



Utilizing small diameter logs from bio-composite products in Indonesia

Introduction

National forest policies in the Asia-Pacific region typically stress the dual goals of achieving sustainable management of forests, and enhancing the supply of goods and services that forests are able to provide. As demand for such goods and services continues to grow, forest management becomes more complex, with sometimes competing interests of different stakeholders.

Indonesia is a case in point. In 1900, the estimated forest cover in Indonesia was 170 million hectares which plunged to less than 100 million hectares by the end of the 20th century. Logging and the burning of forests to clear land for cultivation has made Indonesia the world's third largest emitter of greenhouse gases, behind China and the United States. Various initiatives and policies have attempted to reduce rates of deforestation. For example, in 2011 Indonesia declared a moratorium on new logging contracts, supported by financial incentives from Norway. How-

ever, the rate of deforestation continued to increase so that by 2012 Indonesia had surpassed the rate of deforestation in Brazil, and become the fastest forest clearing nation in the world. In this context, CFC recently funded the four year research project, 'Utilization of Small Diameter Logs from Sustainable Sources for Bio-composite Products' in four countries; Malaysia, Philippines, Papua New Guinea and Indonesia. The project was supported by the International Tropical Timber Organization (ITTO), and was boosted by a financial contribution from the Government of Indonesia. Research was carried out by the Faculty of Forestry, Bogor Agricultural University in Bogor, Indonesia and supported by the Ministry of Forestry.

Professors Yusram Massijaya and Yusuf Sudo trace the origins of this research back to 1984, when "discussions on the sustainability of logging Indonesia's natural forest grew serious. It was apparent that there needed to be a shift to supplying the industry with logs from plantation forest in order to take pressure off natural forests".





Prof Muh. Yusram Massijaya in the field studying the growth rates of plantation forest

In many ways, change has been thrust upon the forestry industry in Indonesia. Before the turn of the century, most companies in Indonesia utilized large diameter logs from natural rainforest (those over 50cm in diameter). Mills were established on the islands of Indonesia such as Sulawesi, Sumatra and Kalimantan, close to their sources of primary forest. There was a lack of interest by the industry in small diameter logs (those under 30cm in diameter) because logs from the natural forest were plentiful and accessible, and small diameter logs were seen as less profitable and require different technologies to process them.

However, a number of factors have forced mills to change their business practices or close down in recent times. As natural forest stocks have dwindled, distances to primary forest with their large diameter trees have increased, and hence have become more difficult and expensive to extract and transport. This has been exacerbated by insufficient investment in reforestation. Added to this is closer government oversight of the industry, fewer forestry concessions to log, certification requirements, and more attention to illegal logging. (Illegal logging is a separate and urgent issue – several studies have estimated that anywhere from 40% -

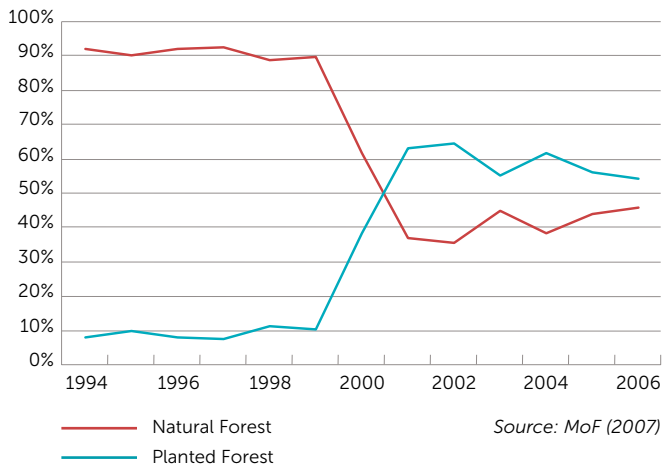
80% of natural forest logged in Indonesia is illegal in some way¹.) What this all means is that small diameter logs from plantations and community forests has become a viable and important alternative source of wood for mills. Until relatively recently, the utilization of small diameter logs has been constrained by insufficient technical data on log properties, and knowledge small diameter logging systems and processing technologies.

Figure 1: Source of Logs (million m³)

Year	Natural Forest	Stated owned forest	Independent plantation forest	Community forest	Total forest
2001	4.1	1.4	5.6	-	11.1
2002	3.2	1.6	4.2	-	9.0
2003	5.0	0.98	5.3	0.06	11.1
2004	5.1	0.9	7.3	0.2	13.5
2005	9.3	0.8	12.8	1.3	24.2
2006	9.0	0.3	11.5	1.0	21.8
2007	9.5	0.1	20.6	1.3	31.5
2008	7.4	0.1	24.5		32.0
2009	-	-	-	-	-
2010	19.7	0.1	18.7	3.9	42.4

¹Chatham House. (2010). *Indonesia illegal logging report card*. <http://www.illegal-logging.info/sites/default/files/uploads/CHillegalloggingreportcardindonesia.pdf>

Figure 2: Changes in log sources in Indonesia (1994-2006)



Some mills made the move from islands like Kalimantan to Java, to be closer to plantation forest and transportation hubs for export markets. Others have simply collapsed (the researchers estimate more than 50%). However, there were also other factors at play, such as competition from other Asian countries, particularly China, and global price fluctuations. One of the most important factors in mills closing was that their machines could not adjust to the small diameter logs sourced from plantation forest, and were not able to invest in new technologies and practices. Another reported factor was that skilled labour for working with small diameter logs from plantation forest is more difficult to find in the east of Indonesia.

Research aims of the project

In light of these challenges, the research project aimed to generate and analyse data on the use of small diameter logs, sourced from both natural forests and plantations, for their utilization in value-added bio-composite timber products. Bio-composite is defined as materials that have been glued or bonded together. The research was focused on the present and future markets of bio-composite products, the physical and mechanical properties of small diameter logs, and the fundamental properties of bio-composite products such as plywood, laminated veneer lumber (LVL), glued laminated timber or lumber (Glulam), particleboard and medium density fiberboard (MDF). The idea is to support industry with practical research to help it access the quantity and quality of timber it requires, and by extension, potentially alleviating the burden on primary natural forest.

The obvious advantage of plantation forest is that it has a much short rotation period 8 years, compared with natural forests which start to mature after 80 years or so. Large plantations on Java are managed by Perum Perhutani (a state owned enterprise), and in addition many small scale farmers are also turning to community forestry, growing trees on small plots of their land.

Logging and the burning of forests to clear land for cultivation has made Indonesia the world's third largest emitter of greenhouse gases in the world



Photo: Shutterstock

The most popular species of plantation forest are pine, mahogany, Rasamala/altinia, teak, and acacia and rubber wood. Teak plantation forest still takes at least 30 years before harvesting mature specimens, making it suitable really to only state forests. However, other species such as acacia can be harvested after 8 years or so. Small diameter logs can be harvested at diameters as small as 10cm, although larger logs are obviously preferred.

Research was carried out on small diameter logs sourced from 24 species from natural forest and 14 species from plantation or community forest in Indonesia, looking at physical, mechanical, and chemical properties and considering their feasibility to be transformed into bio-composite products. The prospective products according to market demands are plywood, laminated veneer lumber (LVL), particleboard, medium density fiberboard (MDF), and glued laminated lumber (Glulam). There is a long list of important issues studied, including wood species, grade, moisture content, dimensions, visual appearance, density, grain, knots and extractive content.

Most of the research was done under lab conditions at the Bogor Agricultural University, using the same technologies as the industry, so they can be potentially adopted by the mills. At present only the largest mills have the capacity to do

their own testing and research, so the project findings can be of use to advance the wider sector. For instance, the Bogor Agricultural University consulted with industry about what experiments they would like the university to conduct. In the lab, the researchers are more flexible to experiment, away from the daily commercial pressures of the mill.

Small diameter logs from plantations and community forests have become a viable and important alternative source of wood for mills.

Interestingly, the researchers also chose to give attention to research on the utilization of small diameter logs from the natural forest, which is already logged by companies under government concessions. With 'stem only harvesting' practices trees are delimbed, leaving by-product (the 'slash') in the forest, which could be utilized by the industry instead of being left to rot. There are no regulations saying that the by-product (the 'slash') from logging large diameter natural forest cannot be utilized, but the issue according to the researchers is that "logging companies do not find this interesting financially, mostly due to transportation costs from the forest".

Mill on Java Island, where women are repairing veneer from small diameter logs



Photo: Roger Byrnolt



Mill in Cianjur state, Java Island, pressing during the process of producing plywood

Photo: Bogor Agricultural University

Research results

The research found that it is indeed feasible for low and medium density plantation wood to be used in bio-composite products, achieving standards that are acceptable for export markets.

Among the international standard being used by Indonesian bio-composite industries are the Japan Standard (JPIC/JAS), British Standard (BS), United States Standard (IHPA), German Standard (DIN). However, the Japan Standard is the most popular used in the Indonesian bio-composite industry. In reality, the domestic market is just as important as the export market, if

not more so. Veneer sheets and particleboard made from small diameter log for domestic market are already being produced, and the research such as this can help improve the quality and help producers compete with Chinese imports.

In order to produce high quality products, several milling issues and quality control concerns for raw material were identified. Among these was the need for publically available data on the fundamental properties of wood, which the research produced and published. Technology-wise, spindless rotary lathes are necessary for veneer production of small diameter logs, as

are hot press veneer driers. Market research by the university showed that prices for Chinese made machinery can be as little as half that paid for higher quality machines produced in Taiwan, Japan, Germany and Italy. Particular labour skills are needed for veneer composing and repairs, gluing and the pressing process.

“The research found that it is indeed feasible for low and medium density plantation wood to be used in bio-composite products, achieving standards that are acceptable for export markets.”

Those interested in the technical details, such as the physical and mechanical properties of all the studied species (density, modulus of rupture (MOR) modulus of elasticity (MOE) and strength class) should refer to the project completion report² and associated research outputs.

Research of this kind is important for the forestry sector in Indonesia as a whole. There are potentially a wide range of beneficiaries from the research, in particular the mills and related industry actors, plantation and community forest owners, consumers (who will have improved quality materials), and hopefully the natural rainforest will also have some respite as demand for bio-composites from small diameter exotics increases. The researchers assert that mills have showed keen interest in utilizing this research to produce optimal products that can be sold on the global market, according to required standards.

Perhaps controversially, the researchers at Bogor University are of the belief that government policy needs to be looked at to pressure those logging primary forest to use all of the tree, including small diameter logs. They believe that if all of the waste is utilized, rather than being left to decompose in logging areas, that this will help to preserve the natural forest, while contributing to the supply for industry. The researchers believe they have at least succeeded in opening this discussion, but the govern-

Prof Muh. Yusram Massijaya at a mill with small diameter logs, all marked with their size



Photo: Bogor Agricultural University

² Bogor Agricultural University, CFC/ITTO/62-PD40/00 Revv.4(i). (2012). *Project Completion Report, Utilization of Small Diameter Logs from Sustainable Sources for Bio-composite Products*. Bogor, Indonesia.



Photo: Bogor Agricultural University

Students studying a community forest applying an intercropping method

ment has reservations because “when you open the door to the cutting of small logs, unexpected consequences could happen”.

The researchers say that “the process of transition from natural to plantation forest is continuing. In the past 10 years there was a lot was trial and error. But now the research done by industry and the university is formalizing knowledge on new technologies, standards and market developments”.

Research outcomes

The university claims no intellectual property rights on the research and wishes for their work to be freely available to support the industry. Eleven papers were published through course of the research, covering topics such as the current and future markets for bio-composite products, basic properties of some wood species from Indonesia, Malaysia, Philippines, and Papua New Guinea and the potential for mills to utilize small diameter logs in their bio-composite products.

The research team organized and convened a regional workshop in Bogor, Indonesia to facilitate the transfer of technology on small diameter logs management and utilization for bio-composite products to regional academicians, the timber industry sectors, and related government officers as well as scientists, students, researchers, related industries representatives and non-governmental groups. Attendees came from as far afield as Malaysia, Philippines, and Papua New Guinea.

The research team believe that small diameter logs, especially from plantation and community forest will be the future of log supply in Indonesia and regionally.

The research helped to strengthen relationships between actors. As the researchers noted, “formal networks do exist, but are weak and not so effective. Seminars, brochures and publications help us to build those networks and practical research like this is imperative. If we have good inventions they [the industry] come”.



Photo: Roger Bymolt

Gluing of veneer sheets at a mill in Cianjur, Java



Photo: Roger Bymolt

Plywood, at a mill in Cianjur, Java

Research projects such as this are also of great importance to the university. Students were involved in research activities, national seminars, international symposiums and the publication of scientific articles. As the university notes, "research projects such as this ensure that capacity continues to be built in the sector, with graduates very often moving to the industry and taking this knowledge with them. Furthermore, the university was able to expand its facilities, and link with industry more closely. Say the researchers, "In Indonesia we don't have so much money so we are doing simple projects and trying to make them as practical as possible. This is important because only the big companies have their own divisions of research, and this knowledge usually stays within the company".

Since the research has been published, there is already one case of investors from Japan engaging the university to support them in their business plan and establishing a mill in Cianjur state to work with plantation forest. This highlights the practical nature of the research done at the university and through the research project.

The research team believe that small diameter logs, especially from plantation and community forest will be the future of log supply in Indonesia and regionally. The project has helped to keep small diameter logs on the policy agenda for both natural and plantation forest, hopefully contributing to more a sustainable industry, with less pressure on Indonesia's precious rainforest.

Author

Roger Bymolt of the Royal Tropical Institute (KIT) in Amsterdam reviewed this project for CFC. Interviews were conducted with the Ministry of Forestry, a certification and verification company (name withheld), Perum Perhutani (State plantation forest management in Cianjur, Java), plywood factories in Cianjur, and professors and students from the Bogor Agricultural University.
