

Forestry in Indonesia

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Abstract

Indonesia has been undergoing a significant change in the last 20 years. From an industry dominated by natural forest harvesting for solid wood products, 55% of production is now for industrial wood for pulp and paper production. FAO statistics for 2016 show that pulpwood made up 40.9 million m³ from a total of 74.7 million m³ produced for the wood industry.

Pulpwood plantations make up almost 2.5 million ha and 85% of this area is either owned, or controlled, by the three major pulp and paper companies. Three species – *Acacia mangium*, *Acacia crassicarpa* and *Eucalyptus pellita* – combine for over 98% of the planted area. Due to disease and monkey damage, the industry has been moving away from acacia to eucalyptus for mineral soil conditions. *Crassicarpa* remains the only feasible choice on peatland soils.

Pulpwood plantations are managed on government-owned land that is leased on a concession basis to private companies for a 30-year period. Due to production demand, rotation lengths are typically five years with a mean annual increment (MAI) of between 23–25 m³/ha/year. This means that over 300,000 ha are harvested and replanted every year.

Plantation owners incur significant challenges in managing their concessions. On top of pests and diseases, they face considerable pressure from fire, encroachment and land claims. All concessions have people either living within or immediately adjacent to them. Despite the government owning the land, local communities have access rights, meaning that compensation must be paid in order to be able to plant. By law, 20% of a concession area must be set aside for livelihood crops for communities, which places further financial pressure on management.

Overview of Indonesia

Country overview

The Republic of Indonesia is a unitary, transcontinental sovereign state located mainly in Southeast Asia, with some territories in Oceania. Situated between the Indian and Pacific oceans, it is the world's largest island nation.

At 1,904,569 sq m, Indonesia is the world's 14th largest country in terms of land area and the seventh largest in terms of combined sea and land area. With over 261 million people, it is the world's fourth most populous country as well as the most populous Austronesian and Muslim-majority country. Java, the world's most populous island, contains more than half of the country's population.

Indonesia's republican form of government includes an elected parliament and president. Indonesia has 34 provinces, five of which have special status. Its capital is Jakarta, which is the second most populous urban area in the world. The country shares land borders with Papua New Guinea, East Timor and the eastern part of Malaysia. Despite its large population and densely populated regions, Indonesia has vast areas of wilderness that support a high level of biodiversity. The country has abundant natural resources such as oil and natural gas, tin, copper and gold. Agriculture mainly produces rice, palm oil, tea, coffee, cacao, medicinal plants, spices and rubber (Workman, 2017).

Indonesia consists of hundreds of distinct native ethnic and linguistic groups, with the largest ethnic group being the Javanese. A shared identity has developed, defined by a national language, ethnic diversity, religious pluralism within a Muslim-majority population, and a history of colonialism and rebellion against it.

Administration of forestry in Indonesia

Indonesia land administration is classified into two principal categories – forest land and non-forest land. Forest land is administered by the Ministry of Environment and Forestry (MEF).

The MEF administers 128 million ha of land, which accounts for nearly 70% of the land area of Indonesia. It is estimated that approximately 80% of forest land is 'forested', mainly by natural vegetation ranging from scrubland to full virgin jungle. Most of Indonesia's forest is owned by the state (86.9%) and the remainder is so-called 'titled forest', meaning that the land title is registered by private organisations or individuals. The vast majority of the production forests are owned by the state, but directly managed by private corporations and institutions based on forest concessions.

Companies and/or individuals wishing to establish plantations forests may apply for the concession rights on government land. These concessions can vary in size from 5,000 to 100,000 ha gross area, and can be managed for 30 years until they either have to be extended for a further period or returned to the government.

Indonesian forestry

Summary of forest areas

In 2015, Indonesia had around 91 million ha of forested land, which constitutes 53% of the total land area. Around 86.1 million ha is primary or otherwise naturally regenerated forest, and around 4.9 million ha planted forest (FAO, 2015).

Of the 4.9 million ha, approximately 2.5 million ha is in acacia and eucalyptus plantations managed for the pulp and paper industry on five to seven-year rotations. The remainder is spread over rubber, teak and plantations for the veneer and solid wood industries. The plantation industry has come under intense scrutiny from NGOs in the last 10 years due to the conversion of natural forest, to the point that most conversion has now stopped, with only a few small companies continuing to do so. Pulp mills will no longer accept natural forest wood for production.

The largest single plantation owner within Indonesia is the Asian Pulp & Paper (APP) Group, which holds the rights to almost 2.5 million ha of concession-based land and has over one million ha of plantation, almost half of which is on peat swamps. To put this into scale, by managing on a five-year rotation, they are harvesting and replanting over 200,000 ha of land every year.

Production summary

There are two distinct forms of forest resource management in Indonesia. These are the plantation industry, which up until recently was dominated by teak plantations in Java, and the selective forestry in natural forests, located mostly on outer islands. Over the past two decades, plantation forestry for the pulp and paper industry has become a significant component of Indonesia's forest industry. Pulpwood plantations are dominated by the acacia and eucalyptus species, which grow quickly in Indonesia's tropical climate and can be managed on short rotations of five to seven years.

According to FAO (2017), the Indonesian industry produced about 75 million m³ of roundwood, which is almost entirely used within the country.

The balance between total roundwood production and subtotals in Table 1 is mostly used for fuelwood, which remains a key source of fuel for cooking and water heating. Logs cannot be exported in roundwood form so all exports are in processed or semi-processed products.

With the exception of pulp and paper, timber industries have been on a decline since the late 1990s. Pulp and paper demand now makes up 50% of the log production in Indonesia and all of this production now comes from plantations. No natural forest wood is used for the production of pulp and paper since 2015.

Indonesia is a net exporter of timber and timber products, and although exports are going worldwide, the Far East contributes to most of the timber exports. Key exports include processed goods, namely, plywood, pulp and paper, mouldings and joinery, furniture, sawn timber and veneer. Pulp and paper products account for over 50% of Indonesia's wood-based exports, which demonstrates the particular relevance of this industry for the Indonesian forest sector.

Pulp and paper industry

There are currently eight Kraft pulpwood mills in Indonesia, six of which remain operational, with the other two having been mothballed (see Figure 1). These are mostly located on the island of Sumatra, with the remainder being in Kalimantan.

The total mill capacity is estimated to be 9.2 million bone dry metric tonnes (BDMT) of bleached hardwood Kraft pulp (BHKP), which would require 32.5 million m³ of roundwood (this estimate is lower than the official estimate published in FAO statistics). Due to mothballing and wood supply issues, the actual mill production is estimated to be 6.6 million BDMT.

APP is a fully integrated pulp and paper group with 14 paper factories located in Sumatra and Java (see Table 2). APRIL produces printer paper at its Kerinci mill site and this company commissioned a viscous fibre plant at Kerinci in 2016. APRIL has historically produced large quantities of market pulp (BHKP), but it appears to be committing to increasing the quantities of downstream pulp and paper products.

Table 1: Indonesia 2015 wood production figures

Category	Production quantity m ³	Imports quantity m ³	Domestic consumption m ³	Exports quantity m ³
Logs (roundwood)	75,040,000	560,000	75,541,000	59,000
Sawn wood	4,169,000	226,000	3,930,000	465,000
Veneer	761,000	16,000	742,000	35,000
Plywood	3,800,000	62,000	1,082,000	2,780,000
Pulpwood (logs)	40,860,000	0	40,860,000	0

Note: Pulpwood logs are used directly by pulp mills or exported as chip

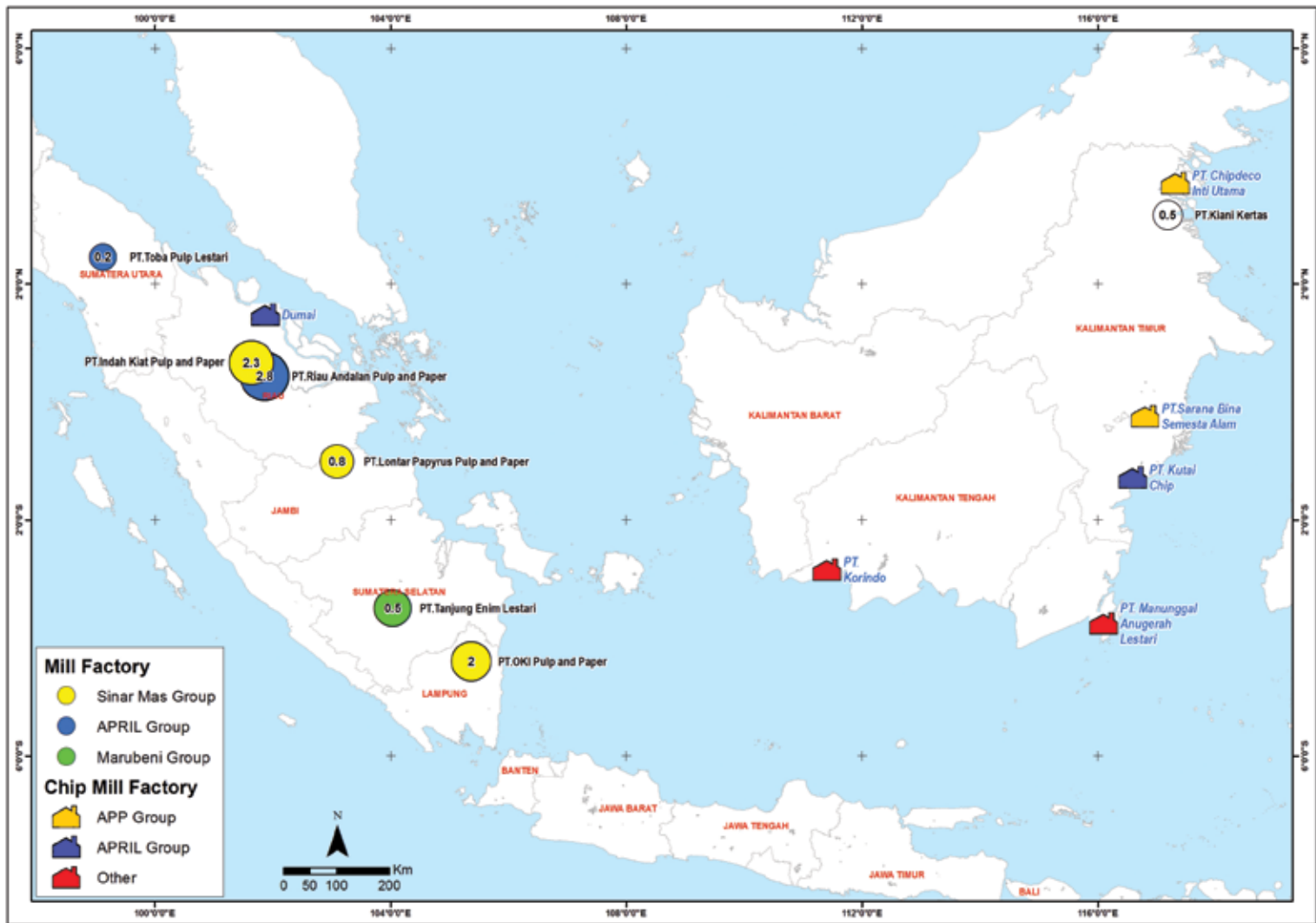


Figure 1: Location of pulpwood processing facilities

Pulpwood plantations

Indonesia has a significant pulpwood plantation resource. Pulpwood plantations were first established in the 1970s on the island of Sumatra. Since the 2000s, pulpwood plantation development has spread to the island of Kalimantan. The total area of pulpwood plantation is estimated at approximately 2.5 million ha as at 2018. It is expected that further plantation development will be located in Kalimantan and maybe some in Papua New Guinea.

Almost 84% of plantations are controlled, either directly or indirectly, by ‘the big three’ pulp and paper companies of APP, APRIL and PT TEL. Most of their concessions were obtained during the New Order regime under President Suharto in the late 1980s and 1990s, or during the transitional political era that followed until around 2005. Since that time, concessions on good quality land that are well located logistically have become scarce. This would suggest that there is little scope for the expansion of pulpwood expansion in the future.

Growth rates within the acacia plantations averaged between 25–27 MAI in the first rotation, with

a general decline in subsequent rotations on mineral soil sites, mainly due to pest and disease impact but also general site degradation through poor harvesting practices. The problems in *A. mangium*, which was the staple crop for the first 20 years, have become so bad that a major change to eucalyptus species has occurred in the last 10 years.

All of the big three companies are struggling to fulfil supply commitments to their pulp mills and the issues for this are complex. There are the pest and disease issues as mentioned above, declining site productivity, but also fire and encroachment by local communities.

In addition, the pulp and paper companies are being forced by the government to rehabilitate peatlands, further compounding the wood supply constraints. Rehabilitation options require ‘re-wetting’ of drained peatlands, needing either changes in commercial species and silvicultural practices or the restoration of natural forest ecosystems. Alternative sources of land are supposed to be provided by the government as compensation, but where these will be located remains unclear and almost certainly they would be more expensive in terms of management and logistics.

Table 2: Pulp mill capacity by location

Mill	Group	Capacity	Estimated production 2017	Potential pulp log consumption (capacity)
		Tonnes of pulp/year (BDMT)		m ³ /yr
PT Indah Kiat Pulp and Paper	Asia Pulp and Paper (APP)	2,300,000	2,100,000	10,350,000
PT Lontar Papyrus Pulp and Paper		800,000	750,000	3,600,000
PT OKI Pulp and Paper Mills		1,900,000	1,000,000	4,500,000
PT Riau Andalan Pulp and Paper	Asia Pacific Resources International Holdings Limited (APRIL)	2,800,000	2,200,000	12,600,000
PT Toba Pulp Lestari		200,000	200,000	900,000
PT Tanjung Enim Lestari	Marubeni	500,000	350,000	2,250,000
PT Kiani Kertas	Nusantara Group	500,000	0	2,250,000
PT Kertas Kraft		135,000	0	610,000
Total		9,135,000	6,600,000	37,060,000

Pulpwood plantation silviculture

Historically, pulpwood plantations were developed in two main species – *A. mangium* and *A. crassicarpa*. *A. mangium* was a hardy species that thrived on the low fertility heavy clays, which are the prevalent type of mineral soil in Indonesia. *A. crassicarpa* is the only known pulpwood species that grows well on tropical peatland soils. Other species were tried, including various eucalyptus, and until recently all these generally failed. The exception is North Sumatra where *E. urophylla*, *E. grandis* and other species have successfully established on volcanic soils at high altitude.

In recent years, *A. mangium* has been beset by rapid increase in attacks from pests and diseases. The three principal problems are:

1. **Root rot** – This has become the most economically damaging disease of *A. mangium* with high tree mortality rates observed during second and third

rotations. Two main types of root rots have been found in *A. mangium*, viz brown root rot and red root disease caused by *Phellinus spp.* and *Ganoderma spp.*, respectively (Eyles, 2008).

2. **Stem canker and wilt** – *Ceratocystis acaciivora* is a fungus that infects wounds on *A. mangium* causing stem damage that quickly leads to death. It is rarely seen in the first rotation stands but can cause in excess of 60% mortality by the third rotation (Brawner et al., 2015).
3. **Monkey damage** – A behavioural change in macaques has led to increased browsing of young *A. mangium* shoots. Monkey damage causes a high level of damage through stem breakage, especially to young trees. The browsing and associated stem damage also makes the plantations highly susceptible to other pests and diseases, especially *Ceratocystis*. Damage levels are usually very high but localised. However, damage has escalated due to rapid population increases of the macaques.

In the 2000s, *E. pellita* was identified as a species that grew well on heavy clay soils at low altitude. The plantation companies have implemented a breeding programme to improve the growth and fibre characteristics of *E. pellita*, and this has been so successful that it is now the preferred pulpwood species for mineral soils. Because of the declining productivity, *A. mangium* has had to be replaced, especially on third and subsequent rotations. It has largely been replaced by *E. pellita*.

The rapid transition from *A. mangium* to *E. pellita* over more than 500,000 ha in a very short time is almost unprecedented in plantation forestry history. The two species are very different in their management, with *A. mangium* being a low input/low maintenance crop that is propagated largely from seed compared to *E. pellita*, which is propagated using clones and requires intensive silvicultural maintenance and high inputs of fertiliser.



Ganoderma root rot



Stem wilt from *Ceratocystis*



Sumatran macaque



Small barge used for transporting logs from the harvesting site to a log yard

One benefit has been that the move to eucalyptus species opens the door to much higher productivity in the future through continued improvements in genetics and tree maintenance.

Companies are now adopting Brazilian approaches to plantation management, with a view to attaining MAI in the high 30s in the next generation of plantations.

Peatland plantations

A distinctive feature of Indonesian pulpwood plantations is that approximately 45% of them are located on peatland soils, which are 100% organic matter and naturally saturated. In order to establish plantations, these areas were cleared of their natural forest cover, then drained and converted to forest plantations. To date, only *A. crassicaarpa* has been found to be commercially viable on peatland soils.

These plantations are accessed and managed through a network of canals, which allow control of the water table to facilitate planting of the tree crops. The canals are used for access as well as for barging of wood during harvesting. Specialist ground-based systems for harvesting have to be developed because of the waterlogged nature of the soil and weak soil structure and New Zealanders played a key role in this process.

Management of drained peatland soils is very contentious and two issues have been particularly troublesome:

- Indonesia is the world's fifth largest producer of greenhouse gases (GHGs) and the largest contributor of forest-based emissions world-wide from land use, land use change, and forestry (LULUCF). The largest source of LULUCF emissions in Indonesia is from oxidation and the burning of drained peatlands
- Forest fires, which are particularly prevalent in drained peatlands, emit huge quantities of smoke and haze. This has nearly catastrophic impacts on public health and aviation, not only in Indonesia, but also in neighbouring countries as well.

In 2015, huge fires destroyed significant tracts of peatland forest, both natural and planted, which prompted a huge international and national response. This brought the public to the full awareness of the environmental impact created through draining and developing peatlands.

This in turn has led the government to create a special task force for the restoration of up to four million ha of peatlands. A significant portion of the area is currently utilised by the two largest pulp and paper companies, meaning that the retirement and restoration of this peatland will have a significant impact upon their raw material supply unless viable alternative sources can be found. This is an ongoing development and the full extent of the new laws and their impact upon plantation production is not yet known.



Typical peatland plantation with canals

Social impact on plantation forestry

The Indonesian situation is significantly different to New Zealand plantation forestry in terms of community interaction and impact. In the pre-2000 New Order era, concessions were issued with little consideration to indigenous people's rights. In a country with a population as large and diverse as Indonesia, this inevitably led to conflict, which was mostly resolved by the authorities, often using force.

Following the establishment of democracy, people started to move back into the concession land, reclaiming and/or demanding recognition of their land rights. The authorities could no longer resort to force, and companies suddenly found themselves with encroachment, arson and sometimes violent conflict. Offices and equipment were burnt or ceased, staff were threatened, and existing plantations cut down and

planted back into other crops. Because of the sheer volume of claims involved, many of these remain unsettled despite years of endeavour.

In reality, all plantation forestry in Indonesia is community-based to a greater or lesser extent. All companies have paid compensation to local communities for the area planted, even though the land is government-owned. All companies must work with local communities for the continued management, protection and development of the concessions.

By law, 20% of land within any given concession must be designated for community projects. This is known as 'Tanaman Kehidupan', or literally 'Livelihood Plantations'. This is an increase from the traditional 10% used pre-2017. These 'Livelihood Plantations' can take many forms and below are just a few examples of the more common formats seen:

- Rubber plantations where the local community either takes a share of the rubber production or of the profit
- Pulpwood plantations where the local community receive an initial payment at planting, get paid for all labour-related work during planting and tending, and then receive a bonus based on production
- Pulpwood plantations where the local community receives an annual rental per hectare and a bonus based on harvesting production
- Alternative livelihood crops such as fruits, nuts or honey
- Intensive agriculture on a smaller portion of the land close to the village that is supported by the company and plantation forestry on the larger portion.

Every plantation company has a special department for the handling of community relations. These teams communicate with communities, negotiate on claims and on compensation for any new planting (and even re-planting after harvesting in some cases), manage community development schemes, and ensure that donations for cultural events are effectively utilised in the correct way.

The definition of communities who have the right to negotiate with the company can be any of the following:

- Communities located within the concession boundaries
- Communities outside the concession boundary, but obtaining economic benefit from within the concession area
- Communities with registered traditional rights to the land.

Recent immigrants into the area are not usually considered for compensation and/or programmes.



Large ocean-going barge for inter-island log transport

These payments impact on company profit levels and therefore need to be carefully managed. Pure plantation companies with no vertical integration have traditionally been marginal, or even loss-making, enterprises. Large levels of compensation or profit sharing cannot be sustained and this is reflected between industry levels of payment. Mining pays the highest, followed by palm oil, rubber, agriculture, and then forestry at the bottom of the list. For this reason, communities prefer almost any other crop to forestry as they receive more payment.

An important aspect to understand is that communities in and surrounding forest concessions are poor, with low levels of savings. They live mostly hand-to-mouth and require constant income just to survive. Any system that ties up land for long periods with no cash flow will not be well received unless alternative sources of income can be developed.

Any new projects (whether for pulp and paper), or higher value products, need to follow the Free and Prior Informed Consent (FPIC) protocols. These are relatively new to Indonesia so their application is not yet widespread or understood.

Future of the Indonesian forestry sector

Transformation in compliance

International and domestic NGOs have been successful in bringing considerable pressure onto the pulp and paper industry to ensure compliance to international sustainability standards. This had

forced companies into looking beyond the legally required certification within Indonesia and pursue internationally recognised voluntary standards such as the FSC, PEFC and IFC performance standards.

It was quickly discovered that no matter how well plantations were managed, they would be unable to obtain FSC due to the 1994 forest conversion cut off limit. Most forests were converted after this date. PEFC has been adapted to an Indonesian equivalent, known as IFCC, and around 600,000 ha is now certified as forest converted pre-2010. While there has been much talk about utilising the IFC performance standards, the forest conversion clauses have thus far precluded any successful application.

In 2003, Indonesia started to develop an operator-based timber control system for all its timber exports, building on a mandatory third-party certification approach for legality and sustainability. The system, called SVLK, became the basis for the timber legality assurance system under Indonesia's Voluntary Partnership Agreement (VPA) with the EU.

The VPA covers all exports, and its coverage will expand to include the domestic market on a stepwise basis. On 15 November 2016, Indonesia began issuing Forest Law Enforcement, Governance and Trade (FLEGT) licences to verified legal timber products exported to the EU. In the following 12 months, Indonesia issued more than 39,000 licences for shipments exported to all 28 EU member states, with a total value of more than one billion Euros (see www.euflegt.efi.int/indonesia).

Sustainability in the pulp and paper industry

Historically, the pulp and paper sector has relied on wood harvested from clear-felling of natural forests. Initially, the natural wood fibre was sourced from concessions allocated for conversion to forest plantations. In the 1990s and 2000s, large quantities of natural wood fibre was sourced from lands being converted to palm oil plantations.

After substantial pressure from international markets and civil society campaigns, the Indonesian pulp and paper sector has completed a transition from natural wood fibre to plantation wood fibre. In 2013, the APP Group commenced its Forest Conservation Program (FCP) based on no deforestation of natural forest and the 100% use of plantation-grown wood fibre. The APRIL Group committed to its own Sustainable Forest Management Policy in 2015.

Recently, the government has announced it will regulate the development of plantations on peatlands. These peatlands emit very high quantities of GHGs and Indonesia has been under tremendous international and domestic pressure to reduce the area of forest and agri-business plantation. The actual implementation requirements are still being developed, but essentially forestry companies will be retired to release large areas of peatlands in the future, re-wet these lands and rehabilitate the natural forest. In return, the government has committed to swapping the peatlands for drylands, which can be developed as forest plantations.

Future for the pulp and paper sector

Going forward, the pulp and paper sector faces considerable challenges in terms of both supply and sustainability. All of the big three pulp and paper companies are currently purchasing wood from external sources while they battle the internal issues of fire, pests, diseases, encroachment and the impact of the peatland regulations.

Operationally, the impact of harvesting every five years must be faced with greater focus. While regular harvesting is a benefit in peat soils (these soils actually improve with some compaction), poor harvesting practices are having a significant impact on the performance of plantations on mineral soils. Low impact harvesting and the introduction of cable systems are critical to the long-term future, and there exists an opportunity for international-level harvesting contractors to come in and obtain large-scale contracts for this.

There is no doubt that Indonesian plantation owners have significantly improved their management according to international-level certification standards,

but there is still significant room for further improvement and the challenge remains about how to verify this. With FSC and IFC being largely unattainable, and IFCC being only partially recognised, how do plantation owners verify that they are meeting the required standards for environmental and social management? ISO only covers some aspects and other local Indonesian standards are not yet acceptable in the international markets.

It is highly unlikely that there will be further significant expansion of pulp and paper processing capacity within Indonesia. Companies must first secure a sustainable level of logs and find a way to demonstrate that plantations are sustainably managed environmentally and socially.

Finally, the transition from *A. mangium* to eucalyptus has had a significant and potentially long-lasting impact on plantation management in Indonesia. Acacia is an easy care and low input species, and companies only needed to implement relatively basic management capabilities to support the species. Companies have had to significantly improve their capabilities in tree breeding and impose greater management control to successfully implement the transition to eucalyptus. In addition to developing the technological approaches and systems, this has required a significant cultural change within the companies.

The first generation of eucalyptus has only really achieved similar yields to acacia. However, if the improvements in tree breeding and silviculture continue, significant gains in plantation productivity are possible, more in line with those achieved in Brazil under similar climatic conditions.

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