistance to developing countries that are currently being explored include a market approach, a fund-based approach or a hybrid mechanism (JICA 2012). The market approach would entail taking the emissions reductions (or maintained/enhanced carbon stocks) achieved through REDD+ projects and converting them into credits, which would then be traded on the carbon market to generate funds. The fund-based approach would involve providing funds directly to developing countries, without carbon market transactions. In the medium term, however, most payments will be for readiness and policy reforms, rather than proven emissions reductions (Angelsen *et al.* 2012).

Carbon monitoring, assessment and verification, particularly the establishment of baseline reference levels of deforestation and carbon emissions, presents technical challenges in many of the Asia-Pacific developing countries. To date, few Asia-Pacific tropical countries have had the capacity to monitor their own deforestation rates. The absence of strong institutions and poor governance is expected to constrain some countries in implementing a market-based REDD+ scheme, given that investors are unlikely to provide REDD+ finance to projects in countries without substantial guarantees. Much of the focus for REDD+, therefore, has been on Measurement, Reporting and Verification (MRV), National Forest Monitoring Systems and understanding the drivers of deforestation and forest degradation. Further concerns have been expressed that REDD+ will impose restrictions upon the use of forest resources with negative implications for local communities and livelihoods, necessitating a need for safeguards for REDD+ so that benefits are equitably distributed.

Many Asia-Pacific tropical countries have already engaged in REDD+ “readiness” and “demonstration” activities which have been aimed to support the development and initial implementation of REDD+ while a formal global mechanism is being negotiated. However, full compliance/implementation using market based mechanisms is not yet operational as there is no

legally binding international agreement in place regarding REDD mechanisms. Limited funding and slow progress in UNFCCC negotiations has been an increasing threat to the long-term success of REDD+.

Asia-Pacific involvement in REDD+

Most of the tropical countries in the Asia-Pacific region are participating in one or more of the global initiatives on REDD+ readiness (I.e. the Forest Carbon Partnership Facility, UN-REDD, the Forest Investment Program, the Global Environment Facility and major bilateral programs on REDD). Some are involved in several initiatives. In the Asia-Pacific region, Cambodia, Indonesia, Papua New Guinea, the Philippines, Solomon Islands and Viet Nam have received support to national programmes under the UN-REDD programme, while Bangladesh, Bhutan, Lao PDR³, Malaysia, Mongolia, Myanmar, Nepal and Sri Lanka have more recently become members.

REDD+ efforts in Indonesia have been more advanced than in other Asia-Pacific countries, which is expected given that Indonesia has the largest emissions from forest and peatland in the world, and given government commitments to cut greenhouse gas emission by 26 percent from business-as-usual levels by 2020. Direct drivers of deforestation in Indonesia include clearances for oil palm and pulpwood plantations in Kalimantan and Sumatra, smallholder agriculture in Sulawesi, in addition to unsustainable harvests, illegal logging and encroachment. Indirect drivers have included corruption, governance factors, land issues between central and local governments, and a lack of certainty between forest land and non-forest land (Kissinger *et al.* 2012). Indonesia participates in all major international REDD+ initiatives, including the REDD+ Partnership, the Forest Carbon Partnership Facility, UN-REDD and the Forest Investment Program. A considerable number of regionally based foreign-supported REDD+ pilots are being implemented throughout the country. A partnership on REDD+ between Indonesia and Norway began in 2010 and is designed to provide payments for results achieved by Indonesia in reducing its emissions from deforestation and forest degradation.

Other REDD+ country involvement is as follows:

- Vietnam also entered into a REDD+ partnership with Norway in 2012.
- The Government of Cambodia has been an active participant in the development REDD+, with pilot projects under way in the country.
- India's national REDD+ program is being developed with the aim of greatly increasing forest carbon stocks, with forest degradation being a major issue.
- Although PNG has been a leading proponent of REDD+ at the international level, poor governance has constrained efforts to create an enabling environment for REDD+ and progress in readiness activities is reportedly slow (CIFOR 2011).
- The Philippines is also strongly engaged in international REDD+ processes, with considerable potential for carbon capture and storage through forest restoration and afforestation, if forest governance is improved (ITTO 2011).

Potential impacts of REDD+

Modelling approach

The impacts of REDD+ have been examined using the GFPM, as described previously for the FPL scenario. In this case, two scenarios (REDD1 and REDD2) were developed, representing the extent of implementation of REDD+ (Table 3). They assume that the REDD+ mechanism/s will contribute directly to a reduction in the rate of deforestation. The scenarios provide two options for reducing the growing stock available for timber production as a result of REDD+ initiatives. The changes in growing stock represent a medium (REDD1) and high (REDD2) implementation of REDD+ for countries in the Asia-Pacific region that are most heavily involved in REDD+ programmes. Forest resources in other major tropical forest producers in the Asia-Pacific region - Malaysia, Myanmar, the

³ Lao PDR is supported by the Forest Carbon Partnership Facility (FCPF).

Solomon Islands, India and Fiji - are assumed, for illustrative purposes, not to be impacted by REDD+ in the forecast period. The scenarios have been based on a subjective assessment of how far towards implementation of REDD+ the countries are likely to be, the likelihood of REDD+ objectives being achieved and the proportion of legal and recorded wood supplies in total production. The scenarios assume that changes in forest stock will occur gradually over the period 2015-2025. Estimates of production and trade to 2025 for these two scenarios were then compared with the baseline simulations for the same time period.

Table 3: REDD+ scenarios – reduction in growing stock available for harvest (%)

Country	REDD1	REDD2
Indonesia	32	72
Nepal	25	40
PNG	15	55
Philippines	10	35
Thailand	1.5	3
Vanuatu	0	0
Viet Nam	0	8
Lao PDR	5	15
Cambodia	5	15

Results

Table 4 shows a summary of the simulated impacts of REDD1 and REDD2 on production of selected wood products (logs, sawnwood, plywood, particleboard and fibreboard) for Asia-Pacific REDD+ producer countries, USA and major EU importing countries.

Table 4: Summary of changes in production by country, by REDD scenario (%)

Country	Logs		Sawnwood		Plywood		Particleboard		Fibreboard	
	REDD 1	REDD 2	REDD 1	REDD 2	REDD 1	REDD 2	REDD 1	REDD 2	REDD 1	REDD 2
USA	0.07	0.07	-0.01	-0.01	-0.02	-0.02	0.68	0.68	-0.02	-0.03
Cambodia	-8.42	-22.91	0	0	0	0	N/A	N/A	N/A	N/A
China	0.64	1.24	-0.03	-0.06	-0.06	-0.13	-0.07	-0.14	-0.08	-0.16
Indonesia	-23.4	-41.59	-0.07	-0.09	-0.08	-0.10	-14.94	-15.93	-1.62	-1.64
Lao PDR	-4.33	-13.35	-6.20	-19.06	-0.13	-0.31	N/A	N/A	N/A	N/A
Malaysia	0.81	1.56	-2.40	-4.53	-0.79	-1.61	-2.36	-4.43	-0.94	-1.81
Nepal	-15.34	-24.22	-0.21	-0.25	-0.57	-0.71	0	0	N/A	N/A
Philippines	-12.56	-34.9	-0.03	-0.05	-0.05	-0.10	-0.12	-0.19	N/A	N/A
Thailand	-2.17	-11.19	-0.04	-0.07	-0.06	-0.11	-1.92	-3.60	-0.99	-1.91
Viet Nam	0.67	-8.00	-0.03	-0.06	-2.60	-5.00	-1.32	-2.65	-1.63	-3.59
PNG	-14.06	-39.90	-0.03	-0.05	0	-0.37	N/A	N/A	N/A	N/A
Vanuatu	0.09	0.28	0	-0.06	N/A	N/A	N/A	N/A	N/A	N/A
France	0.8	1.54	-0.03	-0.06	-3.36	-6.63	-0.07	-0.14	-0.08	-0.16
Germany	0.62	1.22	0.28	0.36	-0.10	-0.19	0.25	0.48	0.64	1.18
Italy	0.78	1.51	-1.99	-3.93	-0.06	-0.12	-0.07	-0.13	-0.09	-0.17
UK	0.48	0.95	0.75	1.47	N/A	N/A	0.53	1.05	-0.23	-0.51

Note: Figures denote percentage changes in average annual production, 2006-2025 for REDD1 and REDD2 scenarios compared with the base case

N/A= not available

The results indicate that, as expected, the REDD1 and REDD2 scenarios result in significant changes from the base case with respect to average annual log production in Asia-Pacific producing countries which are involved in REDD+ programmes. Indonesia's average annual log production declines 23 percent in the medium scenario and 42 percent in the high scenario compared with the base case (from 25.8 million m³ [the base case] to 19.7 million m³ [REDD1] and 15.1 million m³ [REDD2]). This reflects the high level of Indonesia's involvement in REDD+ activities and the significant level of illegal harvest which is likely to be targeted by REDD+ in the REDD scenarios. The model, however, does not differentiate production from plantations and natural stands, and therefore possibly overemphasises the impacts of REDD on industrial roundwood production. Log production in Papua New Guinea, Lao PDR, Cambodia and the Philippines are also significantly reduced in the REDD1 and REDD2 scenarios. With a relatively high proportion of production being from illegal sources, Nepal's log production falls by 15 percent to 24 percent in the two scenarios, albeit from a relatively small production base (1.4 million m³).

The impacts of REDD1 and REDD2 on production of sawnwood, plywood, particleboard and fibreboard in the Asia-Pacific region are relatively minor compared with the substantial changes in log production. This reflects an increase in wood supply from non-REDD countries to replace the loss in availability of industrial roundwood from REDD+ countries in the region⁴. The exceptions are Indonesia's production of particleboard and Lao PDR's production of sawnwood, which decrease 14.9 to 15.9 percent, and 6.2 to 19.1 percent respectively, for the REDD1 and REDD2 scenarios, compared with the base case.

⁴ The model, however, possibly overestimates the volume of substitute industrial roundwood available from non-REDD countries because tropical hardwoods, temperate hardwoods and softwoods are not differentiated in this version of the GFPM.

Table 5: Summary of log trade by REDD scenario, by country (1000 m³)

Country	Base imports	REDD1 imports	REDD2 imports	Base exports	REDD1 exports	REDD2 exports
USA	2,058	2,058	2,058	15,577	15,577	15,577
Cambodia	0	0	6	14	8	3
China	57,999	57,613	57,154	115	115	115
Indonesia	99	5,711	10,389	126	126	126
Lao PDR	0	0	0	25	25	25
Malaysia	18	18	18	6,107	6,541	6,945
Nepal	0	204	324	1	1	1
Philippines	887	976	1,134	1	1	1
Thailand	2,522	2,541	2,718	0	0	0
Viet Nam	1,361	1,323	1,664	2	2	2
PNG	0	0	0	1,819	1,551	1,060
Vanuatu	16	16	16	1	1	1
France	400	400	400	5,611	5,919	6,211
Germany	503	503	503	1,625	1,686	1,871
Italy	6,735	6,653	6,571	2	2	2
UK	96	96	96	102	102	102

Note: Figures denote average annual imports/exports for the period 2006 to 2025, for base case, REDD1 and REDD2 scenarios.

The modelling results show that the impact of both REDD scenarios on the log trade are variable (Table 5), with Indonesia's trade being most affected. With REDD implementation, Indonesia's log production plummets. With Indonesia's log exports remaining at negligible levels, average annual log imports escalate in both the medium and high REDD scenarios, with Indonesia becoming a net (and significant) importer of logs. (The model predicts a relatively sustained consumption of logs in Indonesia's wood processing industries). Although Malaysia's growing stock remains unaffected in both REDD scenarios, log production increases slightly, and log exports increase (by 7 percent in REDD1 and 14 percent in REDD2) in response to a growing demand gap, including in REDD+ implementing countries where industrial roundwood production has declined significantly. In Thailand, the Philippines and Viet Nam, average annual log imports also increase under REDD although the impacts are not as significant as that experienced by Indonesia. Log exports by PNG decline following REDD+ implementation, by 15 percent in REDD1 and 42 percent in the REDD2 scenario, which is expected given the changes in growing stock in the two scenarios. In the consumer countries, France and Germany's exports of logs increase following implementation of REDD in Asia-Pacific, which may indicate increased intra-regional EU trade.

Table 6: Summary of sawnwood trade by REDD scenario, by country (1000 m³)

Country	Base Imports	REDD1 imports	REDD1 imports	Base exports	REDD1 exports	REDD2 exports
USA	30,500	30,500	30,500	3,134	3,134	3,134
Cambodia	0	0	0	17	17	17
China	5,394	5,394	5,394	606	606	606
Indonesia	170	170	170	1,746	1,746	1,746
Lao PDR	0	0	0	158	149	128
Malaysia	762	762	762	3,285	3,143	3,017
Nepal	3	3	3	0	0	0
Philippines	206	206	206	105	105	105
Thailand	1,231	1,231	1,231	1,026	1,026	1,026
Viet Nam	309	309	309	38	38	38
PNG	0	0	0	21	21	21
Vanuatu	2	2	2	5	5	5
France	2,806	2,806	2,806	1,026	1,026	1,026
Germany	3,545	3,545	3,545	7,077	7,146	7,167
Italy	5,896	5,961	6,024	135	135	135
UK	7,039	7,007	6,976	262	262	262

Note: Figures denote average annual imports/exports for the period 2006 to 2025, for base case, REDD1 and REDD2 scenarios.

While there are notable impacts of REDD on the log trade, the results are less conclusive for processed primary wood products (sawnwood, plywood) and wood composites (particleboard and fibreboard). The impacts of REDD1 and REDD2 on the sawnwood trade from Asia-Pacific countries are shown in Table 6. In the Asia-Pacific region, sawnwood exports from Lao PDR and Malaysia are reduced compared with the base case (by 19 percent and 9 percent respectively in the REDD2 scenario) while all other exports are unaffected by REDD. In consumer countries, the US sawnwood trade is unaffected by REDD, while there are some impacts on trade in EU countries. Although not shown in the table, the model results indicate that the impacts of REDD1 and REDD2 on the plywood, particleboard and fibreboard trade are minimal.

Discussion

While some caution should be exercised in utilising the absolute figures generated from the modelling simulations, they do provide indications of broad trends in forecast production and trade within the bounds of the data and assumptions used in the model.

These results indicate that REDD initiatives which result in the changes in growing stock assumed in the REDD1 and REDD 2 scenarios, have the potential to significantly affect log production in Asia-Pacific producer countries which are involved in REDD+ initiatives. These effects are, however, not transferred to the wood processing industries where production is relatively unaffected in the REDD1 and REDD2 scenarios, compared with the base case. Within the Asian region, the results indicate that countries with significant production shortfalls due to REDD are able to access log supplies from other sources, so the impacts on production of further processed wood products are minimal. However, this effect may be overestimated because the model assumes that softwoods and hardwoods are not differentiated in the log supply, whereas in some end-use applications they are not considered direct substitutes. However, if imports are sourced from outside the Asia-Pacific region, dependence on imports from extra-regional sources may increase the risk of economic exposure for countries which have weak economies.

While conclusions cannot be drawn from the model results about the extent to which alternative sources of supply have been accessed from illegal and/or non-sustainable, non-REDD countries within the region, the results highlight the need for regional approaches in addressing deforestation emissions, i.e. forest governance and SFM practices need to be addressed in non-REDD countries in order that REDD+ may achieve reductions in deforestation emissions at the Asia-Pacific regional level.

This analysis has not assessed the many constraints, including the mechanisms required, to achieve the levels of reduction in growing stock available for harvest which were specified in the REDD scenarios. Rather, it provides an estimate of what the impacts of REDD may be on production and trade given these REDD scenarios.

References⁵

- Angelsen A., Brockhaus M., Sunderlin W., Verchot C. (Eds) 2012. *Analysing REDD+. Challenges and Choices*. Center for International Forestry Research, Indonesia. Available at: http://www.cifor.org/publications/pdf_files/Books/BAngelsen1201.pdf
- Black R. 2012. *Gibson settles discord on timber*. BBC News. Science and Environment. 6 August 2012. Available at: <http://www.bbc.co.uk/news/science-environment-19153588>
- Chatham House 2013a. *Indonesia*. Available at: http://www.illegal-logging.info/approach.php?a_id=85
- Chatham House 2013b. *Solomon Islands*. Available at: http://www.illegal-logging.info/approach.php?a_id=110
- Chen Hin Keong; Hewitt J. and Thang Hooi Chew 2012. *Malaysia: Scoping baseline information for forest law enforcement, governance and trade*. EU FLEGT Facility, Kuala Lumpur. EFI. TRAFFIC.
- Cheng B., Le Clue S. 2010. *Forestry in Asia: Issues for Responsible Investors*. Responsible Research, Singapore. September 2010. Available at: http://www.responsible-research.com/Forestry_in_Asia-Issues_for_Responsible_Investors.pdf
- CIFOR 2009. *Realising REDD+. National strategy and policy options*. Center for International Forestry Research, Indonesia. 362pp.
- CIFOR 2011. *Snapshot of REDD+ in Papua New Guinea*. Infobrief. No. 40, August 2011. Center for International Forestry Research, Indonesia.
- Elias P. 2012. *Logging and the Lacey Act. How the U.S. Lacey Act helps reduce illegal logging in the tropics*. Union of Concerned Scientists, Cambridge MA, USA. April 2012.
- EIU 2011. *Building Rome in a day. The sustainability of China's housing boom*. A report from the Economist Intelligence Unit's Access China service. Available at: https://www.eiu.com/public/topical_report.aspx?campaignid=china_realestate_wp
- EIA 2010. *Rogue Traders: the Murky Business of Merbau Timber Smuggling in Indonesia*. Environmental Investigation Agency, London, UK, and Telepak, Bogor, Indonesia.
- European Union FLEGT 2013: *VPAs*. Available at: <http://www.euflegt.efi.int/portal/home/vpas/>
- FAO 2012. FAOSTAT Database. Available at: <http://faostat.fao.org/site/626/default.aspx#ancor>
- FAO 2011. *Pacific Forests and Forestry to 2020*. Subregional Report of the Second Asia-Pacific Forestry Sector Outlook Study. Bangkok, FAO. RAP Publication 2011/01.
- FAO 2010a. *Global Forest Resources Assessment 2010*. Rome, FAO.
- FAO 2010b. *Southeast Asian Forests and Forestry to 2010*. Subregional Report of the Second Asia-Pacific Forestry Sector Outlook Study. RAP Publication 2010/20. Bangkok, FAO.
- Forest Trends 2011a. *Baseline Study 4, Myanmar: Overview of Forest Law Enforcement, Governance and Trade*. Forest Trends for FLEGT Asia Regional Programme. August 2011.
- Forest Trends 2011b. *Baseline Study 2, Lao PDR: Overview of Forest Law Enforcement, Governance and Trade*. Forest Trends for FLEGT Asia Regional Programme. July 2011.

⁵ References cited and/or consulted in this report.

- Forest Trends 2011c. *Baseline Study 1, China: Overview of Forest Governance, Markets and Trade*. Forest Trends for FLEGT Asia Regional Programme. June 2011.
- Forest Trends 2011d. *Baseline Study 3, Vietnam: Overview of Forest Governance, Markets and Trade*. Forest Trends for FLEGT Asia Regional Programme. April 2011.
- Forest Trends 2011e. *Baseline Study 5, Thailand: Overview of Forest Governance, Markets and Trade*. Forest Trends for FLEGT Asia Regional Programme. July 2011.
- Forest Trends 2010: *Timber Markets and Trade between Lao PDR and Vietnam: A Commodity Chain Analysis of Vietnamese-Driven Timber Flows*. Forest Governance, Markets and Trade: Implications for Sustainability and Livelihoods. ISBN: 1-932928-41-3. 37pp.
- Global Timber 2013. *Indonesia*. Available at <http://www.duediligencetimber.eu/Indonesia.htm>
- Human Rights Watch 2009. *Wild Money: The Human Rights Consequences of Corruption and Illegal Logging in Indonesia's Forestry Sector*. Human Rights Watch, New York, United States.
- IMF 2012. *World Economic Outlook. Growth Resuming, Dangers Remain*. April 2012. International Monetary Fund, Washington D.C.
- ITTO 2012. *Annual Review and Assessment of the Tropical Timber Market Situation 2011*. International Tropical Timber Organization, Yokohama, Japan.
- ITTO MIS 2012. *Market Information Service*. International Tropical Timber Organization, Yokohama.
- ITTO 2011. *Status of Tropical Forest Management 2011*. ITTO Technical Series No. 38. International Tropical Timber Organization, Yokohama, Japan. June 2011.
- JICA 2012. *REDD-Plus*. Japan International Cooperation Agency Global Environment Department, Tokyo. International Tropical Timber Organization, Yokohama.
- Kissinger G., Herold M., and de Sy V. 2012. *Drivers of deforestation and forest degradation. A synthesis report for REDD+ policymakers*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65505/6316-drivers-deforestation-report.pdf
- Koenig K. 2012. *Musicians, Environmental Groups in Tune to Stop Illegal Logging*. Woodworking Network. 01/02/2012. Available at: <http://www.woodworkingnetwork.com/news/woodworking-industry-news/Musicians-Environmental-Groups-in-Tune-to-Stop-Illegal-Logging-137765098.html>
- Koh, L.P., Miettinen, J., Liew, S.C., and Ghazoul, J. 2011. *Remotely sensed evidence of tropical peatland conversion to oil palm*. Proc. Natl. Acad. Sci. USA 2011, 108, 5127–5132.
- Lawson S. and Macfaul L. 2010. *Illegal logging and related trade. Indicators of the global response*. Chatham House, London.
- Li, R., J. Buongiorno, J.A. Turner, S. Zhu, and J. Prestemon. 2008. *Long-term effects of eliminating illegal logging on the world forest industries, trade, and inventory*. Forest Policy and Economics 10:480-490.
- Lian Pin Koh, Jukka Miettinen, Soo Chin Liew, and Jaboury Ghazoul 2011: *Remotely sensed evidence of tropical peatland conversion to oil palm*. Proceedings of the National Academy of Sciences. Available at http://www.illegal-logging.info/item_single.php?it_id=1071&it=document.

Maplesden F., Attah A., Tomaselli I., and Wong N. (2013). *Riding out the storm. Improving resilience of the tropical timber sector to the impacts of global and regional economic and financial crises.* ITTO Technical Series 41. International Tropical Timber Organization, Yokohama, Japan. 148pp.

Nguyen Ton Quyen, Tran Huu Nghi 2011. *How Vietnam is prepared to meet legal requirements of timber export markets.* Tropenbos International Viet Nam, Hue City, Viet Nam, X-44pp.

Oliver R. and Donkor B. 2010: *Leveling the Playing Field. Options of boosting the competitiveness of tropical hardwoods against substitute products.* ITTO Technical Series No.36. November 2010. 164pp. ITTO, Yokohama, Japan.

Parliament of Australia 2012. *Illegal logging prohibition bill 2012.* Available at: http://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r4740

Seneca Creek Associates and Wood Resources International 2004: *Illegal logging and wood products markets: the competitive impacts on the US wood product industry.* Available at: <http://www.illegal-logging.info/uploads/afandpa.pdf>

Turner, J.A., Katz, A., and Buongiorno, J. 2007. *Implications for the New Zealand Wood Products Sector of Trade Distortions due to Illegal Logging.* A report prepared for the Ministry of Agriculture and Forestry by Scion and Alphametrik. Scion, Rotorua, New Zealand. www.maf.govt.nz/forestry/illegal-logging/trade-distortion-implications/index.htm

United Nations Statistics Office 2012: UN COMTRADE Database. New York. Available at: <http://comtrade.un.org/db/>

USDA 2013. *Lacey Act.* US Department of Agriculture Animal and Plant Health Inspection Service. Available at: http://www.aphis.usda.gov/plant_health/lacey_act/

WRI Insights 2012. *Gibson Guitar Logging Bust Demonstrates Lacey Act's Effectiveness.* World Resources Institute. Available at: <http://insights.wri.org/news/2012/08/gibson-guitar-logging-bust-demonstrates-lacey-acts-effectiveness>

ACRONYMS

ASEAN	Association of Southeast Asian Nations
CIFOR	Center for International Forestry Research
EC	European Commission
EIU	Economist Intelligence Unit
EU	European Union
EU FLEGT	FLEGT European Union Forest Law Enforcement Governance and Trade
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FLEGT	Forest Law Enforcement Governance and Trade
FPL	Forest products legality
FSC	Forest Stewardship Council
GFPM	Global Forest Products Model
GHG	greenhouse gas
Hong Kong, SAR	Hong Kong Special Administrative Region
HS	Harmonised System
IMF	International Monetary Fund
ITTO	International Tropical Timber Organization
JICA	Japan International Cooperation Agency
Lao PDR	Lao People's Democratic Republic
m ³	cubic metre(s)
MDF	medium density fibreboard
Mg	milligram
MIS	Market Information Service
MRV	measurement, reporting and verification
MtCO ₂ e	Million tonne(s) of carbon dioxide emissions
NA	not available
NGO	non-governmental organisation
NZ	New Zealand
PFE	Permanent forest estate
PNG	Papua New Guinea
REDD	Reducing Emissions from Deforestation and Forest Degradation
RELIEF	Retailers and Entertainers Lacey Implementation and Enforcement Fairness Act
Rep. of Korea	Republic of Korea
RWE	Roundwood equivalent(s)
SFM	sustainable forest management
SME	small or medium-sized enterprise
Spp.	species
SPWP	secondary processed wood products
Taiwan POC	Taiwan Province of China
UAE	United Arab Emirates
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USA	United States of America
USD	United States Dollars
USDA	United States Department of Agriculture
VAT	value-added tax

VPA	voluntary partnership agreement
WRI	World Resources Institute